

GAIA-CLIM Report

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Introduction

The GAIA-CLIM project aims to assess and improve global capabilities to use ground-based, balloon-borne, and aircraft measurements (termed non-satellite measurements henceforth) to characterise space-borne satellite measurement systems. The work under GAIA-CLIM encompasses the following tasks:

1. Defining and mapping existing non-satellite measurement capabilities;
2. Improving the metrological characterisation of a subset of non-satellite (reference) observational techniques;
3. Better accounting for co-location mismatches between satellite observations and non-satellite (reference) observations;
4. Exploring the role of data assimilation as an integrator of information;
5. Creation of a 'Virtual Observatory' (VO) bringing together all comparison data, including their uncertainties, and providing public access to the information they contain;
6. Identifying and prioritising gaps in knowledge and capabilities, resulting in a Gaps Assessment and Impacts Document (GAID) and a list of recommendations resulting from the prioritisation of the gaps.

Under this work package 6, GAIA-CLIM has engaged with the various stakeholder communities, to get advice and feedback about the work undertaken in the project and, especially, about the VO, the GAID and the final recommendations.

The engagement with external stakeholder communities has taken place through several approaches over the course of the project:

- (1) Dedicated user workshops: Two workshops have taken place, one after the first project year (Rome, 7 Oct. 2015), and a second one in November 2016 (Brussels, 21-24/11/2016). The deliverables D6.3 and D6.6 summarize the outcomes of each workshop.
- (2) Continuous collection of feedback via the GAIA-CLIM website throughout the course of the project;
- (3) Outreach activities during international symposia and workshops;
- (4) Roadshow events, carried out in the last half year of the project.

This document reports the feedback collected during the roadshow events. It provides an overview of the events, the communities that have been addressed, and the collected feedback. It also explains the rationale behind these events and the approach that has been adopted. The annex is a concatenation of all individual roadshow feedbacks received from project participants.

1. Rationale and approach for roadshows

Even though the dedicated user workshops delivered interesting and useful feedback, it appeared difficult to get a large attendance from external stakeholders. It turns out to be more difficult than was foreseen to mobilize external stakeholders to free time to travel and attend a workshop even if financial support is offered. Therefore, we decided following consultation with the Project Officer to travel to meet the stakeholders, and hence replace the planned third user workshop by a series of peer-to-peer meetings with the users called roadshows hereafter.

Two kinds of events have been performed:

- (1) Dedicated visits to an institution or more extended presentations of the VO, the GAID and the recommendations during a meeting with stakeholders.
- (2) Outreach events or presentations with narrower, *ad hoc* scope during an international symposium or other gathering of researchers and potential users

1.1. Roadshow training

Substantial efforts were made in advance to ensure a successful outcome. GAIA-CLIM participants leading the GAID, recommendations document and VO provided a set of standard presentation materials consisting of:

1. A brief overview of the project;
2. A summary of the Virtual Observatory;
3. A summary of the GAID and ensuing recommendations;
4. A short version conference presentation;
5. A long version conference presentation;

These materials were hosted on the project's internal website. For dedicated roadtrip events, participants were encouraged to present the first three items given above in that order and with substantive efforts to collect feedback via ensuing discussions. To ensure a set of actionable feedback, templates to collect the feedback were designed to facilitate consistent collection.

A dedicated session to “train the trainers” for these roadtrip events was given on August 31 at EUMETSAT (Darmstadt). This afforded an opportunity to further ensure homogeneity of presentation. The VO evolved between 1 September 2017 and 25 January 2018. This evolution involved improved functionality and fixing of multiple bugs. Rather than provide the static version as at 31st August, the decision was therefore taken to present the latest version at many of the roadtrip events. To facilitate this, refresher training was offered by the EUMETSAT partner remotely before every workshop to make the roadshow presenter acquainted with the then current evolution of the VO.

1.2. Summary of roadtrip events undertaken

The list of roadshow events that have taken place is summarised in Tables I.a and I.b. More events were planned at the start, but not all could happen in the end for various reasons (availability of GAIA-CLIM presenters, availability of audience, logistical reasons); in particular a roadshow event scheduled with EC DC GROW on Dec. 1, 2017 was cancelled by the EC with a few days' notice.

Table I.a: Performed roadshow events including a dedicated session presented in chronological order.

Target User/Stakeholder	GAIA-CLIM actors	Date in 2017/2018, location	Comment	Ref.
NIES	BKS	Sept. 7, Tsukuba		Ia1
WMO (incl. GCOS, CCI, WIGOS, WCRP)	NERSC/NUIM	Sept. 14, WMO Geneva		Ia2
EUMETSAT SAFs – CM-SAF	TUT/EUMETSAT	Oct. 18, Zurich	Focus on VO	Ia3
NDACC Steering Committee annual meeting 2017	BIRA-IASB/BKS	Nov. 8, Boulder, Co	Dedicated session for VO, GAID & Recommendations	Ia4
EUMETSAT SAFs – AC-SAF	KNMI	Nov. 14-15, KNMI		Ia5
Meteo France	MetOffice/EUMETSAT	Nov. 14, MeteoFrance, Toulouse		Ia6
IPSL/CNRS	EUMETSAT, Met Office	Nov. 22-23, Paris		Ia7
NCEO (UK)	NPL	Dec. 5, Reading		Ia8
MET OFFICE (UK): science teams and Hadley Centre	MetOffice	Dec. 7, Exeter		Ia9
University of Hamburg	KIT / NPL	Dec 13, Hamburg	On request by Uni Hamburg	Ia10
Copernicus CAMS & C3S	EUMETSAT/ECMWF/NUIM	Dec. 18, ECMWF, Reading		Ia11
University of Melbourne & Wollongong (AU)	BKS	Jan. 23 2018, Melbourne		Ia12

Table I.b: Performed *ad hoc* roadshow events organised piggy-back on another event (workshop; symposium). Events are presented in chronological order.

Occasion (Workshop/ Symposium)	Target Community	GAIA-CLIM Actor(s)	Date, Location	Comment	
GRUAN ICM-9 ¹	GRUAN community	NUIM, MetOffice, CNR	June 14, FMI	Parallel session	Ib1
CEOS Working Group on Calibration and Validation (WGCV-42)	Space Agencies, Cal/Val community	BIRA-IASB	May 15-18, USGS, Sioux Falls (SD, USA)	GAIA-CLIM reported as part of two oral	Ib2a

¹ GRUAN ICM-9 was a 4-hours dry run for the roadtrip dedicated events

Occasion (Workshop/ Symposium)	Target Community	GAIA-CLIM Actor(s)	Date, Location	Comment	
				presentations	
CEOS Atmospheric Composition Virtual Constellation (AC-VC-13)	Space Agencies, atmospheric composition focus	BIRA-IASB	June 29-30, Paris	Poster presentation	lb2b
JPSS annual Science Team meeting	Joint Polar satellite system / Meteo community	ECMWF	Aug. 14-18, NOAA, Boulder		lb3
EMS annual meeting	Meteorological community	NUIM	Sept. 4-8, Dublin	Oral presentation	lb4
DOAS Workshop	Ground-based remote sensing community	BKS	Sept. 4-6, Japan	Poster presentation	lb5
7th Int'l WMO Symposium on data assimilation	Model/assimilation community – WMO	ECMWF	Sept. 11-15, Brazil		lb6
EUMETSAT annual Conf.	Meteorological & Atmospheric Chemistry satellite community	EUMETSAT	Oct. 2-6, Rome	Booth; oral presentation	lb7
ESA Workshop on Uncertainties in Remote Sensing	ESA / Earth Observation satellite community	BIRA-IASB, ECMWF	Oct. 24 – 25, ESA ESRIN, Frascati	Oral presentation and VO demo	lb8
GEO IVX Plenary Poster	Group on Earth Observation community	NERSC, NUIM	Oct. 25-26, Washington	Poster presentation without attendance	lb9
GEWEX/G-VAP	Water vapour community	NUIM	Oct. 25-26, Leicester	Oral presentation	lb10
Int'l TOVS Study Conf.- XXI	Meteorological & Atmospheric Chemistry satellite community	ECMWF/ EUMETSAT	Nov. 29-Dec. 5, Darmstadt	Live demo of the VO all along poster sessions	lb11

As evidenced by Tables Ia and Ib, GAIA-CLIM has interacted with the meteorological community, and water vapour and GRUAN communities, with communities involved in Copernicus Atmospheric Monitoring Service (CAMS) and Climate Change Service (C3S), with the community of space agencies and in particular with EUMETSAT SAFs (Satellite Application Facility), and the atmospheric chemistry communities more generally (ground-based and space-based observations, and modelling). In total, the roadtrip activities included outreach to several hundred experts interested in the outcomes of the project. Of these in excess of a hundred participants engaged in the dedicated roadshow trips that enabled in-depth discussions of the key project outputs and outcomes.

2. Compilation of collected feedback from roadshow activities

In the following sections, the most common and / or important feedbacks are listed – including a reference to the roadshow event(s) during which this feedback arose. All feedback documents are presented in Annexes numbered according to the reference identification in Tables Ia and Ib.

We note that a comment received frequently was that the VO was not yet mature enough for the roadshow, especially for the early events. Another issue for the roadshow events was that the audience often was not well prepared to discuss the GAID or the recommendations document, making it rather difficult to get good feedback in the limited time available. This happened despite the fact that they were invited and reminded beforehand to look at the available documents, on-line catalogue, etc. to acquaint themselves with this process. Often, the engagement was specifically limited to the time the participants were in the room with the project participants. Sometimes promises were made that documents would be reviewed later, but, to our knowledge, no post-event feedback was received in the majority of cases even when promised. Two exceptions marked the request for a dedicated visit to the University of Hamburg following the roadshow event in Zurich, as well as the specific interest from WMO/WIGOS to get access to the metadata database developed by CNR under WP1.

Some comments were contradictory:

- (1) Some communities were enthusiastic about the VO, others much less. Many communities knew other tools and wondered about overlap, redundancy, interoperability, collaboration among different tool-providers.
- (2) Sometimes the GAID was well received by researchers; sometimes it was considered to be a document of no use for researchers but only for ‘higher-level’ people (funding authorities, EU). Generally, the audience questioned who were the intended audience(s) of the GAID.
- (3) The GAID online catalogue was also received with diverse enthusiasm.

There were also concerns expressed as to whether the recommendations / remedies were really actionable.

2.1. Feedback to VO

Feedback on metadata	Event reference
Nice educational asset, but most interest goes to colocations, and forecasts of colocations	Ib1
Some users want to see colocations graphically (and find them more automatically) and then ‘export’ these ones to the comparisons plots; request for stronger link between metadata 3D-tool and VO functionalities	Ia6, Ia7 Ib11
Maturity matrix information was appreciated, but there are still questions about what is ‘reference’, what is ‘FRM’, what about traceability ?	Ib8, Ib10
Interest in exporting metadata information as a text file	Ia7
Questions about ‘who will use this? ‘	Ib1

Feedback on documentation & traceability	Event reference
More tutorials would be useful; more pop-up windows with information about datasets	la1, la6
More documentation is needed about default colocation criteria and implementation; also visualization of colocation was suggested	la2, la4
Datasets are poorly identified, e.g., which data version? Interest in having links to original datasets	la4, la10 lb11
Stress that the VO is a tool for more than NWP	la2
Feedback on functionalities and operational uses	Event reference
Considered to be of highest priority: implement uncertainties (1) included in the plots (not separately) (2) including different components to uncertainty (statement that added-value of VO lies in the uncertainties; otherwise other tools exist already) (3) information about uncertainty of RT model Remark: scientists in the US are also trying to estimate uncertainties and we should really be aware of their activities, particularly uncertainties in emissivity and radiative transfer.	la2, la4, la9 (general remark) la10 lb3
Collaboration with other tools-providers is suggested; there are redundancies; e.g., with CM and ACM SAF, with S5P OPOT (http://evdc.esa.int/orbit/), with AERIS (France), with ESA EVDC.	la3, la4, la7 lb8
Availability of sub-setting options is considered vital; colocation distance and time selection is vital; default colocation criteria are not optimal? Request for optimizing colocation according to (slant) measurement weight functions	la1, la3, la10, lb1 lb10
Order of selections should be more logical, with measurand as first selection. There should also be a selection based on the data version number of a dataset.	la4
Questions about data access (1) accounting for data policies and licenses (2) to what extent will other than EUMETSAT satellite data be included (3) more data, more ECVs, should be included, e.g., ocean and wind variables, cloud products e.g., model data e.g., Greenhouse gases & geostationary data e.g., Sentinel data e.g., Southern hemisphere data e.g., all long-term ozone sonde data e.g., GPSRO data, whole RS92 network e.g. ESA FRM data e.g., non-European satellite data	la1, la3 Many.... la6, la3 la6, la7 la8 la12 la12 lb3 lb10 lb10
VO is nice to do some quick look verification and as educational tool, and know which data to download to do further analyses. 'Downloading is more useful than tool itself'.	la3, la4, la6, la8, la9, la12
Download of large amounts of data including more parameters (e.g., SZA) should be possible; request for long time series (at least decadal); request for past time series cf. climate applications	la9, lb1, lb10
Important question about operational use of VO: Can scripting of some 'queries' be implemented? Option to 'ping' for new colocations automatically?	la8, lb10
What are requirements on internet speed (e.g., for developing countries)?	lb1
Possibility should exist to compare different datasets, data versions on top of each other, compare statistics with different colocation criteria, ...	la2
Can the VO become a way to replace local storage and processing of large amounts of data by web-based processing?	la6
Make better use of results of GAIA-CLIM WPs 1 - 2 - 3, e.g., to support OSCAR Rolling Requirements Review, to compare to GCOS requirements, etc...	la2

Feedback on functionalities and operational uses	Event reference
VO is useful but only if it can be further developed and survives <i>"If VO cannot be further developed and survive, it is of no interest"</i>	la1, la6, la7, la8, la9, la12, ...
VO has potential to support OSSEs in future	la2
VO will improve use of satellite data in climate applications	la3
Can VO be cited in publications?	la8
Critical comment that tools such as the NWP SAF radiance simulator are only truly applicable for TOA radiances and uncertainties if all processes (such as scattering by hydrometeors) are included; archived NWP fields do not always extend to layer quantities of rain, snow etc. Sceptical question about how widely NWP can be used as a reference	la9
Missing functionalities in VO	Event reference
Move around locations to see the effect on the comparisons. (unrealistic)	la2
See the dependents, e.g. whether a radiosonde has been used in NWP. (would require huge effort to achieve)	la2
See which sites have been used for cal/val activities in the past. (would require continuous updating)	la2
Display technology requirements from GCOS IP next to the graphs. (these requirements would have to be extracted from the GCOS IP into a database format)	la2
Use the VO the other way around for assessing the quality of non-satellite observations. (possible, but not in the focus of GAIA-CLIM)	la2
Use of VO to use the calibrated satellites to then vicariously calibrate baseline and comprehensive non-satellite measurements.	la2
Displaying (known) problems of satellite instruments.	la2
Include cloud products (1) for validation of cloud products (2) for using cloud product for screening other satellite data (3) for having this information at a station	la3 la7
Temporal averaging options	la3
Orbit forecasting tool including overpass predictor in order to plan matching observations	la4, la9
Some information on the local variability (e.g. pixel-to-pixel variability in local satellite data) would be useful in GUI. Things like cloud-masking, glint, frontal proximity etc. could be accounted for.	la10, lb10
Develop plug and play framework: the community should be able to implement additional data sets, additional radiance simulators, 'own data', COSP, etc....; this would increase the usage of the VO	la4, la7, la8, la11, la12
Provide three cloud screening options: cloud-free, cloudy, all	lb10, lb11
Option to see global and regional maps of atmospheric species derived from the satellite measurements.	la4
Feedback on VO presentation	Event reference
Like it; easy to navigate	la1, la4, la12, ... (general remark)
Displayed plots are OK But there is a wish to enhance the selection of display options. E.g., time series of measurand values by two instruments, their corresponding uncertainty bars and the corresponding measurand value differences between the two instruments should be displayable together on the same page, one above the other; e.g., display of multiple satellite data records	la1, la4, la12

2.2. Feedback to GAID

The version of the GAID that has been presented during the roadshows was version GAID v4 and corresponding on-line catalogue (D6.7).

Feedback on document	Event reference
Too long document !	Ib1
Language too negative in general; what has been/is being realised is often 'neglected' in the wording and in the identification of the gaps and needs better acknowledgement	Ia4
Documentation of each gap is appropriate	general remark
Major concern about duplication/ conflicts: <ul style="list-style-type: none"> • has GAID been compared to other gap analyses ? • Are findings consistent? E.g., compare to GCOS IP, other WMO strategic documents, etc. – otherwise we may confuse the policy makers.... 	Ia6, Ib1
Gap types should be aligned with WIGOS application areas	Ia2
Remedies: <ul style="list-style-type: none"> • Make better recourse to EU Research Infrastructures • Mention WMO/WIGO and work with expert teams • Highlight benefits! • Some appeared superficial; suggestion to give remedies to address improving the fundamental scientific understanding. 	Ia2 Ia11
Link recommendations better to WMO activities where possible to gain greater buy-in.	
Keep GAID as a living document; add a Wiki page for interactive comments so that it can also be used as a 'find an expert' resource	Ia10, Ia12, Ib10
Importance of spectroscopy gap is underlined.	Ia11
Audience of GAID? Need to reach instrument makers. Scope of GAID? Need for better introduction.	Ib1
Feedback on catalogue	Event reference
Variable interest in online catalogue: from useless to 'it should be maintained and managed on a sustained basis'	Ia12
Should have a function to select all ECVs (currently missing) and the same may apply to additional selection criteria.	Ia2
Missing gaps	Event reference
Provision of reference network data in an appropriate NRT	Ib1
No mention of ozone data stability over long term	Ib1
Satellite data rescue from the 1979 – to 2000.	Ib1
Measurements must cover the appropriate vertical range to allow an accurate estimation of TOA forcing.	Ib1
Need for a large number of information over Pacific Ocean, Southern Ocean (cf. reference measurements tend to be over land); all climatic zones must be covered and sufficiently sampled.	Ia9, Ib1
Need for homogenization of data format (e.g. hdf5 or he5 not readable by all user).	Ib1
Lack of availability of raw data.	Ib1
GRUAN has been asked to write to WMO for humidity calibration but nothing has been done to date....	Ib1

Missing gaps	Event reference
The need for coherent coordination of surface and space observations in terms of funding. E.g. there is no money provided for colocation measurements time schedules to meet satellite over- passes.	la2
The cross-community support mechanism that enables satellite missions to fund dedicated sustained cal/val was mentioned. This could be considered a governance gap in that satellite agencies should be required to in a sustained manner support the ground-segment. Although covered in current gaps, the specific aspect of satellite agency mandate is not and may be considered an additional gap.	la2

In some cases, the **wordings** should be improved

- Emissivity should be considered for different types of surface rather than a generic surface emissivity gap.
- The formulation of gaps is felt too critical, which can significantly negatively impact the perception a non-expert might have of a given technique, and does not sufficiently acknowledge efforts that might have been made in the past.
- Data availability in NRT is an issue that the VO could be used to highlight the value of exchange?
- When discussing observational governance the ESFRI should be referenced.
- The question was raised whether gaps are globally universal or whether these would look significantly different for people in regions other than Europe (la2).
- Change name to Gaps-AID?

2.3. Feedback to final recommendations

The “Final recommendations” document that has been presented during the roadshows was version 5.0 – see <http://www.gaia-clim.eu/page/recommendations> or Deliverable [D6.8](#).

Feedback on document (form)	Event reference
In the recommendation table, variables and or measurements techniques to which each recommendation is related must be specified to help the reader.	lb1
Shorten document wherever possible; better summarize	lb1
Table 1 is key. Should come earlier perhaps or be repeated in the executive summary. Plus use of greater number of tables?	lb1
Acronyms are an issue – particularly in the gap titles. Remove from main text all acronyms to ensure readability.	lb1
Consistently putting all recommendations under the same format could get repetitive and is not the snappiest way to look. Better would be half page on each: high level description, costs and benefits with traces in the appendix.	lb1
Remove aspects that are repetitive or construed as motherhood and apple pie statements. But don't remove reference to relevant keywords such as Copernicus services.	lb1

Feedback on document (form)	Event reference
Give more specific and univocal (short) recommendations to potential actors; Identify clearly what the status is, what the progress is over recent years, and what remains to be done, and possibly how it could be done. Recommendations are too wordy and vague – can point to several things.	Ia10, Internal feedback
Risks and benefits of any value? Remove from traces. Focus more on benefits.	Ib1
Identified missing recommendations	Event reference
<ul style="list-style-type: none"> Better raise/articulate the need for sustainable access to reference/high-quality data. Data availability in NRT is an issue that the VO could be used to highlight the value of exchange? 	Ia2
The adoption of the tiered system-of-systems networks approach should be somehow captured in the recommendations.	Ia2
Possible recommendation on expansion of approaches to other domains and remaining Copernicus services.	Ib1
Better raise the need for coherent coordination of surface and space observations in terms of funding. E.g. there is no money provided for colocation measurements time schedules to meet satellite over-passes.	Ia2, Ib1
Spectroscopy is seen as an important but neglected issue. Concern that the communities involved in laboratory measurements and those using radiative transfer models tend to be rather separate, need for engagement.	Ia9

It was suggested (Ia2) to ask the “Inter-Programme Expert Team on Observing System Design and Evolution” (IPET-OSDE) to review the recommendations document.

In some cases, the **wordings** should be improved:

- Education is a key need: Better articulate the risks to all sectors from not addressing; expand education to the public user interface issue, to the understanding of the need for reference networks.
- Undercapacity of work force will be interpreted as “we need more staff”, which often is misunderstood as hiring more people as a solution. Needs to be rephrased to: lack of trained staff. Believed to be very important in the recommendation e.g. European Commission does not need to provide money for hiring people but does for training (Ib1).
- The recommendations lack a spatiotemporal consideration for observations, i.e., the relevant recommendation suggests a need to extend the networks but not to carry out more observations (e.g., more radiosondes per day or more radiosonde flights colocated with overpasses). I.e., recommendation for scheduling coherently.
- The co-location of observations recommendation should be better informed by the WP3 work as to what is an acceptable match-up.
- In the geographic coverage recommendation make recourse to exemplar sites.
- There is a general feeling that there is a greater focus on direct matchup than on NWP techniques. Make the use of NWP more explicit in the recommendations (Ib1).
- Highlight EU research infrastructures such as ACTRIS, when discussing observational governance.

- Make clearer in the spectroscopy recommendation that a decade or two ago spectroscopy uncertainty was unimportant. With improved modelling, instrumentation and RT it has now become the limiting factor in many applications.
- General: Link recommendations better to WMO activities where possible to gain greater buy-in. This requires us to work to gain input from relevant WMO experts on the current document.
- Almost all of the recommendations are being done partially already but none adequately. There is lots going on. This needs to be reflected.

The **messages to the actors** should be formulated more clearly:

- The message to WMO & MetServices should be that knowledge/models have progressed so much that uncertainties now matter that haven't been relevant before.
- The message to the EC (and Space Agencies) should be that if funding the multi-billion satellite infra-structure, sustained and high-quality cal/val activities need to be funded from this as well. It cannot come from the little money given to MetServices (and other institutes).

3. Conclusions

The roadshows events have been very effective in collecting feedback from a much wider variety of stakeholder communities than achievable with classical user workshops. The roadshow events managed to reach several hundred people and gained in-depth feedback from in excess of a hundred subject matter experts via dedicated events. Despite substantial outreach efforts, the EC cancelled the roadshow event scheduled at EC DC GROW and several other planned activities proved impossible to schedule. Future projects should aim to start such events earlier and plan them from the outset to maximise the probability of success.

Feedback received from the various stakeholder communities was generally complementary. In a few cases, contradictory feedbacks have been identified, which are highlighted in this report.

In general, the VO, the GAID and the recommendations documents were well received.

With regards to the VO, the need for collaboration with other tool-providers was repeated very often, as a means to avoid redundant tools, as a means to complete it with complementary building blocks, and as a means to make tools and systems harmonised and interoperable. Also repeated very often was the statement that further developments and maintenance on a sustainable level were prerequisites for it being used. Many additional functionalities and data sets are required to satisfy the various users. We would caveat that the VO was not sufficiently advanced when the roadshows started, resulting in a few comments that are no longer valid because they pointed to issues that were solved soon thereafter.

With regard to the GAID, feedback was more difficult to obtain, as the audience was often poorly prepared for it, despite consistent advertisement and provision of the materials beforehand. The feedback was more diverse among communities. Questions were raised about the intended audience(s) and the scope of the GAID.

With regard to the Recommendations documents, a main concern was the length of the document and the repetition. The recommendations should be formulated more directly, precisely and concisely. It was questioned to what extent the recommendations are actionable.

Annex Ia1 – NIES, Japan

Information on outreach activity

Outreach event / activity	Dedicated visit to NIES, Tsukuba, Japan. The activity was held as a 30 minute seminar presentation with an one hour in-depth & more hands-on session straight afterwards.
Audience	The main audience of the seminar were atmospheric, oceanic, and forestry researchers at NIES including head, senior researchers, postdocs, and some PhD students. About 30-40 people attended the general seminar and after the seminar, 6 people stayed for the demonstration of the VO.
Location(s)	NIES (National Institute for Environmental Studies), 16-2 Onogawa, Tsukuba-city, 305-8506 Japan
Date(s) of event	7 September 2017
GAIA-CLIM parties	Dr Karin Kreher (BKS)
Facilitator(s) / Presenter(s) of what ?	The 30 min general presentation plus questions consisted of the primer slides plus some slides on the GAID and recommendations document and the VO presentation. The session afterward covered the VO demonstration only.
Principal individuals met with	Dr. Hideaki Nakajima (event host & principal researcher at NIES) Dr. Tomoko Shirai (database manager) Dr. Tatsuya Yokota (ILAS-II/GOSAT) Dr. Isamu Morino (GOSAT/GOSAT-II validation) Dr. Sachiko Okamoto (Ground-based O3/NO2 observations) Mr. Masanori Takeda (PhD student)
Version of GAID	V4
Version of Recommendations Document (RD)	V1
Version of VO	Development

Virtual Observatory (VO) feedback

Please repeat the below table for each set of feedback on the VO collected.

Scale 1 - 5 = excellent (5) – good (4) – useful but ...(3) – unsatisfactory (2) – rubbish (1)

How satisfied do you think the users were about the VO? (1-5)	(4)
Did the users find the VO potentially useful / informative to their application (which were present) area? Which data are most attractive?	Yes. They found in particular the ground-based data sets to be useful for future satellite (GOSAT/GOSAT-II) validation but definitely also liked the overall presentation and look of the Vo, and future potential.
How easy did the users find it to navigate in the VO? (Are groups for selection relevant for the users, e.g., ECV, Reference, satellite and NWP... Was there any other suggestion?)	Although the attendees didn't navigate the VO in detail, they felt it was quite easy (intuitive) to navigate through it.
What does the user think about (sub) selection features? (clouds, distances , period ...) Does he have more criteria to suggest?	We only touched on the sub-selection features briefly but, in general, distance and time period selection was seen as vital.
Does the user seem to need more documentation? Help button to navigate more efficiently?	The general feeling in the group was that more tutorial materials would be most helpful.
Is the provided tool set useful? <ul style="list-style-type: none"> Plotting (bars, lines, etc., Data analyses in particular statistics (dif, RMSE, Bias, std. ...) 	The group seemed to understand what was presented and to appreciate the displayed plots.
How satisfied the people are with the figure display? (color, size ...); Did the user find the visibility of uncertainties good enough?	Comment: "figure display looks nice" and seemed satisfactory.

Did they find any tools / functionalities superfluous?	No.
How did the user rate the data download function (accessibility, relevance and functionality)? (1-5)	(4) – But we only covered this briefly; reoccurring comment was that the amount of available data should be improved but they understood that this was work in progress.
What does the user plan to do with the downloaded data (e.g., compare to other data (which one, e.g., field experiment, etc.) not in the VO)?	Downloaded data would be mainly used for future satellite data validations but the attendees were also open for any other options and opportunities
What is missing in the VO: <ul style="list-style-type: none"> • In terms of supported applications; • In terms of data (ECVs?); • In terms of tools, e.g., plotting maps. 	Users felt it was too difficult to judge and comment on this yet.
Are the users aware of similar toolboxes to compare datasets and how do these complement/overlap each other? Why would they use another toolbox rather than the VO or their own toolbox?	They either were not aware or had no comments on this.

Any other comments:

The attendees were really interested in the VO and would like to use it, especially when fully up and running; they commented that the amount of available data and atmospheric parameter should be improved with the most interest in availability of ozone data.

Overall, the way the roadshow was received was very positive and encouraging.

Annex Ia2 – WMO, Switzerland

Information on outreach activity

Outreach event / activity	Dedicated visit to WMO HQs in Geneva.
Audience	Interested WMO staff, mainly from OBS (WIGOS, space programme, CIMO), WCRP, and Climate departments
Location(s)	WMO HQs in Geneva
Date(s) of event	14 Sept 2017
GAIA-CLIM parties	Peter Thorne (NUIM), Anna Mikalsen (NERSC)
Facilitator(s) / Presenter(s) of what ?	Peter: general overview presentation (1h) followed by in depths session of VO Anna: GAID and recommendations document
Principal individuals met with	Attending the in depths training: Timo Proeschold (WIGOS), Luis Nunes (WIGOS), Valentin Aich (GCOS), Tim Oakley (GCOS), Stephan Bojinski (space programme) Also provided comments during general presentation: Etienne Charpentier (OBS), Christian Blondin (retired Dir. External relations, advisor), Michel Rixen (WCRP)
Version of GAID	V4
Version of Recommendations Document (RD)	V1
Version of VO	Under construction

1st feedback report

Virtual Observatory (VO) feedback

Please repeat the below table for each set of feedback on the VO collected.

Scale 1 - 5 = excellent (5) – good (4) – useful but ...(3) – unsatisfactory (2) – rubbish (1)

How satisfied do you think the users were about the VO? (1-5)	3 The lack of uncertainties in current version of the VO was regarded as major disadvantage
Did the users find the VO potentially useful / informative to their application (which were present) area? Which data are most attractive?	4 The potential of the VO was well recognized, however, special interests in WMO may seem slightly out of the original focus/purpose of the VO. Participants would have been most interested in uncertainty information and seeing their contributions, as well as comparison to specifications and requirements set by WMO/WIGOS/GCOS/CEOS.
How easy did the users find it to navigate in the VO? (Are groups for selection relevant for the users, e.g., ECV, Reference, satellite and NWP... Was there any other suggestion?)	n.a. Participants were only shown a guided tour through the VO. The version available at this time did not allow users to navigate the VO freely on their own.
What does the user think about (sub) selection features? (clouds, distances , period ...) Does he have more criteria to suggest?	Clarification as to what was meant by the criteria was sought, e.g. it has been suggested to visualize (the geometry of) the distance to a satellite measurement.
Does the user seem to need more documentation? Help button to navigate more efficiently?	Yes, particularly on underlying features, see point above, but also on the resolution displayed and how this compares to the measurement resolution.
Is the provided tool set useful? • Plotting (bars, lines, etc.,	Yes.

<ul style="list-style-type: none"> Data analyses in particular statistics (dif, RMSE, Bias, std. ...) 	
<p>How satisfied the people are with the figure display? (color, size ...);</p> <p>Did the user find the visibility of uncertainties good enough?</p>	<p>It was unsatisfactory that uncertainties could not be displayed. Also the contributing factors of uncertainties would have been of high interest. It was suggested to remove the line in summery statistic plots of uncertainties.</p>
<p>Did they find any tools / functionalities superfluous?</p>	<p>No.</p>
<p>How did the user rate the data download function (accessibility, relevance and functionality)? (1-5)</p>	<p>n.a.</p>
<p>What does the user plan to do with the downloaded data (e.g., compare to other data (which one, e.g., field experiment, etc.) not in the VO)?</p>	<p>n.a.</p>
<p>What is missing in the VO:</p> <ul style="list-style-type: none"> In terms of supported applications; In terms of data (ECVs?); In terms of tools, e.g., plotting maps. 	<p>The following suggestions were made (stated irrespective of possibility to realize it). WMO people would like to:</p> <ul style="list-style-type: none"> - move around locations to see the effect on the comparisons. (unrealistic) - see the dependents, e.g. whether a radiosonde has been used in NWP. (would be heavy effort to achieve) - see which sites have been used for cal/val activities in the past. (would require continuous updating) - compare with requirements maintained in the OSCAR database from WMO/CEOS. - display technology requirements from GCOS IP next to the graphs. (these requirements would have to be extracted from the GCOS IP into a database format) - use the VO the other way around for assessing the quality of non-satellite observations. (possible, but not in the focus of GAIA-CLIM) - displaying (known) problems of satellite instruments.

Are the users aware of similar toolboxes to compare datasets and how do these complement/overlap each other? Why would they use another toolbox rather than the VO or their own toolbox?	Not aware of similar toolbox. The uniqueness to provide uncertainty information was recognized. WMO staff would likely not use such toolbox to investigate data themselves.
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Any other comments:

- The potential for the VO to support OSSEs much beyond the project was highlighted.
- It was recommended to extract a few high-level points why the VO is a useful tool for the community and present these more clearly.

GAID & RD feedback summary

Scale 1 - 5 = excellent (5) – good (4) – useful but ...(3) – unsatisfactory (2) – rubbish (1)

Did the users find the GAID easily accessible and the cross-sections on the online catalogue useful? Did they have feedback on accessibility?	4
Did the user(s) believe any gaps not to be gaps? Please note respective gap references and a brief rationale why they came to this conclusion.	Participants had not explored gaps in detail before the visit.
Any additional gaps? If yes, please provide a summary of each such gap and remedy, suggesting relevant WP lead to engage further. If possible, give contact details for GAIA-CLIM personnel to contact for background information /clarification of additional gaps.	The need for cohered coordination of surface and space observations in terms of funding . E.g. there is no money provided for colocation measurements time schedules to meet satellite over- passes.
Any comments to the description of a gap or the associated remedies?	Remedies should mention WMO/WIGO and try to work with respective expert teams. The gap types should match application areas used by WIGOS.
Feedback on <u>presentational aspects</u> of the RD. Any suggestions on how it can be made more appealing to key stakeholders / funders?	-
Did the user(s) find any recommendation inappropriate, irrelevant, badly formulated? If yes, which one, why?	-
Did they suggest additional recommendations?	Better raise/articulate the need for sustainable access to reference/high-quality data.

<p>If yes to above please specify including reference to underlying gap(s)</p>	<p>The tired networks approach should be somehow captured in the recommendations.</p> <p>Highlight EU research infrastructure such as ARCTIS.</p> <p>Better raise the need for coherent coordination of surface and space observations in terms of funding. E.g. there is no money provided for collocation measurements time schedules to meet satellite over-passes.</p>
<p>Any general or specific comments from the user concerning the identified actors?</p>	<p>The message to WMO & MetServices should be that knowledge/models have progressed so much that uncertainties now matter that haven't been relevant before.</p> <p>The message to the EC should be that if funding the multi-billion satellite infrastructure, cal/val activities need to be funded from this as well. It cannot come from the little money given to MetServices.</p>
<p>Would users prefer a prioritization and if yes, what would be their personal top 3 priorities from the list of recommendations and why?</p>	<p>-</p>
<p>More general suggestions on the gap assessment <u>exercise</u>?</p> <p>(usefulness – e.g. compared to alternative gaps assessments, comprehensiveness, accessibility, ...) ?</p>	<p>The question was raised whether gaps are globally universal or whether these would look significantly different for people in regions other than Europe.</p>
<p>More general suggestions on the recommendations <u>approach</u>?</p> <p>(appropriateness, comprehensiveness, well justified ? , will it have impact ? ...) ?</p>	<p>-</p>
<p>Were there any users interested in reviewing future drafts? If so, please provide email contact details here.</p>	<p>Etienne Charpentier suggested the “Inter-Programme Expert Team on Observing System Design and Evolution” (IPET-OSDE) to review the recommendations document. This has to be followed up by email as the team won't meet again until early 2018.</p>

Any other comments: The difficulty was recognized to reach not only the people interested, but the most knowledgeable experts with these roadshow visits.

2nd feedback report

Virtual Observatory (VO) feedback

Please repeat the below table for each set of feedback on the VO collected.

Scale 1 - 5 = excellent (5) – good (4) – useful but ...(3) – unsatisfactory (2) – rubbish (1)

How satisfied do you think the users were about the VO? (1-5)	3 – lack of uncertainty estimates inclusion on several plots was noted as a significant current shortcoming. With these the score would be higher
Did the users find the VO potentially useful / informative to their application (which were present) area? Which data are most attractive?	Yes, although the utility is limited in current form with the limited use of the uncertainty information.
How easy did the users find it to navigate in the VO? (Are groups for selection relevant for the users, e.g., ECV, Reference, satellite and NWP... Was there any other suggestion?)	<p>Only a guided tour was given as the VO was still under development. Users did not explore the facility themselves.</p> <p>Michel Rixen asked whether innovation statistics for reanalysis against reference observations would be able to be incorporated</p> <p>It was queried whether the VO could be extended to visualize some of the WP1 and WP3 results around the quantification of the effects of gaps and mismatches to support the OSCAR RRR (rolling review of requirements) process.</p>
What does the user think about (sub) selection features? (clouds, distances, period ...) Does he have more criteria to suggest?	The user wondered whether summary statistics could be shown by space and / or time co-location criteria as well as current all sample and timeseries options. They'd like to explore the differences by degree of co-location achieved.

Does the user seem to need more documentation? Help button to navigate more efficiently?	Not tried as a live user experience
Is the provided tool set useful? <ul style="list-style-type: none"> Plotting (bars, lines, etc., Data analyses in particular statistics (dif, RMSE, Bias, std. ...) 	Yes, although see previously noted suggestions to the earlier points made.
How satisfied the people are with the figure display? (color, size ...); Did the user find the visibility of uncertainties good enough?	The figures themselves were good. At this stage there is insufficient representation of uncertainties on many plots and users stressed that to be useful to them the priority had to be adding in the uncertainty information to all plots.
Did they find any tools / functionalities superfluous?	
How did the user rate the data download function (accessibility, relevance and functionality)? (1-5)	Not tried so N/A
What does the user plan to do with the downloaded data (e.g., compare to other data (which one, e.g., field experiment, etc.) not in the VO)?	Various uses envisaged including revising the RRR process as alluded to above.
What is missing in the VO: <ul style="list-style-type: none"> In terms of supported applications; In terms of data (ECVs?); In terms of tools, e.g., plotting maps. 	<p>Some alluded to in prior answers. In addition user would like to see:</p> <p>Instrument metadata (satellite manouvers, reclaibrations etc.)</p> <p>Use of VO to use the calibrated satellites to then vicariously calibrate baseline and comprehensive non-satellite measurements.</p> <p>VO should consider building a case study of a known instrument that had an effect to showcase what the VO can do.</p>
Are the users aware of similar toolboxes to compare datasets and how do these complement/overlap each other? Why would they use	Not discussed

another toolbox rather than the VO or their own toolbox?	
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Any other comments: As noted above the primary concern was that the VO must adequately account for the uncertainties quantified in underlying WPs. Incorporation of this information was suggested to be the top priority in coming work to finalise the VO developments within the project lifetime.

GAID & RD feedback summary

Scale 1 - 5 = excellent (5) – good (4) – useful but ...(3) – unsatisfactory (2) – rubbish (1)

<p>Did the users find the GAID easily accessible and the cross-sections on the online catalogue useful? Did they have feedback on accessibility?</p>	<p>Users had not considered the GAID in-depth prior to the meeting. The online catalogue was intuitive to them for the main part.</p> <p>GAID and traces were seen as daunting but no way was seen to reasonably address this.</p> <p>The gap traces should have a function to select all ECVs (currently missing) and the same may apply to additional selection criteria.</p>
<p>Did the user(s) believe any gaps not to be gaps? Please note respective gap references and a brief rationale why they came to this conclusion.</p>	<p>None were noted. They did however question to what extent the gaps may be a product of the mix of expertise in the consortium and be euro-centric in nature. How different would the gaps be if they had arisen from a distinct non-European project process?</p> <p>It was suggested that a cross-check be made against the GCOS IP and a number of additional WMO strategic documents to ensure against conflicts which may serve to confuse policymakers.</p>
<p>Any additional gaps? If yes, please provide a summary of each such gap and remedy, suggesting relevant WP lead to engage further. If possible, give contact details for GAIA-CLIM personnel to contact for background information /clarification of additional gaps.</p>	<p>The cross-community support mechanism that enables satellite missions to fund dedicated sustained cal/val was mentioned. This could be considered a governance gap in that satellite agencies should be required to in a sustained manner support the ground-segment. Although covered in current gaps the specific aspect of satellite agency mandate is not and may be considered an additional gap.</p>
<p>Any comments to the description of a gap or the associated remedies ?</p>	<p>Better recourse should be made to Research Infrastructures in the remedies to several gaps.</p>

<p>Feedback on <u>presentational aspects</u> of the RD. Any suggestions on how it can be made more appealing to key stakeholders / funders?</p>	<p>No substantive comments received on this aspect</p>
<p>Did the user(s) find any recommendation inappropriate, irrelevant, badly formulated ? If yes, which one, why ?</p>	<p>No, but they had some specific suggestions as follows:</p> <p>General: link recommendations better to WMO activities where possible to gain greater buy-in. This requires us to work to gain input from relevant WMO experts on the current document.</p> <p>Education is a key need. Better articulate the risks to all sectors from not addressing.</p> <p>In the geographic coverage recommendation make recourse to exemplar sites</p> <p>The co-location of observations recommendation should be better informed by the WP3 work as to what is an acceptable match-up</p> <p>Data availability in NRT is an issue that the VO could be used to highlight the value of exchange?</p> <p>When discussing observational governance the ESFRI should be referenced.</p> <p>Make clearer in the spectroscopy recommendation that a decade or two ago spectroscopy uncertainty was unimportant. With improved modelling, instrumentation and RT it has now become the limiting factor in many applications.</p>

	Stress that the VO is a tool for more than NWP
Did they suggest additional recommendations? If yes to above please specify including reference to underlying gap(s)	They suggested that the tiered system-of-systems approach adoption could make a useful additional recommendation
Any general or specific comments from the user concerning the identified actors ?	Not covered
Would users prefer a prioritization and if yes, what would be their personal top 3 priorities from the list of recommendations and why?	Not covered
More general suggestions on the gap assessment <u>exercise</u> ? (usefulness – e.g. compared to alternative gaps assessments, comprehensiveness, accessibility, ...) ?	As noted above the need to avoid conflicting with existing GCOS and WMO documents was noted
More general suggestions on the recommendations <u>approach</u> ? (appropriateness, comprehensiveness, well justified ? , will it have impact ? ...) ?	No.
Were there any users interested in reviewing future drafts? If so, please provide email contact details here.	Not requested

Any other comments: Participants recognized that relevant colleagues were not present. This shall likely be an abiding feature throughout the roadtrip. They will attempt to engage these colleagues.

Annex Ia3 – CM-SAF, Switzerland

Information on outreach activity

Outreach event / activity	CM SAF Project Meeting
Audience	Scientist – Academic
Location(s)	Zurich
Date(s) of event	19/10/2017
GAIA-CLIM parties	EUMETSAT, TUT
Facilitator(s) / Presenter(s) of what ?	Kalev Rannat (Primer, GAID) Stephanie Guedj (intro VO, live demo)
Principal individuals met with	
Version of GAID	V4
Version of Recommendations Document (RD)	V1
Version of VO	Development

Virtual Observatory (VO) feedback

Please repeat the below table for each set of feedback on the VO collected.

Scale 1 - 5 = excellent (5) – good (4) – useful but ...(3) – unsatisfactory (2) – rubbish (1)

How satisfied do you think the users were about the VO? (1-5)	4
Did the users find the VO potentially useful / informative to their application (which were present) area? Which data are most attractive?	They find it very useful. It may significantly improve the use of satellite obs in Climate applications.
How easy did the users find it to navigate in the VO? (Are groups for selection relevant for the users, e.g., ECV, Reference, satellite and NWP... Was there any other suggestion?)	
What does the user think about (sub) selection features? (clouds, distances , period ...) Does he have more criteria to suggest?	
Does the user seem to need more documentation? Help button to navigate more efficiently?	
Is the provided tool set useful? <ul style="list-style-type: none"> Plotting (bars, lines, etc., Data analyses in particular statistics (dif, RMSE, Bias, std. ...) 	Yes, but they seem more interested in the export tool to be able to work on the data on their own; One comment mentioned that uncertainties and consistency should be more separated.
How satisfied the people are with the figure display? (color, size ...); Did the user find the visibility of uncertainties good enough?	Uncertainties not clear.

Did they find any tools / functionalities superfluous?	
How did the user rate the data download function (accessibility, relevance and functionality)? (1-5)	
What does the user plan to do with the downloaded data (e.g., compare to other data (which one, e.g., field experiment, etc.) not in the VO)?	Statistics and Plots
What is missing in the VO: <ul style="list-style-type: none"> • In terms of supported applications; • In terms of data (ECVs?); • In terms of tools, e.g., plotting maps. 	Cloud information. Cloud colocations do not exist yet. They would be very interested if cloud products are ingested into the VO; Actually it would be double advantage: Validation of cloud products and cloud screening of other satellite data.
Are the users aware of similar toolboxes to compare datasets and how do these complement/overlap each other? Why would they use another toolbox rather than the VO or their own toolbox?	Yes, the CM SAF already have a colocation tool. They will get back to us to provide more details about it and how we can include this tool into the VO for observations were do not still collocate; They also suggest to implement some temporal average for measurement with high frequency. Not yet applicable with GRUAN but still a topic to work on.

Any other comments:

Some questions were asked about:

- The accessibility of data and copyright policies, especially related to some Reference observations.
- Flexibility of colocation, how many pixels are collocated with the radiosondes ...

The suggested the use of different cloud masks such as COMET or CLASS (CM SAF webpage).

The also mention some potential and fruitful collaboration with international organizations such as GEOS/GCAS.

GAID & RD feedback summary

Scale 1 - 5 = excellent (5) – good (4) – useful but ...(3) – unsatisfactory (2) – rubbish (1)

Did the users find the GAID easily accessible and the cross-sections on the online catalogue useful? Did they have feedback on accessibility?	Yes, but they have asked time to look it through and will sent feedback later.
Did the user(s) believe any gaps not to be gaps? Please note respective gap references and a brief rationale why they came to this conclusion.	There was not time enough to go into the gap details, if something will be noticed, we should get feedback by the 1 st of December.
Any additional gaps? If yes, please provide a summary of each such gap and remedy, suggesting relevant WP lead to engage further. If possible, give contact details for GAIA-CLIM personnel to contact for background information /clarification of additional gaps.	It was asked to send feedback on any gaps the users may notice as missing from their practical viewpoints. Hollmann Rainer Rainer.Hollmann@dwd.de
Any comments to the description of a gap or the associated remedies ?	No special comments.
Feedback on <u>presentational aspects</u> of the RD. Any suggestions on how it can be made more appealing to key stakeholders / funders?	
Did the user(s) find any recommendation inappropriate, irrelevant, badly formulated ? If yes, which one, why ?	
Did they suggest additional recommendations?	

<p>If yes to above please specify</p> <p>including reference to underlying gap(s)</p>	
<p>Any general or specific comments from the user concerning the identified actors ?</p>	
<p>Would users prefer a prioritization and if yes, what would be their personal top 3 priorities from the list of recommendations and why?</p>	
<p>More general suggestions on the gap assessment <u>exercise</u> ?</p> <p>(usefulness – e.g. compared to alternative gaps assessments, comprehensiveness, accessibility, ...) ?</p>	
<p>More general suggestions on the recommendations <u>approach</u> ?</p> <p>(appropriateness, comprehensiveness, well justified ? , will it have impact ? ...) ?</p>	
<p>Were there any users interested in reviewing future drafts? If so, please provide email contact details here.</p>	

Any other comments:

Annex Ia4 – NDACC Steering Committee, USA

Information on outreach activity

Outreach event / activity	Dedicated roadshow event during NDACC SC meeting in Boulder, on November 8 pm
Audience	NDACC SC members (NDACC members and representatives of cooperating networks like AGAGE, HATS; K. Jucks from NASA UARP, A. Dehn from ESA and C. Long from NOAA NCEP were also present)
Location(s)	NCAR, Boulder, CO, USA
Date(s) of event	Nov. 8 pm, 2017, full afternoon
GAIA-CLIM parties	K. Kreher (BKS), M. De Mazière, J.-C. Lambert, M. Van Roozendaal (BIRA-IASB)
Facilitator(s) / Presenter(s) of what ?	K. Kreher for the VO; M. De Mazière for the project primer, the GAID and the recommendations
Principal individuals met with	All, and in particular T. Leblanc (JPL), A. Dehn (ESA) and I. Petropavlovskikh (NOAA GMD)
Version of GAID	V4
Version of Recommendations Document (RD)	V1
Version of VO	Development

Virtual Observatory (VO) feedback

Please repeat the below table for each set of feedback on the VO collected.

Scale 1 - 5 = excellent (5) – good (4) – useful but ...(3) – unsatisfactory (2) – rubbish (1)

How satisfied do you think the users were about the VO? (1-5)	3
Did the users find the VO potentially useful / informative to their application (which were present) area? Which data are most attractive?	3 Users seemed to find the VO most useful as a ‘quick look ‘ tool and as an educational tool. The interest for data comparisons was more limited due to several weaknesses expressed individually and mentioned below.
How easy did the users find it to navigate in the VO? (Are groups for selection relevant for the users, e.g., ECV, Reference, satellite and NWP... Was there any other suggestion?)	4
What does the user think about (sub) selection features? (clouds, distances , period ...) Does he have more criteria to suggest?	<ul style="list-style-type: none"> • A more natural order of presentation of the selection features – as opposed to the current (alphabetical) order - is recommended: the measurand should be in first position. • There should be also a selection based on the data version number of a dataset, an information that is currently missing. • No other specific feedback
Does the user seem to need more documentation? Help button to navigate more efficiently?	<ul style="list-style-type: none"> • The audience didn’t seem to have many difficulties playing with the VO. • General documentation making VO methods and procedures more transparent (e.g., definition of co-location criteria) was wished.
Is the provided tool set useful? <ul style="list-style-type: none"> • Plotting (bars, lines, etc., • Data analyses in particular statistics (dif, RMSE, Bias, std. ...) 	No specific feedback
How satisfied the people are with the figure display? (color, size ...);	No feedback, except that the general “look” of the VO and its graphical outputs do meet current standards.

Did the user find the visibility of uncertainties good enough?	
Did they find any tools / functionalities superfluous?	?
How did the user rate the data download function (accessibility, relevance and functionality)? (1-5)	This function didn't work
What does the user plan to do with the downloaded data (e.g., compare to other data (which one, e.g., field experiment, etc.) not in the VO)?	<ul style="list-style-type: none"> • To perform own data comparisons with other ground-based data and also satellite data. Therefore more parameters associated with the displayed satellite data should be downloadable (e.g., solar zenith angle of the satellite measurements). • Participants expressed also the wish to plot – or have at disposal – global maps of atmospheric species derived from the satellite measurements. • No other feedback
<p>What is missing in the VO:</p> <ul style="list-style-type: none"> • In terms of supported applications; • In terms of data (ECVs?); • In terms of tools, e.g., plotting maps. 	<p>Missing: An orbit forecast option, to plan for collocated measurements</p> <ul style="list-style-type: none"> • It was wished to enhance the selection of display options. E.g., time series of measurand values by two instruments, their corresponding uncertainty bars and the corresponding measurand value differences between the two instruments should be displayable together on the same page, one above the other. • Looking with interest at the orbit properties displayed on screen, several participants suggested extending the current orbit propagator with an overpass predictor in order to enable dedicated operation of ground-based validation facilities, e.g., optimal launch of ozonesondes or optimal operation of tropospheric lidars in good co-location with the satellite overpass. • The display of multiple satellite data records – from different satellites or of the same satellite but with different data versions – on the same graph would be appreciated. • More generally, the datasets need to be better identified. E.g., GOME-2A/B does not say enough on the origin of the data (GOME-2A, GOME-2B or a merging of both?), the algorithm version (GDP x.y, GODFIT V x...)
Are the users aware of similar toolboxes to compare datasets and how do these complement/overlap each other? Why would they use	<ul style="list-style-type: none"> • ESA has implemented a toolbox for S5P and 27 other EO satellites, that has some similarities but is essentially complementary – see S5P OPOT : http://evdc.esa.int/orbit/ • The VO is appreciated as a 'quick look ' tool and as an educational tool but it does not offer (yet?) the

another toolbox rather than the VO or their own toolbox?	functionalities required for an operational data validation system. For this reasons existing toolboxes and data comparison facilities are preferred.
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Any other comments:

We had the feeling that it was difficult to get precise feedback as most useful options are not yet completely or correctly implemented.....

GAID & RD feedback summary

Scale 1 - 5 = excellent (5) – good (4) – useful but ...(3) – unsatisfactory (2) – rubbish (1)

Did the users find the GAID easily accessible and the cross-sections on the online catalogue useful? Did they have feedback on accessibility?	Accessibility: no negative feedback
Did the user(s) believe any gaps not to be gaps? Please note respective gap references and a brief rationale why they came to this conclusion.	<p>Yes:</p> <p>T. Leblanc wrote:</p> <p>Although I did not have much time to inspect every identified gap in the list, I noticed several inaccuracies, and very concerning material:</p> <p>1) Regarding Lidar, I strongly disagree with statements G2.08 and G2.12</p> <p>2) More generally speaking, I think the language used in this list is much too critical, which can significantly negatively impact the perception a non-expert might have of a given technique, and do not acknowledge efforts that might have been made in the past</p>
Any additional gaps? If yes, please provide a summary of each such gap and remedy, suggesting relevant WP lead to engage further. If possible, give contact details for GAIA-CLIM personnel to contact for background information /clarification of additional gaps.	No feedback
Any comments to the description of a gap or the associated remedies ?	See above
Feedback on <u>presentational aspects</u> of the RD. Any suggestions on how it can be made more	No explicit feedback

appealing to key stakeholders / funders?	
Did the user(s) find any recommendation inappropriate, irrelevant, badly formulated ? If yes, which one, why ?	No explicit feedback
Did they suggest additional recommendations? If yes to above please specify including reference to underlying gap(s)	No explicit feedback
Any general or specific comments from the user concerning the identified actors ?	No explicit feedback
Would users prefer a prioritization and if yes, what would be their personal top 3 priorities from the list of recommendations and why?	No explicit feedback
More general suggestions on the gap assessment <u>exercise</u> ? (usefulness – e.g. compared to alternative gaps assessments, comprehensiveness, accessibility, ...) ?	Not much enthousiasm for the GAID nor for the recommendations
More general suggestions on the recommendations <u>approach</u> ? (appropriateness, comprehensiveness, well justified ? , will it have impact ? ...) ?	Not much enthousiasm for the GAID nor for the recommendations
Were there any users interested in reviewing future drafts? If so, please provide email contact details here.	I don't think so

Any other comments:

It is understood that the GAIA-CLIM GAID has been elaborated in the framework of a H2020 project, with its specific actors, goals and constraints. A more comprehensive exercise involving a wider community of instrument representatives, measurement techniques and networks might be useful.

We asked explicitly for feedback by Email, formulating explicit questions extracted from this feedback document, and did not get any answer up to now.....

Annex Ia5 – AC-SAF, the Netherlands

Information on outreach activity

WHAT? Outreach event / activity / Conference	30-min seminar with hands-on demonstration of the VO
WHO? Audience / subject of session / size	AC SAF project team, about 20 persons at seminar, about 10 persons came to the hands-on session. Mostly AC-SAF retrieval scientists and KNMI staff
WHERE? Location(s)	KNMI
WHEN? Date(s) of event	14-15 Nov 2017
WHO from the project? GAIA-CLIM parties	Michiel van Weele, KNMI WP6
What you did? Type of presentation	Seminar plus hands-on demo of VO
WHO did you talk to in detail? Principal individuals met with	--

Recollection of relevant feedback received:

GAID/RD: no specific feedback at the seminar, questions only to get clarifications

VO:

General: strong interest in the aerosol and ozone data sets included in the VO; lots of practical questions related to browser issues, reset buttons etc.

Specific:

What aerosol data sets are going to be included? For what time periods will satellite and ground-based data be provided? Will more and more data sets be added?

Is there any automated selection of co-locations: how to optimize the co-location search?

When is this VO ready to use?

Overall: seems an interesting tool. Thanks for sharing and let us know when it is ready to use.

Annex Ia6 – Meteo-France, France

Information on outreach activity

Outreach event / activity	Dedicated event with introduction to the project, presentation of GAID and RD, presentation and live demo of the VO, and presentation of the GRUAN processor.
Audience	Meteo-France climate and weather sections
Location(s)	Meteo-France, Toulouse
Date(s) of event	14 November 2017
GAIA-CLIM parties	Stephanie Guedj WP5 Fabien Carminati WP 4
Facilitator(s) / Presenter(s) of what ?	Intro: Stephanie, GAID/RD: Fabien, VO: Stephanie, GProc: Fabien
Principal individuals met with	CNRM/GMGEC (climat): Philippe Ricaud, Samuel Somot CNRM/GMAP (nwp): Jean Francois Mahfouf, Philippe Chambon, Benjamin Ménétrier, Nadia Fourrié, Christophe Payant, Pascal Brunel (CMS-Lanion)
Version of GAID	V4
Version of Recommendations Document (RD)	V1
Version of VO	Development

Virtual Observatory (VO) feedback

Please repeat the below table for each set of feedback on the VO collected.

Scale 1 - 5 = excellent (5) – good (4) – useful but ...(3) – unsatisfactory (2) – rubbish (1)

How satisfied do you think the users were about the VO? (1-5)	3
Did the users find the VO potentially useful / informative to their application (which were present) area? Which data are most attractive?	Users, especially from climate science found the VO potentially very attractive with maybe the best functionalities proposed among the web portals, but they also remarked that it would be of no use to them if not supported over the long term. We received a very negative feedback pointing out that this road show event should have been organized at the end of the project with a finished, supported, and operational version. They felt that introducing the VO in the current state was a loss of time because there are no guaranties it will survive after the end of the project.
How easy did the users find it to navigate in the VO? (Are groups for selection relevant for the users, e.g., ECV, Reference, satellite and NWP... Was there any other suggestion?)	NA
What does the user think about (sub) selection features? (clouds, distances , period ...) Does he have more criteria to suggest?	They would like to be able to find all overpasses for a given spot via cesium and get the data in the VO. (something automatic, not manually making the satellite fly until it comes above the chosen spot)
Does the user seem to need more documentation? Help button to navigate more efficiently?	Yes, they asked for more pop-up windows to get direct information about the dataset they can select.
Is the provided tool set useful? <ul style="list-style-type: none"> Plotting (bars, lines, etc., Data analyses in particular statistics (dif, RMSE, Bias, std. ...) 	Yes, but not free of bugs.

How satisfied the people are with the figure display? (color, size ...);	Difficult to judge as most of the functionality are still missing. What was available seemed good enough.
Did the user find the visibility of uncertainties good enough?	They would use functionality online if they are flexible enough.
Did they find any tools / functionalities superfluous?	No
How did the user rate the data download function (accessibility, relevance and functionality)? (1-5)	NA
What does the user plan to do with the downloaded data (e.g., compare to other data (which one, e.g., field experiment, etc.) not in the VO)?	Various
<p>What is missing in the VO:</p> <ul style="list-style-type: none"> • In terms of supported applications; • In terms of data (ECVs?); • In terms of tools, e.g., plotting maps. 	<p>Surface observations, oceanic observations, wind.</p> <p>In the present configuration, the uncertainties are given at station/observation scale/level and compared to model (ie downscaling of model uncertainties), they would like to see the uncertainties at model grid scale around the station/observation (ie upscaling the obs uncertainties).</p>
Are the users aware of similar toolboxes to compare datasets and how do these complement/overlap each other? Why would they use another toolbox rather than the VO or their own toolbox?	The VO would represent a gain of time and (physical) space especially in climate science as it seems that the general tendency goes toward web data processing (not enough physical space to store all climate data in labs). It was also suggested that the VO could be used for specific case studies or to give a first look at some data to know if it worth putting more effort in their analysis (via download).

Any other comments:

Some users would like the possibility to process climate models in the VO. Those are obs-free and coherent in time. Used by climate people to validate long series of satellite obs.

GAID & RD feedback summary

Scale 1 - 5 = excellent (5) – good (4) – useful but ...(3) – unsatisfactory (2) – rubbish (1)

Did the users find the GAID easily accessible and the cross-sections on the online catalogue useful? Did they have feedback on accessibility?	None of the present user have read the GAID or the RD or browsed the catalogue.
Did the user(s) believe any gaps not to be gaps? Please note respective gap references and a brief rationale why they came to this conclusion.	No
Any additional gaps? If yes, please provide a summary of each such gap and remedy, suggesting relevant WP lead to engage further. If possible, give contact details for GAIA-CLIM personnel to contact for background information /clarification of additional gaps.	No
Any comments to the description of a gap or the associated remedies ?	No
Feedback on <u>presentational aspects</u> of the RD. Any suggestions on how it can be made more appealing to key stakeholders / funders?	NA
Did the user(s) find any recommendation inappropriate, irrelevant, badly formulated ? If yes, which one, why ?	No
Did they suggest additional recommendations?	No

If yes to above please specify including reference to underlying gap(s)	
Any general or specific comments from the user concerning the identified actors ?	No
Would users prefer a prioritization and if yes, what would be their personal top 3 priorities from the list of recommendations and why?	NA
More general suggestions on the gap assessment <u>exercise</u> ? (usefulness – e.g. compared to alternative gaps assessments, comprehensiveness, accessibility, ...) ?	Has the GAID inter-compared with WMO OSCAR gap and ESA gap and the copernicus gap lists?
More general suggestions on the recommendations <u>approach</u> ? (appropriateness, comprehensiveness, well justified ? , will it have impact ? ...) ?	No
Were there any users interested in reviewing future drafts? If so, please provide email contact details here.	No

Any other comments:

Several users found the lack of wind in the addressed ECV problematic as this is an important component of climate analysis. My personal feeling is that they did not get the fundamental sense of GAIA CLIM, thinking that it's a climate oriented project, and not something aimed to improve the satellite cal/val.

Annex Ia7 – LMD, France

Information on outreach activity

WHAT? Outreach event / activity / Conference	2h seminar with live demonstration of the VO
WHO? Audience / subject of session / size	Laboratoire de Météorologie Dynamique (LMD) about 15 persons. Subject: Introduction to GC, GAID/RD, VO, GRUAN Processor
WHERE? Location(s)	Polytechnique School Paris in Palaiseau
WHEN? Date(s) of event	22 Nov 2017
WHO from the project? GAIA-CLIM parties	Stephanie Guedj WP5 Fabien Carminati WP4
What you did? Type of presentation	Seminar plus VO live demo
WHO did you talk to in detail? Principal individuals met with	Raymond Armante (LMD) Sophie Bouffies-Cloche (IPSL)

Recollection of relevant feedback received:

GAID/RD:

The RD lacks a spatiotemporal side for observation, ie it suggests a need to extend the networks but not to carry out more observations (eg more radiosondes per day or more radiosonde collocated with overpasses).

In RD: ‘undertake associated innovations in radiative-transfer modelling’ it is not clear what innovations means here.

VO:

Often ask how the colocation tool works, users are pointed to gaiacim documentation.

The VO will provide aerosol optical thickness, that's an integrated quantity, why not providing non-integrated quantities as well?

We were asked if greenhouse gases and geostationary data will be in the VO.

GRUAN proc:

Are there any plans to use line-by-line spectroscopy? No, not now.

Information on outreach activity

WHAT? Outreach event / activity / Conference	2h seminar with live demonstration of the VO
WHO? Audience / subject of session / size	Institut Pierre Simon Laplace (IPSL) about 6 persons. Subject: Introduction to GC, GAID/RD, VO, GRUAN Processor
WHERE? Location(s)	Jussieu Paris
WHEN? Date(s) of event	23 Nov 2017
WHO from the project? GAIA-CLIM parties	Stephanie Guedj WP5 Fabien Carminati WP4
What you did? Type of presentation	Seminar plus VO live demo
WHO did you talk to in detail? Principal individuals met with	Sophie Bouffies-Cloche (IPSL)

Recollection of relevant feedback received:

3D metadata tool:

Users want to be able to export textfile with the metadata from cesium (right panel).

They want an 'automatic' tool that gives all possible colocations for a certain time range/or area without manual/visual inspection needed.

where does the orbitography information come from ?

Information on outreach activity

WHAT? Outreach event / activity / Conference	1h seminar with live demonstration of the VO
WHO? Audience / subject of session / size	IPSL satellite working group about 12 persons. Subject: Introduction to GC, GAID/RD, VO, GRUAN Processor
WHERE? Location(s)	Jussieu Paris
WHEN? Date(s) of event	23 Nov 2017
WHO from the project? GAIA-CLIM parties	Stephanie Guedj WP5 Fabien Carminati WP4
What you did? Type of presentation	Seminar plus VO live demo
WHO did you talk to in detail? Principal individuals met with	Sophie Bouffies-Cloche (IPSL)

Recollection of relevant feedback received:

Atmospheric observations are also gathered in France and accessible via the portal pole atmosphere (cannot find a link ?), redundancy with the VO?

The VO is an interesting tool but only if maintain/extend in the future.

User want to be able to add to the VO their own satellite data, for own validation.

Frequently asked questions:

Is a cloud cover product available? Information at the station would be useful.

Will it be possible to plug in the VO another piece of software like COSP (going from radiance to products)?

When the VO would be available?

Would it be possible for a user to add 'easily' its own satellite data?

Annex Ia8 – NCEO, UK

Information on outreach activity

Outreach event / activity	Dedicated visit – 50 minute seminar format.
Audience	NCEO
Location(s)	University of Reading
Date(s) of event	5/12/17
GAIA-CLIM parties	Provide full list of GAIA-CLIM participants involved
Facilitator(s) / Presenter(s) of what ?	Paul Green
Principal individuals met with	Provide names of attendees interacted with Chris Merchant, Peter-Jan van Leeuwen, Nancy Nichols, Jon Mittaz, Kevin Pearson, Claire Watt, Michael? Jan Fillingham, Debbie Clifford + 3 others
Version of GAID	online version on 5/12/17
Version of Recommendations Document (RD)	online version o 5/12/17
Version of VO	Development

Virtual Observatory (VO) feedback

Please repeat the below table for each set of feedback on the VO collected.

Scale 1 - 5 = excellent (5) – good (4) – useful but ...(3) – unsatisfactory (2) – rubbish (1)

How satisfied do you think the users were about the VO? (1-5)	4 – the general consensus was that it was a very useful tool. Excited about the possibilities.
Did the users find the VO potentially useful / informative to their application (which were present) area? Which data are most attractive?	Very useful. Especially the co-location generator that is a large effort study-by-study, PhD-by-PhD student. All data from a range of networks in one place was well received.
How easy did the users find it to navigate in the VO? (Are groups for selection relevant for the users, e.g., ECV, Reference, satellite and NWP... Was there any other suggestion?)	Only a short demonstration was provided. Feedback via email suggested by attendees once they have had a play!
What does the user think about (sub) selection features? (clouds, distances, period ...) Does he have more criteria to suggest?	The audience were positive about the flexibility of features. No-one disputed 500km & 6 hours as an upper limit.
Does the user seem to need more documentation? Help button to navigate more efficiently?	Only a short demonstration was provided. Feedback via email suggested by attendees once they have had a play!
Is the provided tool set useful? <ul style="list-style-type: none">• Plotting (bars, lines, etc.,• Data analyses in particular statistics (dif, RMSE, Bias, std. ...)	Only a short demonstration was provided. Feedback via email suggested by attendees once they have had a play!
How satisfied the people are with the figure display? (color, size ...); Did the user find the visibility of uncertainties good enough?	No complaints.

Did they find any tools / functionalities superfluous?	Only a short demonstration was provided. Feedback via email suggested by attendees once they have had a play!
How did the user rate the data download function (accessibility, relevance and functionality)? (1-5)	Only a short demonstration was provided. Feedback via email suggested by attendees once they have had a play!
What does the user plan to do with the downloaded data (e.g., compare to other data (which one, e.g., field experiment, etc.) not in the VO)?	<p>The discussion centered on the VO as a good exploratory tool, but downloaded data would be used for publications & 'more serious' use of the tool.</p> <p>I was asked how stable & reproducible the results are, can this VO be cited in papers? How should it be cited? Will the same results be found again in the future? [I suggested after the project finishes, it will become more reproducible.]</p>
<p>What is missing in the VO:</p> <ul style="list-style-type: none"> • In terms of supported applications; • In terms of data (ECVs?); • In terms of tools, e.g., plotting maps. 	<p>How to cite it in publications.</p> <p>I was asked if other data sets could be added. Can users suggest their own.</p> <p>Does it support API usage. Script/batch usage?</p>
Are the users aware of similar toolboxes to compare datasets and how do these complement/overlap each other? Why would they use another toolbox rather than the VO or their own toolbox?	Not discussed

Any other comments:

Can the NWP products be compared directly?

Do the instrumental uncertainties include representation uncertainties, in terms of the how well the measurement aligns to the ECV directly?

How can the VO be used in publications?

Is there a plan to add Sentinel data to the VO? Engage with ESA as well as EUMETSAT/EC to put the other big dataset into the VO.

Lots of discussion on availability into the future, long term development options etc.

GAID & RD feedback summary

Scale 1 - 5 = excellent (5) – good (4) – useful but ...(3) – unsatisfactory (2) – rubbish (1)

Did the users find the GAID easily accessible and the cross-sections on the online catalogue useful? Did they have feedback on accessibility?	Only a short description was provided. Feedback via email suggested by attendees once they have had a play!
Did the user(s) believe any gaps not to be gaps? Please note respective gap references and a brief rationale why they came to this conclusion.	
Any additional gaps? If yes, please provide a summary of each such gap and remedy, suggesting relevant WP lead to engage further. If possible, give contact details for GAIA-CLIM personnel to contact for background information /clarification of additional gaps.	
Any comments to the description of a gap or the associated remedies ?	
Feedback on <u>presentational aspects</u> of the RD. Any suggestions on how it can be made more appealing to key stakeholders / funders?	
Did the user(s) find any recommendation inappropriate, irrelevant, badly formulated ? If yes, which one, why ?	
Did they suggest additional recommendations?	

If yes to above please specify including reference to underlying gap(s)	
Any general or specific comments from the user concerning the identified actors ?	
Would users prefer a prioritization and if yes, what would be their personal top 3 priorities from the list of recommendations and why?	
More general suggestions on the gap assessment <u>exercise</u> ? (usefulness – e.g. compared to alternative gaps assessments, comprehensiveness, accessibility, ...) ?	
More general suggestions on the recommendations <u>approach</u> ? (appropriateness, comprehensiveness, well justified ? , will it have impact ? ...) ?	
Were there any users interested in reviewing future drafts? If so, please provide email contact details here.	

Any other comments:

NCEO are organizing a DTP with NERC, and wanted to know how the Education recommendation could translate into support for EO specialist training opportunity.

NCEO were keen to help advertise GAIA CLIM further. There is a NCEO all staff meeting in March 2018, and NCEO/CEOI/RSPSoc conference in Sept 2018, where we have been encouraged to present. Clearly

none of this was possible in the Oct-Dec 2017 window. We should look to continue to advertise GAIA CLIM passed the end of the project, using alternate funds.

Annex Ia9 – Met Office, UK

Information on outreach activity

WHAT? Outreach event / activity / Conference	Met Office Weather Science seminar
WHO? Audience / subject of session / size	15 attendees from Science directorate including the Hadley Centre
WHERE? Location(s)	Met Office, Exeter, UK
WHEN? Date(s) of event	7 December 2017
WHO from the project? GAIA-CLIM parties	Stu Newman and Fabien Carminati
What you did? Type of presentation	Seminar including introduction to GAIA-CLIM work packages, description of the GAID and recommendations document, and interactive demonstration of the Virtual Observatory
WHO did you talk to in detail? Principal individuals met with	Mike Cooke; Neill Bowler; Stuart Fox

Recollection of relevant feedback received:

On the GAID:

- *Some reluctance to delve deeper into the GAID, perception that it is so information rich it is slightly bewildering for a novice (but support for condensed recommendations document for this reason)*
- *Question about “actionable”, what realistic prospects are there of gaps being addressed in e.g. next five years?*

On the recommendations document:

- *Regarding geographical coverage, strong view that all climatic zones should be monitored and that some zones such as the Southern Ocean have very poor representation (measurements tend to be over land).*
- *One person noted that special observing periods (e.g. dedicated sonde launches) have been organised in the past for field campaigns and recommendation for scheduling coherency is an extension of that.*
- *Spectroscopy seen as an important but neglected issue. Concern that the communities involved in laboratory measurements and those using radiative transfer models tend to be rather separate, need for engagement.*
- *Critical comment that tools such as the NWP SAF radiance simulator are only truly applicable for TOA radiances and uncertainties if all processes (such as scattering by hydrometeors) are included, archived NWP fields do not always extend to layer quantities of rain, snow etc.*

On the Virtual Observatory:

- *Comment (and nodding agreement from participants) that HIRS vs GRUAN vs NWP comparison would be much more useful if all the uncertainty contributions were included.*
- *We showed an example from the development version of the VO for ozone (DOAS/GOME-2). The ability to display time series and aggregated uncertainties was perceived as very useful ("pretty cool").*
- *Question about whether cloud-free satellite scenes can be selected (answer: yes; we demonstrated the tick box option).*
- *The Cesium tool drew positive comments. One attendee suggested it could be part of a tool kit used during field campaigns for satellite cal/val.*
- *Question about whether the ECV list in the VO can be extended. It was explained that the resources in the VO will be expanded up until the end of project.*
- *One attendee asked about the long-term status of the VO. (There are no guarantees, but hopeful that it will live on beyond GAIA-CLIM.)*
- *User requirement for offline data analysis for subset of collocations. The plot.ly data extraction and visualisation was demonstrated.*

Other comments:

- *With respect to NWP, how do we know whether O-B biases stem from instrument or model? (Discussion on this point: GRUAN processor helps to constrain magnitude of model error. There will be instances where model bias will dominate, e.g. stratospheric temperature biases. Validation case studies such as MTVZA/GMI show potential/limits of NWP to identify calibration-related biases.)*
- *Climate related applications need long time series. Can the VO be populated with data over decadal time scales? (In principle, but limits to how far back some reference data such as GRUAN will go.)*
- *Related: How stable is NWP as a reference over time? We noted that NWP-GRUAN statistics have been collected for a period of a few years and show some trends and discontinuities that may be related to model changes/upgrades as well as seasonal effects.. So it is important to use GRUAN as an anchor to a reference.*

- *Sceptical question about how widely NWP can be used as a reference, e.g. which ECVs beyond temperature and humidity? There was a short discussion on this point – NWP is probably not capable currently of adequately representing all processes (e.g. ocean salinity) but we [Bill at ECMWF] will scope how NWP/reanalysis advances might make this possible in future.*

Annex Ia10 – University of Hamburg / MPI, Germany

Information on outreach activity

Outreach event / activity	Dedicated invited seminar + hands on exercise
Audience	14 people for GAIA-CLIM overview, 4 for hands on and feedback
Location(s)	University of Hamburg / Max Planck Institute
Date(s) of event	13 Dec 2017
GAIA-CLIM parties	Provide full list of GAIA-CLIM participants involved
Facilitator(s) / Presenter(s) of what ?	Björn-Martin Sinnhuber (KIT) and Tom Gardiner (NPL)
Principal individuals met with	Martin Burgdorf, Stefan Bühler (Uni Hamburg)
Version of GAID	V4
Version of Recommendations Document (RD)	V1
Version of VO	Development / Stage

Virtual Observatory (VO) feedback

Please repeat the below table for each set of feedback on the VO collected.

Scale 1 - 5 = excellent (5) – good (4) – useful but ...(3) – unsatisfactory (2) – rubbish (1)

How satisfied do you think the users were about the VO? (1-5)	4
Did the users find the VO potentially useful / informative to their application (which were present) area? Which data are most attractive?	Mostly interested in validation of (operational) humidity and temperature sensors Availability of AMSU data requested
How easy did the users find it to navigate in the VO? (Are groups for selection relevant for the users, e.g., ECV, Reference, satellite and NWP... Was there any other suggestion?)	N/A – VO driven by presenters.
What does the user think about (sub) selection features? (clouds, distances, period ...) Does he have more criteria to suggest?	Better default sub-selection for time and distance co-location suggested
Does the user seem to need more documentation? Help button to navigate more efficiently?	Not for VO itself, but for underlying data sets
Is the provided tool set useful? <ul style="list-style-type: none">• Plotting (bars, lines, etc.,• Data analyses in particular statistics (dif, RMSE, Bias, std. ...)	Seen as potentially very interesting / useful for their application. Some information on the local variability (e.g. pixel-to-pixel variability in local satellite data) would be useful in GUI.
How satisfied the people are with the figure display? (color, size ...); Did the user find the visibility of uncertainties good enough?	3

Did they find any tools / functionalities superfluous?	No
How did the user rate the data download function (accessibility, relevance and functionality)? (1-5)	Important
What does the user plan to do with the downloaded data (e.g., compare to other data (which one, e.g., field experiment, etc.) not in the VO)?	Mostly interested in validation of (operational) humidity and temperature sensors
What is missing in the VO: <ul style="list-style-type: none"> • In terms of supported applications; • In terms of data (ECVs?); • In terms of tools, e.g., plotting maps. 	Suggested to consider (HIRS) pixel size, additional pixels. Further information on uncertainty of RT model would be useful.
Are the users aware of similar toolboxes to compare datasets and how do these complement/overlap each other? Why would they use another toolbox rather than the VO or their own toolbox?	Not discussed

Any other comments: Interested in considering how the tools developed for Gaia Clim, particularly in relation to co-location uncertainties, could be applied within the Fiduceo project.

GAID & RD feedback summary

Scale 1 - 5 = excellent (5) – good (4) – useful but ...(3) – unsatisfactory (2) – rubbish (1)

Did the users find the GAID easily accessible and the cross-sections on the online catalogue useful? Did they have feedback on accessibility?	See other comments below on specific GAID feedback .
Did the user(s) believe any gaps not to be gaps? Please note respective gap references and a brief rationale why they came to this conclusion.	
Any additional gaps? If yes, please provide a summary of each such gap and remedy, suggesting relevant WP lead to engage further. If possible, give contact details for GAIA-CLIM personnel to contact for background information /clarification of additional gaps.	
Any comments to the description of a gap or the associated remedies ?	
Feedback on <u>presentational aspects</u> of the RD. Any suggestions on how it can be made more appealing to key stakeholders / funders?	
Did the user(s) find any recommendation inappropriate, irrelevant, badly formulated ? If yes, which one, why ?	
Did they suggest additional recommendations?	

If yes to above please specify including reference to underlying gap(s)	
Any general or specific comments from the user concerning the identified actors ?	
Would users prefer a prioritization and if yes, what would be their personal top 3 priorities from the list of recommendations and why?	Prioritization was seen as important, but general difficulty of that task acknowledged. They had specific interest in the gaps relating to microwave measurements (G2.13 and G2.36).
More general suggestions on the gap assessment <u>exercise</u> ? (usefulness – e.g. compared to alternative gaps assessments, comprehensiveness, accessibility, ...) ?	Continuation of the GAID as a living document beyond the GAIA-CLIM project lifetime, maybe along the VO, was suggested
More general suggestions on the recommendations <u>approach</u> ? (appropriateness, comprehensiveness, well justified ? , will it have impact ? ...) ?	Comments that the recommendations may be too unspecific / broad
Were there any users interested in reviewing future drafts? If so, please provide email contact details here.	martin.burgdorf@uni-hamburg.de

Any other comments:

It became obvious that the participants very likely did not have a look at the GAID and recommendations prior to our visit and thus had only few specific comments, but seem to be very much interested in providing feedback in the near future after studying the GAID and recommendations in more detail.

Annex Ia11 – ECMWF (Copernicus), UK

Information on outreach activity

Outreach event / activity	ECMWF dedicated event
Audience	ECMWF Research department and Copernicus department
Location(s)	ECMWF
Date(s) of event	18/12/17
GAIA-CLIM parties	Peter Thorne, Joerg Schultz, Heather Lawrence, Bruce Ingleby, Jacky Farnan (nee Goddard), Bill Bell
Facilitator(s) / Presenter(s) of what ?	Peter Thorne presented the Gaps documents and Joerg Schultz presented the virtual observatory
Principal individuals met with	Niels Bormann, Alan Geer, Bill Bell, Sean Healy, Hans Hersbach. Also present were Antje Innes and Mohamed Dahoui.
Version of GAID	V4
Version of Recommendations Document (RD)	V1
Version of VO	Development

Virtual Observatory (VO) feedback

Please repeat the below table for each set of feedback on the VO collected.

Scale 1 - 5 = excellent (5) – good (4) – useful but ...(3) – unsatisfactory (2) – rubbish (1)

How satisfied do you think the users were about the VO? (1-5)	
Did the users find the VO potentially useful / informative to their application (which were present) area? Which data are most attractive?	
How easy did the users find it to navigate in the VO? (Are groups for selection relevant for the users, e.g., ECV, Reference, satellite and NWP... Was there any other suggestion?)	
What does the user think about (sub) selection features? (clouds, distances , period ...) Does he have more criteria to suggest?	
Does the user seem to need more documentation? Help button to navigate more efficiently?	
Is the provided tool set useful? <ul style="list-style-type: none"> • Plotting (bars, lines, etc., • Data analyses in particular statistics (dif, RMSE, Bias, std. ...) 	
How satisfied the people are with the figure display? (color, size ...); Did the user find the visibility of uncertainties good enough?	

Did they find any tools / functionalities superfluous?	
How did the user rate the data download function (accessibility, relevance and functionality)? (1-5)	
What does the user plan to do with the downloaded data (e.g., compare to other data (which one, e.g., field experiment, etc.) not in the VO)?	
What is missing in the VO: <ul style="list-style-type: none"> • In terms of supported applications; • In terms of data (ECVs?); • In terms of tools, e.g., plotting maps. 	
Are the users aware of similar toolboxes to compare datasets and how do these complement/overlap each other? Why would they use another toolbox rather than the VO or their own toolbox?	

Any other comments:

Hans Hersbach was strongly urging for a data upload function where users can upload their own data. But Joerg said that this is more complex than it sounds as one would need to run the co-location of such data somewhere or the user needs to prepare this in advance.

GAID & RD feedback summary

Scale 1 - 5 = excellent (5) – good (4) – useful but ...(3) – unsatisfactory (2) – rubbish (1)

Did the users find the GAID easily accessible and the cross-sections on the online catalogue useful? Did they have feedback on accessibility?	No specific feedback on this but some users looked online during the meeting and seemed to have no problems looking through the gaps.
Did the user(s) believe any gaps not to be gaps? Please note respective gap references and a brief rationale why they came to this conclusion.	No – they seemed happy with the gaps identified, particularly the spectroscopy gap.
Any additional gaps? If yes, please provide a summary of each such gap and remedy, suggesting relevant WP lead to engage further. If possible, give contact details for GAIA-CLIM personnel to contact for background information /clarification of additional gaps.	No additional gaps were mentioned but rather some comments on the existing ones (see below).
Any comments to the description of a gap or the associated remedies ?	No comments on the description. Some comments on the associated remedies (see below).
Feedback on <u>presentational aspects</u> of the RD. Any suggestions on how it can be made more appealing to key stakeholders / funders?	No comments on this.
Did the user(s) find any recommendation inappropriate, irrelevant, badly formulated ? If yes, which one, why ?	No.

<p>Did they suggest additional recommendations?</p> <p>If yes to above please specify including reference to underlying gap(s)</p>	<p>Both Niels Bormann and Bill Bell mentioned that the spectroscopy gap is important and are glad to see that it has prominence.</p> <p>Bill (speaking as a member of Copernicus C3S) mentioned in addition that reanalysis fields are a good means to validate FCDRs. He said that in ERA-5 we produce uncertainty to reanalysis fields using ensemble methods providing the random part of the uncertainty. However, reference measurements can help to assess the systematic component.</p> <p>Alan Geer made the comment that some of the remedies appeared superficial and suggests that we give remedies to address improving the fundamental scientific understanding. He referred specifically to the emissivity gap (which has since been updated and now does account for Alan's comments). Alan mentioned the 'Caviar project' as an example of a European project which has addressed fundamental scientific understanding.</p> <p>Niels Bormann suggested that in the spectroscopy gap we include examples of methods that could be used to estimate the uncertainties, including methods that have been explored to some degree in GAIA-CLIM and were discussed at the recent ITSC conference. He also suggested we could mention important frequencies to look at.</p> <p>Sean Healy suggested that we could mention double-differencing with NWP as a recommendation for addressing colocation mismatch.</p>
<p>Any general or specific comments from the user concerning the identified actors ?</p>	<p>There was the suggestion to extend our thinking to formulate it towards a call aiming at FP-9 or last call of H2020 maybe.</p>
<p>Would users prefer a prioritization and if yes, what would be their</p>	<p>This was not discussed.</p>

personal top 3 priorities from the list of recommendations and why?	
More general suggestions on the gap assessment <u>exercise</u> ? (usefulness – e.g. compared to alternative gaps assessments, comprehensiveness, accessibility, ...) ?	No.
More general suggestions on the recommendations <u>approach</u> ? (appropriateness, comprehensiveness, well justified ? , will it have impact ? ...) ?	No.
Were there any users interested in reviewing future drafts? If so, please provide email contact details here.	No.

Any other comments:

Information on outreach activity

Outreach event / activity	ECMWF / Copernicus event
Audience	ECMWF RD / CAMS / C3S
Location(s)	ECMWF
Date(s) of event	18/12/17
GAIA-CLIM parties	Peter Thorne, Joerg Sculz, Heather Lawrence, Bruce Ingleby
Facilitator(s) / Presenter(s) of what ?	Peter (intro / GAID+recommendations), Joerg (VO)
Principal individuals met with	Hans Hersbach, Shaun Healy, Nils Boehr, Bill Bell,
Version of GAID	V4
Version of Recommendations Document (RD)	V1
Version of VO	Development

Virtual Observatory (VO) feedback

Please repeat the below table for each set of feedback on the VO collected.

Scale 1 - 5 = excellent (5) – good (4) – useful but ...(3) – unsatisfactory (2) – rubbish (1)

How satisfied do you think the users were about the VO? (1-5)	4. Very impressive overall. A catalogue would be useful so you can see immediately what is available. Avoids the null space issue. Users got annoyed at running searches and getting no results back. You need to avoid giving users options that shall return no data.
Did the users find the VO potentially useful / informative to their application (which were present) area? Which data are most attractive?	Who the users are is unclear. Can this be made clearer in the VO front matter?
How easy did the users find it to navigate in the VO? (Are groups for selection relevant for the users, e.g., ECV, Reference, satellite and NWP... Was there any other suggestion?)	The date selection needs to be strictly restricted to the period for which data is available for each target ECV. Otherwise the user will give up when they repeatedly hit no data matches.
What does the user think about (sub) selection features? (clouds, distances , period ...) Does he have more criteria to suggest?	Would like to use these as x-axis variables in the plotting tools rather than just having calendar date to visualize what effect of choices would be before hitting a data download. At the moment having only chronological timing on the x-axis is somewhat limiting compared to the ideal utility of the tool.
Does the user seem to need more documentation? Help button to navigate more efficiently?	It wasn't clear to the user what the colocation criteria were. Can you guide the user on the colocation criteria? Can the colocation effects be restricted based upon the WP3 LUT results that were mentioned?
Is the provided tool set useful? <ul style="list-style-type: none"> Plotting (bars, lines, etc., Data analyses in particular statistics (dif, RMSE, Bias, std. ...) 	The newer analyses showed more promise than the release undertaken in September. Still work required to guide the user better.

How satisfied the people are with the figure display? (color, size ...); Did the user find the visibility of uncertainties good enough?	Can the x-axis be varied from time to colocation distance for example? We would like to look at distinct dimensionality from chronological time e.g. distance or colocation time offset.
Did they find any tools / functionalities superfluous?	No.
How did the user rate the data download function (accessibility, relevance and functionality)? (1-5)	They wondered whether ASCII download could be provided for use in simple application areas. Adapters could be written but after the project? User interface would be used by the users present to discover then download
What does the user plan to do with the downloaded data (e.g., compare to other data (which one, e.g., field experiment, etc.) not in the VO)?	They would like to bulk download everything and use it all together to understand what uses they could put it to. The whole set may be useful for some of the reanalysis activities undertaken by ECMWF.
What is missing in the VO: <ul style="list-style-type: none"> • In terms of supported applications; • In terms of data (ECVs?); • In terms of tools, e.g., plotting maps. 	There was a concern expressed around the small sample size of stations. Could more stations be included? Is radiative transfer uncertainty properly projected / handled?
Are the users aware of similar toolboxes to compare datasets and how do these complement/overlap each other? Why would they use another toolbox rather than the VO or their own toolbox?	How does this compare to O-B statistics served by e.g. ECMWF? Can a similar functionality be added?

Any other comments:

User would like option to download absolutely everything. Can we add datasets upon user request?
How can a user add functionality?

What further development would be required to allow user adapters that enable upload of data for characterization etc?

Make clear that VO is limited to colocations only.

RT uncertainties / development community as a potential user base?

Why can they not use all of the measurements rather than just reference measurements? What makes these reference observations useful? What can a user do with these they can't do with remaining observations? This is an open question and a challenge to the uptake of reference measurements. This applies not just to GAIA-CLIM but is a generic problem.

GAID & RD feedback summary

Scale 1 - 5 = excellent (5) – good (4) – useful but ...(3) – unsatisfactory (2) – rubbish (1)

Did the users find the GAID easily accessible and the cross-sections on the online catalogue useful? Did they have feedback on accessibility?	They hadn't had a look at these documents in advance so didn't have feedback on this aspect
Did the user(s) believe any gaps not to be gaps? Please note respective gap references and a brief rationale why they came to this conclusion.	No
Any additional gaps? If yes, please provide a summary of each such gap and remedy, suggesting relevant WP lead to engage further. If possible, give contact details for GAIA-CLIM personnel to contact for background information /clarification of additional gaps.	No
Any comments to the description of a gap or the associated remedies ?	For co-location scheduling gaps recourse should potentially be made to model double differencing techniques which provide a reasonable estimate of the co-location effect. Would enable us to remove at least some of the impacts and be synergistic with activities GAIA-CLIM have undertaken.
Feedback on <u>presentational aspects</u> of the RD. Any suggestions on how it can be made more appealing to key stakeholders / funders?	The Recommendations are too generic. Specificity is required to make them more actionable. Should be research focused where possible.
Did the user(s) find any recommendation inappropriate, irrelevant, badly formulated ? If yes, which one, why ?	The spectroscopic recommendation needs to specify the EM ranges to target and should stress the benefits for Copernicus activities more holistically. Users present clearly saw this as the single most important / limiting factor in their work.

	<p>The scheduling recommendation needs to be nuanced to reflect the range of measurement techniques and reflect the distinction between at launch vs. sustained characterization</p> <p>Why do we need global expansion in reference networks? Need to make clear need to cover dynamic range, variability and capture potential latitudinal and longitudinal gradients.</p>
<p>Did they suggest additional recommendations?</p> <p>If yes to above please specify including reference to underlying gap(s)</p>	No
Any general or specific comments from the user concerning the identified actors ?	No
Would users prefer a prioritization and if yes, what would be their personal top 3 priorities from the list of recommendations and why?	No, although clearly the spectroscopic understanding recommendation was their single most important.
<p>More general suggestions on the gap assessment <u>exercise</u> ?</p> <p>(usefulness – e.g. compared to alternative gaps assessments, comprehensiveness, accessibility, ...) ?</p>	
<p>More general suggestions on the recommendations <u>approach</u> ?</p> <p>(appropriateness, comprehensiveness, well justified ? , will it have impact ? ...) ?</p>	Needs a research focus and more specificity
Were there any users interested in reviewing future drafts? If so, please provide email contact details here.	None stated

Any other comments:

None

Annex Ia12 – Melbourne, Australia

Information on outreach activity

Outreach event / activity	Dedicated visit
Audience	Academic, predominantly measurement scientists but also some satellite data and modelling expertise
Location(s)	School of Earth Sciences, University of Melbourne Remote participation from Wollongong
Date(s) of event	23 January 2018
GAIA-CLIM parties	Karin Kreher
Facilitator(s) / Presenter(s) of what ?	GAIA-CLIM VO, GAID & recommendations doc.
Principal individuals met with	Prof David Karoly (University of Melbourne) Prof Peter Rayner (Uni Melb) Dr Robyn Schofield (Uni Melb) Robert Ryan (PhD student, (Uni Melb) Dr Stephen Utembe (Uni Melb) Dr Zoe Loh (CSIRO) Dr Stephen Wilson (Wollongong) Dr Nicholas Deutscher (Wollongong)
Version of GAID	As online available
Version of Recommendations Document (RD)	As online available
Version of VO	Development

Virtual Observatory (VO) feedback

Please repeat the below table for each set of feedback on the VO collected.

Scale 1 - 5 = excellent (5) – good (4) – useful but ...(3) – unsatisfactory (2) – rubbish (1)

How satisfied do you think the users were about the VO? (1-5)	(3)/(4)
Did the users find the VO potentially useful / informative to their application (which were present) area? Which data are most attractive?	Yes, they did find the VO very useful but were disappointed that there was no data set for the Southern Hemisphere included.
How easy did the users find it to navigate in the VO? (Are groups for selection relevant for the users, e.g., ECV, Reference, satellite and NWP... Was there any other suggestion?)	Overall, they found that to be easy to follow.
What does the user think about (sub) selection features? (clouds, distances , period ...) Does he have more criteria to suggest?	Most interest in ozone comparison (UV-vis and FTIR) but commented on the lack of SH data.
Does the user seem to need more documentation? Help button to navigate more efficiently?	Not discussed but short online tutorial would be perceived as helpful.
Is the provided tool set useful? <ul style="list-style-type: none">• Plotting (bars, lines, etc.,• Data analyses in particular statistics (dif, RMSE, Bias, std. ...)	Yes, e.g. the actual data comparison as well as the difference incl. all uncertainties and the way it has been displayed graphically was received positively.
How satisfied the people are with the figure display? (color, size ...); Did the user find the visibility of uncertainties good enough?	Yes, all ok.

Did they find any tools / functionalities superfluous?	No.
How did the user rate the data download function (accessibility, relevance and functionality)? (1-5)	They were very interested and suggested: “A data extract option that allowed the extract if the satellite data for a specific location as a time series with uncertainties from the VO would be very valuable for a wide range of potential users. This would allow the easy comparison of satellite data with researchers' own local data or field data, rather than only reference data. This would lead to a much larger group of users of GAIA-CLIM VO.”
What does the user plan to do with the downloaded data (e.g., compare to other data (which one, e.g., field experiment, etc.) not in the VO)?	<ul style="list-style-type: none"> • Satellite data extraction through the VO to compare with own ground-based fieldwork datasets. • Very useful for pollution studies e.g. around cities
What is missing in the VO: <ul style="list-style-type: none"> • In terms of supported applications; • In terms of data (ECVs?); • In terms of tools, e.g., plotting maps. 	<ul style="list-style-type: none"> • Suggestion: To have a data extract option that allowed the extract of the satellite data for a specific location as a time series with uncertainties from the VO would be very valuable for a wide range of potential users. This would allow the easy comparison of satellite data with researchers' own local data or field data, rather than only reference data. This would lead to a much larger group of users of GAIA-CLIM VO. • Suggestion to include all long-term ozonesonde data stations • There is very limited inclusion in the VO of reference datasets from Australian and NZ sites, including GRUAN, AEROCHEM, ARM and NDASC stations. There are major data gaps in the SH, particularly for Africa, Asia and the South Pacific. Can these be filled or research partners provide these data for inclusion?
Are the users aware of similar toolboxes to compare datasets and how do these complement/overlap each other? Why would they use another toolbox rather than the VO or their own toolbox?	Not very likely but this did not come up explicitly in the discussion.

Any other comments:

General verdict: The GAIA-CLIM Virtual Observatory (VO) appears to be a very valuable tool with excellent graphics, easy to use access to metadata and excellent uncertainty analysis for both satellite and ground-based data sets where they have been uploaded.

However, there were also major concerns: How long will the GAIA-CLIM VO be maintained? Its value and number of potential users would increase greatly if it could be maintained for a period longer than one year, preferably three years or more.

One further comment: Thanks for a very useful presentation. The GAIA-CLIM project and products certainly do seem to be very useful. I share the concerns regarding maintenance of the Virtual Observatory. I am also a little cynical in the sense that I feel that something like this needs some ongoing promotion and maintenance until it reaches critical mass - otherwise I expect that it would not reach its potential audience and userbase very effectively.

GAID & RD feedback summary

Scale 1 - 5 = excellent (5) – good (4) – useful but ...(3) – unsatisfactory (2) – rubbish (1)

Did the users find the GAID easily accessible and the cross-sections on the online catalogue useful? Did they have feedback on accessibility?	(4) – (5)
Did the user(s) believe any gaps not to be gaps? Please note respective gap references and a brief rationale why they came to this conclusion.	No.
Any additional gaps? If yes, please provide a summary of each such gap and remedy, suggesting relevant WP lead to engage further. If possible, give contact details for GAIA-CLIM personnel to contact for background information /clarification of additional gaps.	No.

Any comments to the description of a gap or the associated remedies ?	<p>The GAIA-CLIM Gaps Assessment is also very valuable for understanding limitations of some existing observational datasets. Some of the Gaps identified agree well with gaps identified by PhD student Rob Ryan for MaxDOAS data and by Nick Deutscher for FTIR data.</p> <p>Rob Ryan: “This is a tremendously useful resource for grad students, in formulating research questions and targeting research aims. As discussed, many of the gaps relating to MAX-DOAS are similar to those I identified during my PhD reading and confirmation process. I think this is also a very useful resource for academics/supervisors looking to write funding or student project proposals.”</p>
Feedback on <u>presentational aspects</u> of the RD. Any suggestions on how it can be made more appealing to key stakeholders / funders?	No.
Did the user(s) find any recommendation inappropriate, irrelevant, badly formulated ? If yes, which one, why ?	No.
<p>Did they suggest additional recommendations?</p> <p>If yes to above please specify including reference to underlying gap(s)</p>	No.
Any general or specific comments from the user concerning the identified actors ?	No.
Would users prefer a prioritization and if yes, what would be their personal top 3 priorities from the list of recommendations and why?	N/A

<p>More general suggestions on the gap assessment <u>exercise</u> ?</p> <p>(usefulness – e.g. compared to alternative gaps assessments, comprehensiveness, accessibility, ...) ?</p>	<p>The roadshow presentation of the GAID was found to be useful and gaps in their current form as well.</p>
<p>More general suggestions on the recommendations <u>approach</u> ?</p> <p>(appropriateness, comprehensiveness, well justified ? , will it have impact ? ...) ?</p>	<p>No.</p>
<p>Were there any users interested in reviewing future drafts? If so, please provide email contact details here.</p>	<p>N/A but see comments below for an interesting idea on how to proceed.</p>

Any other comments:

Three interesting suggestions came up:

- 1) Change name/acronym from GAID to GapsAID, GAPSAID or GAPS-AID, was perceived as much more meaningful and intuitive.
- 2) Include comments or Wiki page for on “GAPSAID” page so that feedback, comments and updates could be included from researchers, and so that the Gaps Assessment could be updated with new information. The question came up if this document will be kept up-to-date and alive – otherwise not useful anymore if not updated in regular intervals. Rob Ryan: “I think the Gaps section has great potential to be a networking site and ongoing collaboration tool, provided it can be updated. This could be through a ‘comments’ section (i.e. one researcher posts something saying “I’m currently working on this aspect of this gap”), and through updating of the gaps list (i.e. identifying when a gap or part of a gap has been filled).
- 3) The gaps section could also benefit from a list of people currently working on this or similar areas, i.e. as a “find an expert” resource. This could be a great tool for students or researchers looking for help tackling particular questions, people chasing up someone who can help interpret data, or people looking for collaboration opportunities. There is so much potential for links to publication databases etc., but this is broader and perhaps out of GAIA-CLIM’s scope.

Annex Ib1 – GRUAN ICM-9, Finland

Information on outreach activity

Outreach event / activity	GRUAN ICM-9 parallel session
Audience	
Location(s)	FMI, Helsinki, Finland
Date(s) of event	14/6/17
GAIA-CLIM parties	Provide full list of GAIA-CLIM participants involved
Principal individuals met with	Provide up to 5 names of main people who were interacted with
Version of GAID	V4
Version of prioritization document	V1
Version of VO	Development

Initial prototype run of a development version of the outreach materials to garner feedback and if necessary reassess approach. Audience consists of GAIA-CLIM and GRUAN participants.

GAID feedback summary

Please repeat the below table for each set of feedback on the GAID collected

Sector and field of work or principal expertise / interest of the audience	NWP, climate observations, GNSS-Ro / proposed microwave occultation
Did they find the GAID easily accessible and the cross-sections on the online catalogue useful? Did they have feedback on accessibility?	Difficult to understand the audience intended for the GAID. There needs to be a better introduction to the scope
Did the user(s) believe any gaps not to be gaps? Please note respective gap references and a brief rationale why they came to this conclusion.	Not covered
Any additional gaps? If yes, please provide a summary of each such gap and remedy, suggesting relevant WP lead to engage further. If possible, give contact details for GAIA-CLIM personnel to contact for background information /clarification of additional gaps.	
Additional gap remedies? If so, please summarize affected gap and proposed remedy. Give contact details for background information /clarification of proposed remedies.	In G6.03 may be a use for DD – John Eyre
Have the right actors been identified in the GAID and would it be feasible for them to react accordingly?	
More general suggestions on the gap assessment exercise. Does the document provide enough justification for all gaps? Is it	Need for broader consultation.

comprehensive and does it outline the issues at hand clearly? Please provide more information as required	
Are they aware of alternative gaps assessments and how do these complement each other? Or is there redundancy?	Yes, particularly in the WMO. Concern over duplication / conflict between these.

Priorities document feedback

Please repeat the below table for each set of feedback on the prioritization document collected

Did the users have any feedback on the approach to prioritization adopted?	Generally positive view as to approach and currently picked priorities.
<p>Did the audience agree / disagree with those priorities and their impact on satellite calibration/validation as identified in the draft?</p> <ul style="list-style-type: none"> ○ Did they see recommendations which in their view should not be there? ○ Did they suggest additional recommendations be used? <p>If yes to above please specify</p>	<p>There may be value in mapping the geophysical data to the intermediate satellite function space</p> <p>Education expanded to the public user interface issue. Use VO to do it?</p> <p>Almost all of the recommendations are being done partially already but none adequately. There is lots going on.</p> <p>Possible recommendation on expansion of approaches to other domains and remaining Copernicus services</p> <p>Acronyms an issue – particularly in the gap titles. Remove from main text all acronyms to ensure readability.</p> <p>Summarise things a little better.</p>
What would be their personal top 3 priorities from the list of recommendations and why? What would addressing these recommendations mean for their application areas and day-to-day tasks?	Education, VO, access to harmonized holdings
Feedback on presentational aspects of the document. Any suggestions on how it can be made more appealing to key stakeholders / funders?	Consistently putting under the same format could get repetitive. Not snappiest way to look. Better would be half page on each. High level description, costs and benefits with traces in the appendix.

	<p>Table 1 is key. Should come earlier perhaps or be repeated in the executive summary. Plus use of greater number of tables?</p> <p>Risks and benefits of any value? Remove from traces?</p> <p>Remove aspects that are repetitive or construed as motherhood and apple pie statements. But don't remove reference to relevant keywords such as Copernicus services</p>
Are there any additional stakeholders who should be invited to comment on the prioritization document?	
Would the users be interested in reviewing future drafts? If so, please provide email contact details here.	

Virtual Observatory (VO) feedback

Please repeat the below table for each set of feedback on the VO collected

What application(s) would the user intend to use the VO for? What kind of tools do they expect to be available on the VO? What further applications should the VO support?	Need to be able to select the colocation criteria to subset the data
How easy did the user find it to navigate the VO? Are they aware of similar toolboxes to compare datasets and how do these complement each other? Why would they use the VO rather than another toolbox or their own toolbox?	Metadata tool is a nice training tool, but would it be used by expert users? What are the users here? Can you think of specific case study users? Operational community know how to use it. More interested in the colocations. Will the GRUAN processor be in the VO? Needs ability to download high amounts of selected data to netcdf and this needs to be obvious. Role for reanalysis? Would add value to e.g. EQC under CAS/C3S?
Did they find the VO potentially useful / informative to their application area?	Yes, but only marginally at least as available presently.
Did they find any tools / functionalities superfluous?	
What tools would they like to see that are not yet available?	
What further applications should the VO support?	Increased range of ECVs
Did the user try to download data? If so, how did they rate its	No

accessibility, relevance and functionality?	
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Group attendee:

Bruce Ingleby (ECMWF)

Tim Oakley (Met Office)

Jordis Tradpowsky (Dodeker Scientist)

Marco Rosoldi (?)

Swei Lin (Singapoor)

Facilitator: Fabien Carminati (Met Office)

Information on outreach activity

Outreach event / activity	GRUAN ICM-9 parallel session
Audience	
Location(s)	FMI, Helsinki, Finland
Date(s) of event	14/6/17
GAIA-CLIM parties	Provide full list of GAIA-CLIM participants involved
Principal individuals met with	Provide up to 5 names of main people who were interacted with
Version of GAID	V4
Version of prioritization document	V1
Version of VO	Development

Initial prototype run of a development version of the outreach materials to garner feedback and if necessary reassess approach. Audience consists of GAIA-CLIM and GRUAN participants.

GAID feedback summary

Please repeat the below table for each set of feedback on the GAID collected

Sector and field of work or principal expertise / interest of the audience	
Did they find the GAID easily accessible and the cross-sections on the online catalogue useful? Did they have feedback on accessibility?	<p>None of the group member has read the GAID or browsed the entire list of gaps on the gap trace web page.</p> <p>Someone point out that not all documents are accessible to not member.</p>
Did the user(s) believe any gaps not to be gaps? Please note respective gap references and a brief rationale why they came to this conclusion.	Not known since not read.
Any additional gaps? If yes, please provide a summary of each such gap and remedy, suggesting relevant WP lead to engage further. If possible, give contact details for GAIA-CLIM personnel to contact for background information /clarification of additional gaps.	<p>Need for homogenization of data format (e.g. hdf5 or he5 not readable by all user).</p> <p>Lack of availability of raw data.</p>
Additional gap remedies? If so, please summarize affected gap and proposed remedy. Give contact details for background information /clarification of proposed remedies.	
Have the right actors been identified in the GAID and would it be feasible for them to react accordingly?	Need to reach instrument makers.
More general suggestions on the gap assessment exercise. Does the document provide enough	

justification for all gaps? Is it comprehensive and does it outline the issues at hand clearly? Please provide more information as required	
Are they aware of alternative gaps assessments and how do these complement each other? Or is there redundancy?	

Priorities document feedback

Please repeat the below table for each set of feedback on the prioritization document collected

<p>Did the users have any feedback on the approach to prioritization adopted?</p>	<p>No one read the recommendation document. The general feeling was that the whole thing was approached the wrong way (Peter first talked about the GAID then breaking group then talk on the recommendation then breaking group), everyone agreed that it should have been at least the other way around (recommendation first, and later in the same talk the GAID, then one breaking group session). The future presentation/roadshow should go as follow:</p> <ol style="list-style-type: none"> 1) Get people interested with a 1-page bullet type summary of the recommendation (maybe a flyer). 2) Once people attention is captured move the next level of complexity with the recommendation document. 3) From the recommendation document, invite people to dig into the GAID for further information. <p>Rewording suggestion:</p> <p>Emissivity of different types of surface rather than surface emissivity gap.</p> <p>Focus more on the benefit or at least make them more visible.</p>
<p>Did the audience agree / disagree with those priorities and their impact on satellite calibration/validation as identified in the draft?</p> <ul style="list-style-type: none"> ○ Did they see recommendations which in their view should not be there? ○ Did they suggest additional recommendations be used? <p>If yes to above please specify</p>	<p>Someone asked if there is a sense of priority in the order of the recommendation in the way they are listed. He was surprised to see formation/education first.</p>

<p>What would be their personal top 3 priorities from the list of recommendations and why? What would addressing these recommendations mean for their application areas and day-to-day tasks?</p>	<p>Wider network of reference observation.</p> <p>Education, i.e., lack of understand of need of reference network.</p> <p>If money was coming from satellite agencies to fund colocation there would be more work done. Need for more bridges. Not clear what satellite agencies want/need in term of in-situ observations. Laxk of communication.</p> <p>There is a general feeling that there is a greater focus on direct matchup than on NWP technics. Make the use of NWP more explicit in the recommendations.</p> <p>GRUAN has been asked to write to WMO for humidity calibration but nothing has been done to date, case for GAID.</p> <p>Provide homogenized procedures and methodology document to publish one for each type of network. ??</p>
<p>Feedback on presentational aspects of the document. Any suggestions on how it can be made more appealing to key stakeholders / funders?</p>	<p>Get a nice flyer to hand out on roadshow.</p> <p>Regarding the lack of understanding for satellite calibration, users were surprised that there is only one gap and then 2 pages of discussions on it. Educational aspect is missing gaps in the GAID or are they skipped in the recommendations.</p> <p>Wording problem:</p> <p>Under capacity of work force will be interpreted as “we need more staff”, which imply hiring more people as solution. Need to be rephrased to: lack of trained staff. Believed to be very important in the recommendation e.g. European commission do not provide money for hiring people but does for training.</p>
<p>Are there any additional stakeholders who should be</p>	

invited to comment on the prioritization document?	
Would the users be interested in reviewing future drafts? If so, please provide email contact details here.	

Virtual Observatory (VO) feedback

VO not working, a few questions but no feedback. From my point of view, I think that WP5 should absolutely focus on one good single profile/NWP/Satellite-obs and get it to work well to show all the tools offered by the VO during the roadshow rather than trying to get all the networks/sites/dates/... and ending up with nothing to show.

Please repeat the below table for each set of feedback on the VO collected

What application(s) would the user intend to use the VO for? What kind of tools do they expect to be available on the VO? What further applications should the VO support?	
How easy did the user find it to navigate the VO? Are they aware of similar toolboxes to compare datasets and how do these complement each other? Why would they use the VO rather than another toolbox or their own toolbox?	
Did they find the VO potentially useful / informative to their application area?	
Did they find any tools / functionalities superfluous?	
What tools would they like to see that are not yet available?	
What further applications should the VO support?	
Did the user try to download data? If so, how did they rate its accessibility, relevance and functionality?	

Information on outreach activity

Outreach event / activity	GRUAN ICM-9 parallel session
Audience	
Location(s)	FMI, Helsinki, Finland
Date(s) of event	14/6/17
GAIA-CLIM parties	Provide full list of GAIA-CLIM participants involved
Principal individuals met with	Provide up to 5 names of main people who were interacted with
Version of GAID	V4
Version of prioritization document	V1
Version of VO	Development

Initial prototype run of a development version of the outreach materials to garner feedback and if necessary reassess approach. Audience consists of GAIA-CLIM and GRUAN participants.

GAID feedback summary

Please repeat the below table for each set of feedback on the GAID collected

Sector and field of work or principal expertise / interest of the audience	Satellite observations, Global Chemistry model, Lidar observations
Did they find the GAID easily accessible and the cross-sections on the online catalogue useful? Did they have feedback on accessibility?	<p>Everybody had a very quick reading of the document. The idea behind GAID looked quite clear but the document was considered too long.</p> <p>No one showed interest for the online catalogue.</p>
Did the user(s) believe any gaps not to be gaps? Please note respective gap references and a brief rationale why they came to this conclusion.	All the gaps were considered appropriate. Gaps related to ozone (lidar and soundings) have been considered addressable by the ongoing activities within SHADOZ, NDACC, Copernicus.
Any additional gaps? If yes, please provide a summary of each such gap and remedy, suggesting relevant WP lead to engage further. If possible, give contact details for GAIA-CLIM personnel to contact for background information /clarification of additional gaps.	<p>One additional gap was proposed.</p> <p>The topic is the “Long time delay in the provision of Reference network data in an appropriate NRT”.</p> <p>Users would like to get data within a delay of 2-4 weeks.</p> <p>Maybe this could be merged with existing gaps on Reference network, if possible may represent a new gap.</p> <p>Tim Oakley (GCOS-MetOffice) has proposed it.</p> <p>Moreover, Viktoria Sofieva (FMI) complained that in the gaps and the related remedies for ozone measurements the data stability over long term is never mentioned.</p> <p>Satellite people preferred to see the absolute accuracy described, instead.</p> <p>Viktoria Sofieva suggested also a gap on satellite data rescue from the 1979 – to 2000.</p>

	<p>Other gaps raised (potential integration with the existing ones) are related to:</p> <ul style="list-style-type: none"> - Measurements must cover the appropriate vertical range to allow an accurate estimation of TOA forcing. - Need for a large number of information if Pacific Ocean.
Additional gap remedies? If so, please summarize affected gap and proposed remedy. Give contact details for background information /clarification of proposed remedies.	<p>GSICS is going to undertake a task for the evaluation of the benefit from Reference data (e.g. GRUAN) in operational satellite validation (e.g. IASI).</p> <p>Need to cross-check to which gap this may be related.</p>
Have the right actors been identified in the GAID and would it be feasible for them to react accordingly?	NC
More general suggestions on the gap assessment exercise. Does the document provide enough justification for all gaps? Is it comprehensive and does it outline the issues at hand clearly? Please provide more information as required	<p>The exercise must be done over a longer time session and participants may have more time to read the document in detail.</p> <p>Generally, they found the gaps justification appropriate and they do not see the need to modify it.</p>
Are they aware of alternative gaps assessments and how do these complement each other? Or is there redundancy?	No.

Priorities document feedback

Please repeat the below table for each set of feedback on the prioritization document collected

Did the users have any feedback on the approach to prioritization adopted?	The approach was appreciated.
<p>Did the audience agree / disagree with those priorities and their impact on satellite calibration/validation as identified in the draft?</p> <ul style="list-style-type: none"> ○ Did they see recommendations which in their view should not be there? ○ Did they suggest additional recommendations be used? <p>If yes to above please specify</p>	<p>They found all the priorities appropriate and comprehensive.</p> <p>In the recommendation table, variables and or measurements techniques to which each recommendation is related must be specified to help the reader.</p>
What would be their personal top 3 priorities from the list of recommendations and why? What would be addressing these recommendations mean for their application areas and day-to-day tasks?	<p>Understanding and quantifying irreducible co-location effects, Better match non-satellite and satellite scheduling coherency, Harmonised</p> <p>reference data and metadata holdings.</p>
Feedback on presentational aspects of the document. Any suggestions on how it can be made more appealing to key stakeholders / funders?	Shortening the document whenever possible.

Are there any additional stakeholders who should be invited to comment on the prioritization document?	
Would the users be interested in reviewing future drafts? If so, please provide email contact details here.	

Virtual Observatory (VO) feedback

Please repeat the below table for each set of feedback on the VO collected

What application(s) would the user intend to use the VO for? What kind of tools do they expect to be available on the VO? What further applications should the VO support?	<p>Include additional information in the visualized metadata such as altitude. Colocations may be selected on the Cesium interface?</p> <p>More satellites can be supported through the VO.</p>
<p>How easy did the user find it to navigate the VO?</p> <p>Are they aware of similar toolboxes to compare datasets and how do these complement each other? Why would they use the VO rather than another toolbox or their own toolbox?</p>	<p>Metadata tool has larger education impact.</p> <p>Cuban colleagues found it useful to check the overpasses in real-time but maybe difficult to run with low-speed internet connections.</p> <p>GSICS colleague will discuss possible cooperation with the VO and Cesium software developer in the next annual meeting.</p>
Did they find the VO potentially useful / informative to their application area?	Yes, but not specific added value to the other existing platform (e.g. NPROVS) have been remarked.
Did they find any tools / functionalities superfluous?	
What tools would they like to see that are not yet available?	
What further applications should the VO support?	
<p>Did the user try to download data?</p> <p>If so, how did they rate its accessibility, relevance and functionality?</p>	No

Annex Ib3 – JPSS Science meeting, USA

Information on outreach activity

WHAT? Outreach event / activity / Conference	JPSS Science Meeting (Conference)
WHO? Audience / subject of session / size	Approx.. 105 – 200
WHERE? Location(s)	NOAA Star, Washington D.C.
WHEN? Date(s) of event	14 – 16 August 2017
WHO from the project? GAIA-CLIM parties	Heather Lawrence
What you did? Type of presentation	Talk
WHO did you talk to in detail? Principal individuals met with	Mitch Goldberg, Isaac Moradi, Wes Berg

Recollection of relevant feedback received:

I attended the JPSS meeting in Maryland from 14 – 16 August 2017. The main topics for the meeting were the ongoing monitoring and use of the Suomi-NPP instruments and preparation for the launch of the next mission JPSS-1. I presented some results of the GRUAN processor, assessing a bias change for the Suomi-NPP ATMS instrument using the processor.

Regarding the GRUAN processor, Mitch Goldberg recommended that we try to include GPSRO data and do a comparison between satellite data and GPSRO. This feedback was specific to the evaluation I had done for the ATMS instrument. Mitch suggested looking at GPSRO because they themselves had analysed the ATMS instrument with GPSRO and come to opposite conclusions.

I spoke with Isaac Moradi in the coffee break after my talk about the use of GRUAN data in the processor. He recommended that we expand to look at the full RS92 network. He said that ‘there is a lot of talk about GRUAN but the data quality is the same as RS92’ (I am a little bit paraphrasing from memory). Isaac also said that radiosondes have many known errors for humidity so to be careful with using radiosonde data for evaluation of humidity. (He has tried to do this in the past.)

My general impression at the meeting was that scientists in the US are also trying to estimate uncertainties and we should really be aware of their activities, particularly uncertainties in emissivity and radiative transfer.

I had some discussion about radiative transfer errors with Isaac and also Wes Berg. Isaac said that he is planning to look at estimating the uncertainties of RTTOV by a comparison between RTTOV and CRTM (for AMSU-A). He thinks this could be the largest source of uncertainty for AMSU-A. Wes Berg has done a similar thing for imager channels and found differences of the order of 1 K for the 22 GHz humidity line.

Wes Berg has also compared the FASTEM and RSS emissivity models (as have I) and we had some discussion on this. Wes has also carried out a study on how well the instrument spectral response function needs to be characterized at different frequencies (estimating the uncertainty due to this parameter used in RTTOV).

Annex Ib4 – EMS 2017, Ireland

Information on outreach activity

WHAT? Outreach event / activity / Conference	EMS 2017
WHO? Audience / subject of session / size	40-50 participants in session on observations using profiling and satellite data
WHERE? Location(s)	DCU, Dublin, Ireland
WHEN? Date(s) of event	4-8/9
WHO from the project? GAIA-CLIM parties	Peter Thorne
What you did? Type of presentation	Oral
WHO did you talk to in detail? Principal individuals met with	

Recollection of relevant feedback received:

Interest expressed in use of ceilometers in combination with lidar in the system of systems context.

Question around most important recommendations which is likely to arise frequently.

Annex Ib6 – Seventh International Symposium on Data Assimilation, Brazil

Information on outreach activity

WHAT? Outreach event / activity / Conference	Seventh International WMO Symposium on Data Assimilation
WHO? Audience / subject of session / size	Broad audience from across all aspects of data assimilation~200
WHERE? Location(s)	Brazil Florianopolis
WHEN? Date(s) of event	11/09/17-15/09/17
WHO from the project? GAIA-CLIM parties	Jacky Farnan (nee Goddard)
What you did? Type of presentation	Poster presentation
WHO did you talk to in detail? Principal individuals met with	Yannick Tremolet, Polly Smith, Hans Ngodock, Amos Lawless

Recollection of relevant feedback received:

I attended the Seventh International WMO Symposium on Data Assimilation in Florianopolis, Brazil from 11-15th September. The conference had a wide range of topics within data assimilation.

I presented a poster in the methodology session titled “The ECMWF weak-constraint 4D-Var formulation and validation against the GCOS Reference Upper-Air Network (GRUAN)”. The poster described the operational implementation of weak-constraint 4D-Var at ECMWF and showed an example of validating this method against the GRUAN network using the GRUAN processor.

The poster was well received with people interested in how the GRUAN processor could be used as additional validation for model development verification in addition to a comparison between operational centres and the GRUAN network.

Annex Ib7 – EUMETSAT Satellite Meteorology Conference, Italy

Information on outreach activity

WHAT? Outreach event / activity / Conference	EUMETSAT Satellite Meteorology Conference
WHO? Audience / subject of session / size	Scientific audience interested in climate
WHERE? Location(s)	Rome, Italy
WHEN? Date(s) of event	4 October
WHO from the project? GAIA-CLIM parties	Jörg Schulz
What you did? Type of presentation	12 minute conference presentation on GAIA-CLIM project and VO in the conference session on climate. I advertised on one slide that people can ask for roadshow visits if their organization is interested.
WHO did you talk to in detail? Principal individuals met with	NN asked a question Bomin Sun, NOAA, USA Martin Burgdorf, Uni Hamburg, Germany

Recollection of relevant feedback received:

1. The presentation received the direct question if the VO would constitute a cal/val tool for new satellite missions. I answered yes, but also that this was not the intention of the currently existing VO and that it would need much more work to operate it in real time mode.
2. Bomin Sun from NOAA said they were interested in a roadshow element at NOAA which may god still be done in January 2018. They are most interested in elements for real time monitoring of T,q associated radiance from IR and MW sounders. The first attempt for October 2017 failed because of calendar clashes.
3. Martin Burgdorf did not directly talk to me but requested with Anna a visit to the Meteorological Institute at the University of Hamburg that may get realized.

Annex Ib8 – ESA workshop on uncertainties in remote sensing, Italy

Information on outreach activity

WHAT? Outreach event / activity / Conference	ESA workshop on uncertainties in remote sensing
WHO? Audience / subject of session / size	50 scientists, specialists in level-1 and level-2 satellite data production and cal/val, from a wide range of communities (land, ocean,...) Session: Validation of uncertainties
WHERE? Location(s)	ESA ESRIN, Frascati, Italy
WHEN? Date(s) of event	24-25 October 2017
WHO from the project? GAIA-CLIM parties	Tijl Verhoelst + Heather Lawrence
What you did? Type of presentation	30min presentation on work on uncertainties (reference and co-location mismatch) in GAIA-CLIM + 15min demo of the Virtual Observatory
WHO did you talk to in detail? Principal individuals met with	Philippe Goryl (ESA, head of SPPA) Angelika Dehn (ESA, S5p data quality manager) Chris Merchant (Fiduceo) Nigel Fox (NPL)

Recollection of relevant feedback received:

GAIA-CLIM presentation was very well received, even if it was the only contribution on atmospheric ECVs. People were highly impressed with our achievements within the project and the importance of co-location issues was referred to repeatedly afterwards. ESA staff expressed that they were happy to finally get to see GAIA-CLIM, having missed the user workshops.

The VO demonstration was also very well received. The ESA staff involved in the EVDC were very interested, if a little frustrated/annoyed that there's so much duplication of work, the VO having very similar features to the EVDC. The maturity matrix information in the metadata tool was also considered of great value.

General consensus among the audience was that this works needs to be continued and that it would be a shame if valorization is not possible due to lack of follow-up.

Annex Ib10 – GEWEX G-VAP workshop, UK

Information on outreach activity

WHAT? Outreach event / activity / Conference	GEWEX G-VAP workshop
WHO? Audience / subject of session / size	Böhm, Christoph (U Cologne) Borger, Christian (MPI-C) Brogniez, Helene (U Versailles St Quentin) Calbet, Xavier (AEMET) Casadio, Stefano (ESA) Corlett, Gary (U Leicester) Ho, Shu-Peng (UCAR) Ituk, Vaughan (NEMA, Nigeria) Luo, Johnny (CUNY, TBC) Kursinski, E. Robert (SSE) Nielsen, Johannes (DMI) Picon, Laurence (LMD) Preusker, Rene (FU Berlin) Radovan, Ana (U Cologne) Remedios, John (U Leicester) Schröder, Marc (DWD) Slijkhuis, Sander (DLR) Shi, Lei (NOAA) Siddans, Richard (RAL) Pinnock, Simon (ESA)

	Trent, Tim (U Leicester)
WHERE? Location(s)	University of Leicester
WHEN? Date(s) of event	25 th -26 th October
WHO from the project? GAIA-CLIM parties	Peter Thorne
What you did? Type of presentation	Presentation on VO incl. brief walk through; presentation on gaps and remedies
WHO did you talk to in detail? Principal individuals met with	

Recollection of relevant feedback received:

VO presentation:

Sadly the metadata interface and development server were both down so limited to using old version of VO in very brief live demo.

Much interest in the colocation quantification. Can the VO be further optimized via associating location with weighting function peaks per channel rather than a single fixed value for in-situ / slantwise measurement techniques?

Do the cloudy scenes use cloudy RTTOV or are all scenes processed by the GRUAN processor using RTTOV assuming clear sky?

Rather than cloud free and all can three flags be given. Namely: Cloud free, cloudy and all? Default tick cloud free but users could choose cloudy or all.

Need to consider and document how to expand this to include other variables and in particular the ESA FRM program measurements.

Users would like to be able to script to regularly ping and download new colocations without using the interface directly.

How is the Level 1 to Level 2 satellite processing uncertainty quantified and propagated? If it isn't calculated then does this point to required further work? Do we need to caveat our level 2 comparisons accordingly?

Showing / downloading the n nearest pixels would enable greater interpretative value. Can we show / associate more than nearest pixel? Things like cloud-masking, glint, frontal proximity etc. could be accounted for. Can we show such spatial information?

Would like to go as far back as possible in time. For HIRS can we show for all GRUAN profiles not just 2013 to show the climate value within the GAIA-CLIM project timeline? Would showcase the climate application potential.

How do the community get to suggest new data streams? Can EUMETSAT include more than European satellites?

Framework should be extendable to include additional measurements and radiance simulators. Can we make it possible for the community to contribute / plug + play?

How do we define what constitutes a fiducial reference measurement? Who is the policeman? How is that traceability assured?

GAID and recommendations presentation:

We were running behind time so there was limited appetite for feedback. Also, we had not previously presented this to participants so I was effectively cold-calling this process onto them.

A specific question on whether GRUAN was looking to SHADOZ sites to augment the network coverage.

A question on what role there was for Data Assimilation

Several promises to look at and comment upon the documents later.

GVAP co-chairs suggested that there was significant value in continuing the GAID process post-project completion and urged a consideration of who may host this on a sustained basis and how it may be managed.

Annex Ib11 – International TOVS Study Conference, Germany

Information on outreach activity

Outreach event / activity	International TOVS conference / VO demo during all poster sessions
Audience	Satellite, NWP, data assimilation scientist
Location(s)	Darmstadt
Date(s) of event	29 November - 5 December 2017
GAIA-CLIM parties	Stephanie Guedj, Fabien Carminati
Facilitator(s) / Presenter(s) of what ?	Stephanie run the demo and Fabien was helping with questions
Principal individuals met with	Tony Reale Claude Camy-Peyret And several others
Version of GAID	V4
Version of Recommendations Document (RD)	V1
Version of VO	Development

Comment: At that time I presented 2 versions of the VO. Colocation for Brightness temperature were presented in the old version of the VO (<http://193.40.13.83/vo/#/>) whereas Ozone and Aerosol were presented in the new version with pre-loaded pages (<http://193.40.13.83/vo-dev/#/>).

Virtual Observatory (VO) feedback

Please repeat the below table for each set of feedback on the VO collected.

Scale 1 - 5 = excellent (5) – good (4) – useful but ... (3) – unsatisfactory (2) – rubbish (1)

How satisfied do you think the users were about the VO? (1-5)	4
Did the users find the VO potentially useful / informative to their application (which were present) area? Which data are most attractive?	Yes. Large interest for the GRUAN processor behind BT colocations. Both BT and Ozone colocation were very attractive. Not enough data from aerosols were available. The 3D-tool was described as a nice way to get an overview of all available data (satellite/ground based).
How easy did the users find it to navigate in the VO? (Are groups for selection relevant for the users, e.g., ECV, Reference, satellite and NWP... Was there any other suggestion?)	Yes, even if the new version of the VO was very unstable. A list of available data (period) was suggested.
What does the user think about (sub) selection features? (clouds, distances, period ...) Does he have more criteria to suggest?	The sub-selection is ok. It would be useful to select different cloud screening methods. The criteria for colocation (distance/time) received positive results.
Does the user seem to need more documentation? Help button to navigate more efficiently?	Yes. Help buttons and pop-up windows as well as some links to the source of dataset. Questions were asked on details on the method applied for colocations
Is the provided tool set useful? <ul style="list-style-type: none"> Plotting (bars, lines, etc., Data analyses in particular statistics (dif, RMSE, Bias, std. ...) 	A maps of reference data would be helpful. Stat are fine to get an overview of the dataset and treat them offline.
How satisfied the people are with the figure display? (color, size ...); Did the user find the visibility of uncertainties good enough?	Uncertainties for BT are too small and incomplete. Very interesting uncertainties details for ozone. Definition of each sources were missing.

Did they find any tools / functionalities superfluous?	No
How did the user rate the data download function (accessibility, relevance and functionality)? (1-5)	4
What does the user plan to do with the downloaded data (e.g., compare to other data (which one, e.g., field experiment, etc.) not in the VO)?	Validation studies
What is missing in the VO: <ul style="list-style-type: none"> • In terms of supported applications; • In terms of data (ECVs?); • In terms of tools, e.g., plotting maps. 	More Level 2 data (retrieval of T and Q) A stronger link/interactions between the VO and the 3D-tool. Interactive map would be ideal (click on the GRUAN site, select dates and get direct access to colocations)
Are the users aware of similar toolboxes to compare datasets and how do these complement/overlap each other? Why would they use another toolbox rather than the VO or their own toolbox?	The graphical interface, level of development, functionalities were mentioned to be higher than what is it done in USA presently (Tony Reale).

Any other comments:

Some problems has been underlined regarding the representation of uncertainties. For radiosondes, Claude suggests to present correlated profiles instead of standard deviation because the last are contaminated by the spike removal algorithm.

I also received many questions regarding the future of the VO.