GAIA-CLIM -Gap Analysis for Integrated Atmospheric ECV Climate Monitoring

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 640276.

Project Rationale. Earth observation (EO) through the combination of satellite-based and in situ based instruments provides in-depth environmental information and comprehensive analysis informing decision making. However, there is a recognised need across the scientific community for establishing sound methods for the characterisation of satellite-based EO data by non-satellite measurement platforms.

Systematic characterisation of the comparators is a necessary pre-requisite to avoid ambiguity in interpretation of long-term characterisation of EO data. Ideally, all measurements undertaken to monitor the climate system would be sustained, metrologically traceable and comparable, as well as having quantified uncertainty estimates. Ancillary datasets need to be of high-quality and sufficient quantity to robustly characterise sensor performance and radiative transfer modelling in order to provide confidence in the satellite data.

Comprehensive metrological traceability allows us to understand and quantify the role of uncertainty of data comparisons, including additional uncertainties and impacts that result from measurement mismatches. It is crucial to ensure rigorous satellite data characterisation, and unfortunately without traceability in the comparator measures, there is inevitable and undesirable ambiguity.

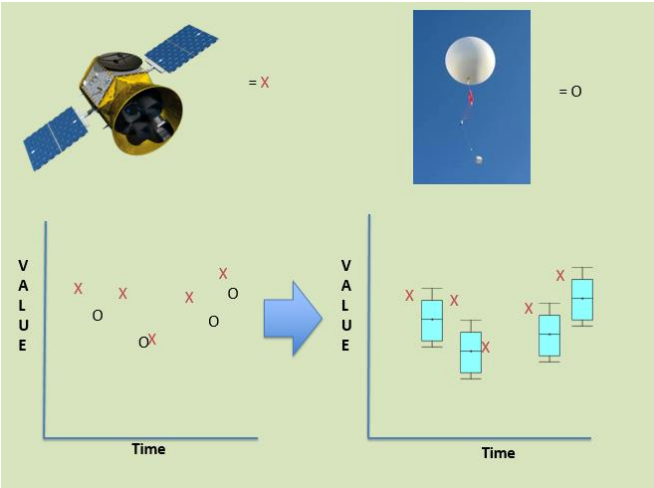

Fig 1: Example of comparison of satellite and balloon-borne measurements and the importance of comprehensive uncertainty quantification.

The aim of the 3-year GAIA-CLIM H2020 funded project is to support Copernicus by leading to a step change in the availability of, and ability to utilize, truly reference quality traceable measurements to better characterise satellite observations in long-term climate monitoring. GAIA-CLIM is expected "to lead to significant advances in greater consistency and cross-calibration/validation of long term space based measurements with ground-based historical references (including balloon-borne and aircraft measurements)". Strong focus is given to meeting user needs in relation to the non-satellite component of the GCOS monitoring infrastructure relevant for climate monitoring for six of the GCOS Essential Climate Variables: Temperature, Water vapour, Ozone, Carbon Dioxide, Methane and Aerosols.

The tools developed within this project will increase the ability to accurately use a robust mapping framework that assures metrological traceability into future EO missions, and would maximize and open up new opportunities for their usage in long-term environmental monitoring of ECVs.

Work under GAIA-CLIM will:

Define and map existing non-satellite measurement capabilities

Improve metrological characterization of a subset of non-satellite observations

Better account for co-location mismatches between satellite observations and non-satellite (reference) observations

Provide usable and actionable information to end users by identifying and prioritizing gaps in knowledge and capabilities.

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The consortium is organised into six scientific work packages (WP), each WP has a distinctive role and key objectives which are met through scientific progress, technological developments and outreach activities.

WP1: Identifying geographical capabilities and gaps in existing systems at European and Global levels.

Adopting a tiered approach enables a comprehensive mapping of capabilities and enables rigorous EO data characterisation for multiple posited applications. GAIA-CLIM is concentrating upon identifying and utilising high-quality reference measurements using an assessment of measurement technique maturity, as well as mapping the existing reference and non-reference measurements available at the global scale.

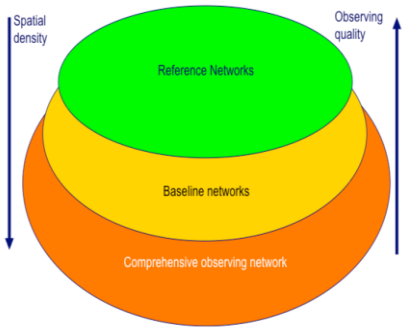

Fig 2. Cascade of observing networks

WP2: Improve metrological characterization of existing measurements

Defining reference-quality measurement capabilities for instruments currently lacking full traceability. This will benefit these measurement programs by providing increased understanding of the instruments characterization and uncertainties in all three types of network (Reference, Baseline and Comprehensive Observing networks).

WP3: Account for non-coincidence of space-based and sub-orbital measurements.

Observations from a spaceborne instrument and a sub-orbital measurement are never exactly coincident. GAIA-CLIM will explore ways to account for and quantify irreducible spatial and temporal measurement mismatch effects.

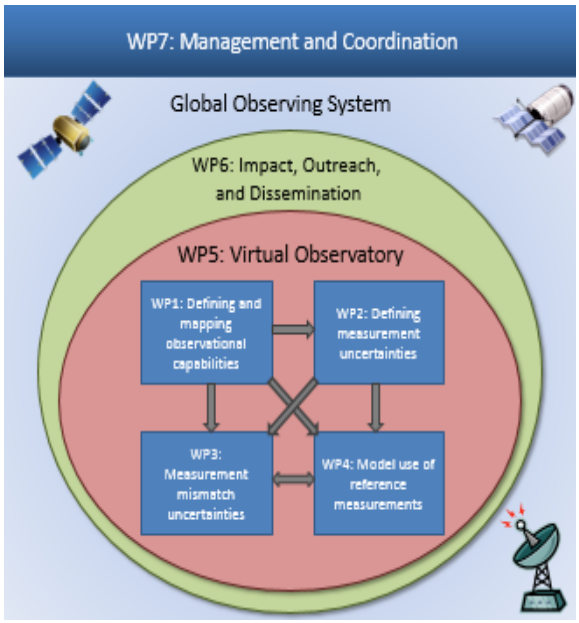

Fig 3: Overall WPs process diagram and their key aims

WP4: The use of NWP models for satellite validation

GAIA-CLIM will demonstrate, and develop, the use of data from state-of-the-art Numerical Weather Prediction (NWP) models (Met Office and ECMWF) for the validation of satellite (Level 1) data. Traceability will be achieved through a comparison of NWP fields with GRUAN data.

WP5: "Virtual Observatory" (VO) to visualize, interrogate and download co-location data and corresponding uncertainties

The VO will be a key outcome of the project and will enable end users to explore, interrogate, extract and analyse co-locations between satellite data and high-quality reference network data. Its final design shall make use of the outcomes of previous WPs while enabling a sustainable operational facility to be implemented in the future.

WP6: Outreach and engagement including assessment of gaps and impacts

Systematic consulting and user engagement between consortium members and stakeholder communities is a key aspect of GAIA-CLIM. This will ensure broad usability and relevance of project findings. The assessment of gaps and their impacts is recorded through the life of the project in the Gaps Assessment and Impacts Document (GAID). It will form the basis for the production of a set of prioritized recommendations which will be developed in the final year of the project.

We are looking for your support! Please contact project coordinators if interested

Input to the latest version of our GAID, either by suggesting new gaps or updating on already-identified gaps. Current document is available at: http://www.gaia-clim.eu/page/gaid

User workshops shall be scheduled for Nov 2016 and in 2017

Testing and providing feedback on early versions of the VO