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Ensuring consistency in metrological approaches

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Differences between GAIA-CLIM and FIDUCEO

- Chains and Measurement Equation focus
  - FIDUCEO for FCDRs: Similar forms, single step
  - GAIA-CLIM: Very different types of measurements, multistep process, no single step, single equation
  - FIDUCEO for CDRs

Measurement Eq. Tree Traceability model diagrams

Formal Equation and other steps

- With a step in the processing chain with an equation
  - Similar approaches – back to effects, measurement equation trees
- Decision making (e.g. cloud screening)
  - Very different uncertainty analysis (statistical approaches of false positive / negatives)
- Optimal estimation / retrieval
  - Not linearly propagated

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Effects tables

Information / data	Type / value / equation	Notes / description
Name of effect	Vaisala CAL4 facility calibration	
Contribution identifier	2	
Measurement equation parameter(s) subject to effect	Temperature product	
Contribution subject to effect	Temperature product	
Element correlation form	none	
Time correlation form	none	
Units element correlation	K	
Units time correlation	K	
Scales element correlation	1	
Scales time correlation	1	
Uncertainty PDF shape	Normal	
Uncertainty	±0.15	
Uncertainty units	K	
Sensitivity coefficient	1	
Correlation(s) between affected parameters	None	
Cross-contribution correlation(s)	None	
Element/step common for all sites/users?	Yes	
Traceable to …	2a - reference T sensor	
Validation	Inter-comparison studies.	

Beneficial to users

Get key numbers / information in common format in single location

Not searching through papers

		Value / Expression	Notes
Name of effect			
Affected term in measurement function			
Channels / bands			
Correlation type and form	within scanline [pixels]		
	from scanline to scanline [scanlines]		
	between images/orbits [orbits]		
	Across time [appropriate time units e.g. days, months, years]		
	between channels / bands		
Correlation scale	within scanline [pixels]		
	from scanline to scanline [scanlines]		
	between images/orbits [orbits]		
	Across time		
	between channels / bands		
Uncertainty PDF shape			
Uncertainty units			
Uncertainty magnitude			
Sensitivity coefficient			

Challenges on acceptance of metrological rigour

- Some resistance to doing this depth of study
- People who understand instruments need to do study – but can be difficult, different from what they are used to
- Everyone thinks it is important, but few want to do it
- Case study: “this was hard, but it was worth it”
- Need for capacity building and expertise in environmental metrology
- Mechanisms to formalise involvement of metrologists in these programmes and funding to support this type of activity by instrument and process scientists

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Metrological understanding of instruments

- Is there a need of a FIDUCEO-scale effort in rigorous metrological characterisation of instruments (processes, uncertainties, correlations) and their raw products for the GAIA-CLIM instruments? (Smaller WP in GAIA-CLIM; some instruments done at a deeper level)
  - Future FIDU-CLIM project ☺

- If Europe is going to realise the value of its investments in these ground-based instrument infrastructures, there needs to be a FIDUCEO-style sustained and detailed understanding of those instruments so we can make best use of them

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Comparison to validate uncertainties

- There is no simple comparison between relatively raw products from the two types of sensor. Any comparison would need radiative transfer and co-location analysis.
- So we also need appropriate metrological rigour on spectroscopy and RT modelling

- Closest we'd get is radiosonde converted to TOA radiance
  - Instantaneous
  - Averages over space and time
- Also with NWP as intermediate transfer standard and to validate each individually

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Additional work to fund

- Improved metrological rigour on spectroscopy / radiative transfer
- Minimise colocation uncertainties
  - E.g. intentional mission through Suomi-NPP at Southern Great Plains Site of radiosondes that are before / after overpass. Our projects not using this information now, but could use methodologies on those
- Vocabulary – check we agree, joint publication – present to external agencies
- FIDU-CLIM – expanding GAIA-CLIM WP2 into something big enough to realise the full value of European in situ infrastructure

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