NPL

FRM4SOC: ‘community workshop’

Welcome

Professor Nigel Fox
Head of Earth Observation, Climate and Optical, NPL
Chair CEOS WGCV IVOS

esa

fiducial reference measurements for satellite ocean colour

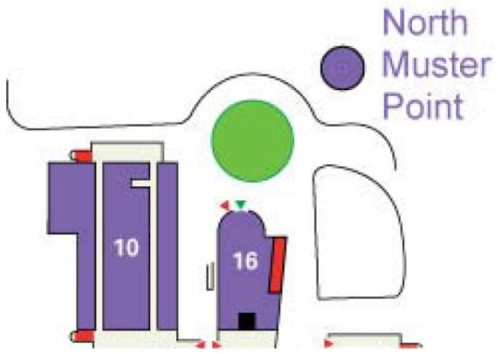
CEOS

Housekeeping

Please ensure mobile phones are turned off or are on silent.

There are no fire alarm tests scheduled today. If the fire alarm sounds (siren and/or voice system) please follow instructions given. If asked to evacuate please leave via the nearest exit and assemble at the North muster point. NPL staff will give directions.

The North muster point is on the grass area the other side of the roundabout opposite reception.



Do not wait on road.

Toilets (‘restrooms’) for men and women are located both on the first floor and ground floor behind the reception hall.

Smoking is not permitted anywhere in the building

Wireless network for visitors

To connect to the guest network

Connect to TEMP-ACCESS

1. Open your internet browser, please note our wireless network is not compatible with Windows Vista
2. Accept the unsigned certificate if prompted [you may receive a message from your pc advising you not to do this]
3. Log in with user name: guest
4. Password: teddington

International EO community

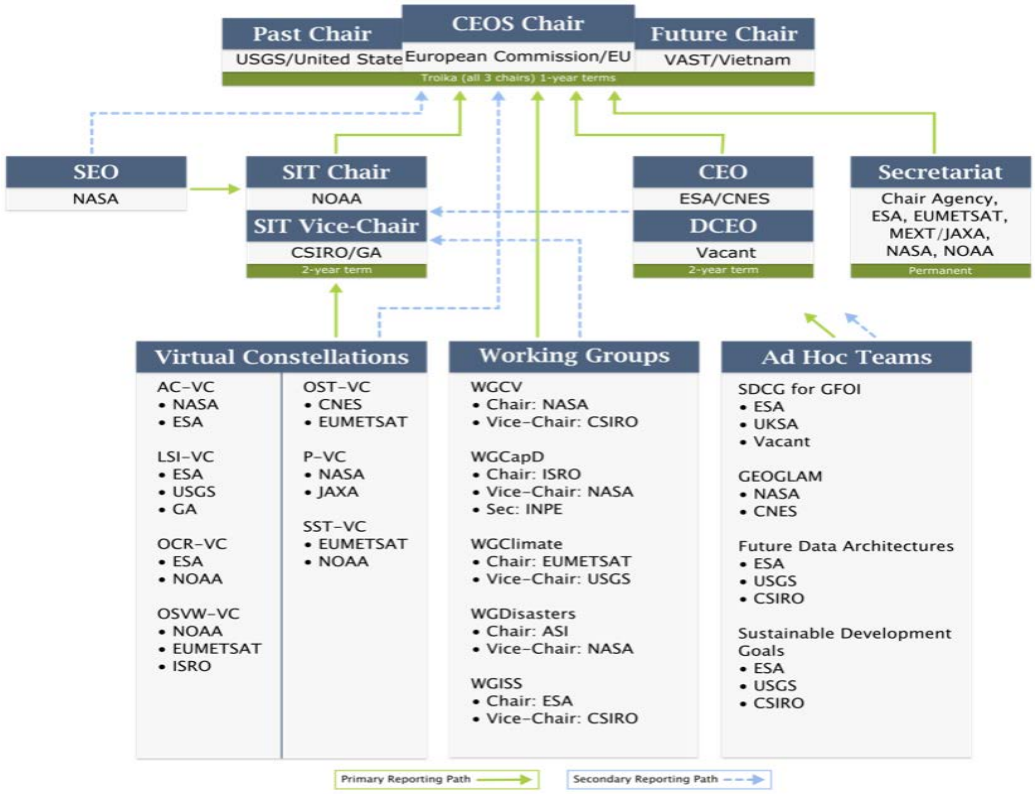
NPL National Physical Laboratory | Centre for Carbon Measurement

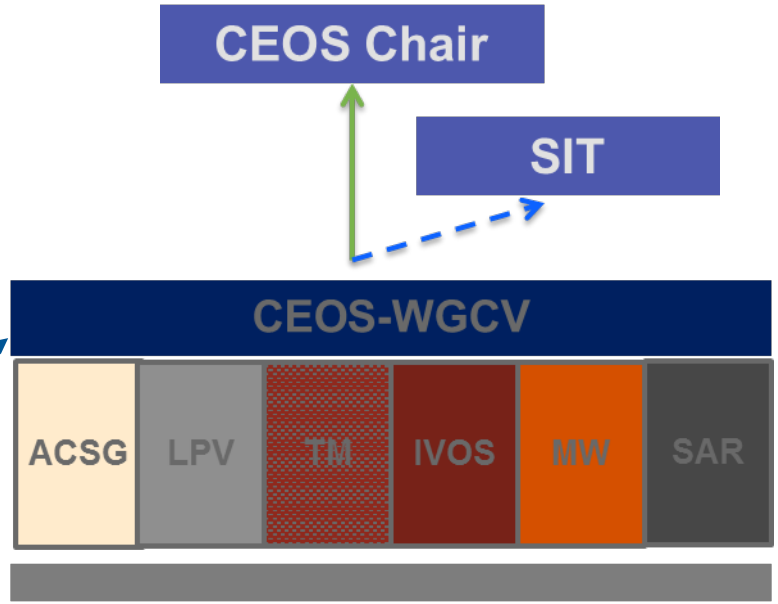
GEO GROUP ON EARTH OBSERVATIONS

103 member countries + 90 organisations

CEOS Committee on Earth Observation Satellites

31 member Agencies + 28 organisations





GSICS Global Space-based Inter-Calibration System

Operational (Meteorological space agencies)

The Metre convention (système International d' unités (SI)

BIPM, Sèvres, Paris

- Created 1875
- Currently 58 member states, 41 associates
- Mutual Recognition Arrangement (MRA)
  - Created 1999 to ensure equivalence of measurements between countries
  - Includes: WMO, IRMM, IAEA & ESA

Governance

Conférence Général des Poids et Mesures (CGPM) 4 yrly

2018 Change definition of Kg, K, Mol, A to fixed constants

Comité International Poids et Mesures (CIPM)

Consultative committees (for each unit) (technical from NMIs)

propose definitions, decide on and organise comparisons etc

(CCPR 'Photometry and Radiometry') (optical measurements)

EO @ NPL Vision: *build from heritage strengths in optical radiation to establish world class, globally leading infrastructure & expertise to meet metrology needs of worlds EO and Climate community*

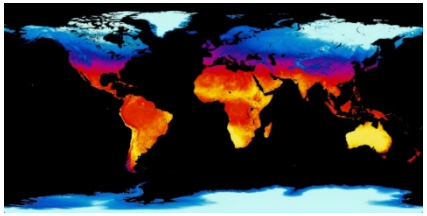
NPL National Physical Laboratory

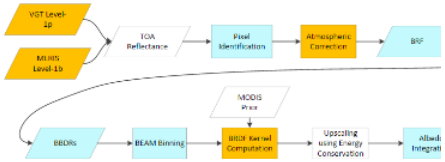
Satellite data quality

Pre-flight

In-flight

Products & information

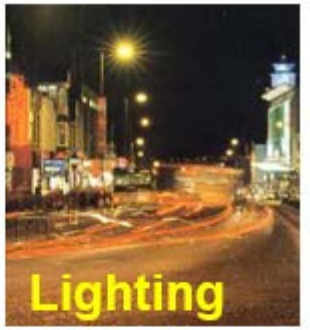




opernicus
Europe's eyes on Earth

Clima
Servi

&



How to define a Fundamental (Climate) Data Record?

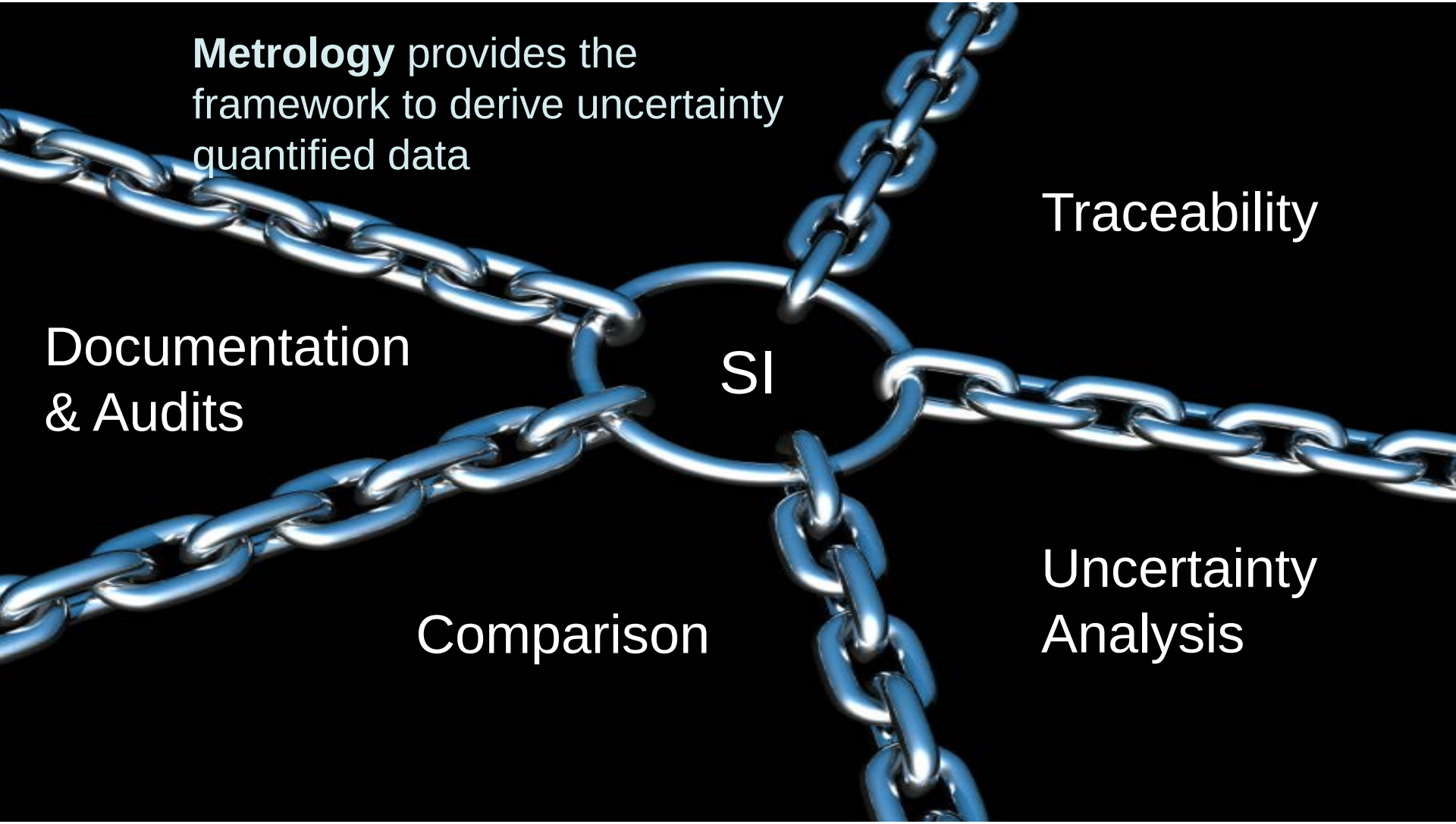
(Draft definition under consideration by CEOS/CGMS Working Group Climate during 2018:) **An FCDR consists of a long, harmonised record of uncertainty-quantified sensor observations that are calibrated to physical units and located in time and space, together with all ancillary and lower-level instrument data used to calibrate and locate the observations and to estimate uncertainty.**

Note

The term Fundamental Data Record may be applied to records meeting similar standards to an FCDR, but which is either too short to be informative about climate variability and change, or whose contents are relevant for purposes not considered to be climate applications. (Logically, one should define FDR as the baseline concept and add climate-specific requirements to define FCDR, and this may yet be recommended.)

METROLOGY

NPL National Physical Laboratory

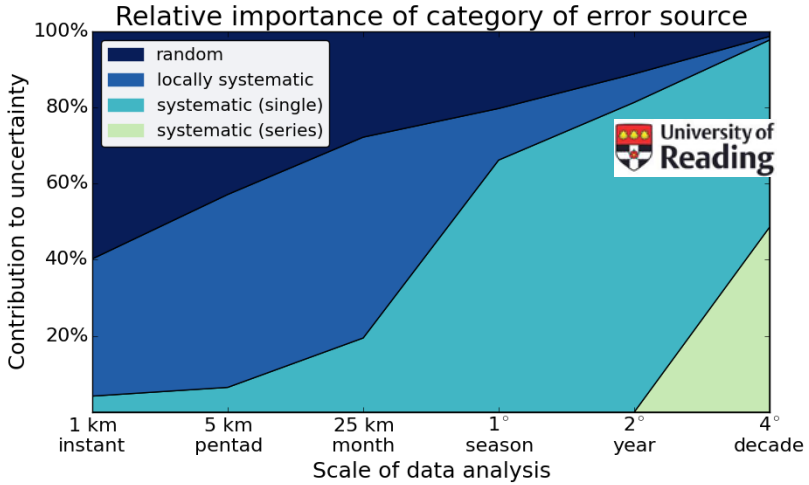


Why SI Traceability?

Unequivocally linking an '**observation**' to an invariant constant of nature (international system of units) with a robust estimate of **uncertainty** ensures the '**measurement**' can be: trusted, coherent and comparable with others, have longevity 'improves with age'

NEEDS to be evidenced at point of use - i.e. in space

Some applications MAY not need radiometric SI Traceability or high accuracy – reliant on data from a single mission/image where SNR and relative pixel to pixel variances are enough (still need Uc/error corrections stray light, MTF ….)

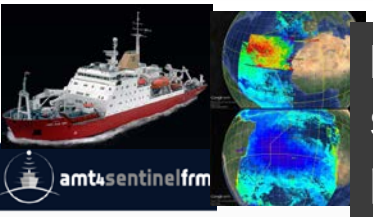


Merchant (SST example Fiduceo)

- **Single mission measurements over time,**
- **Mission to mission interoperability**
- **Multi-decadal climate**
- **Litigation/treaties/large investments…**

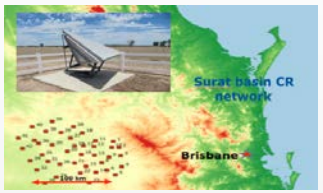
In the absence of an SI traceable sensor in space (of sufficient accuracy) an 'unequivocal reference data set' that can anchor all sensors is necessary to enable an Integrated EO System of climate quality

SI traceable validation (FRM4…) mitigate against data gaps & test/anchor FDRs



Fiducial Reference Measurements (FRM) are a sub-set of 'in-situ' measurements of satellite measured parameters (L1/L2) that can be robustly <u>compared</u> to those independently derived from a satellite to:

- Validate the sensor performance and any processing
- Provide a means to bridge any potential data-gaps
- Facilitate interoperability between sensors and anchor/establish FDRs
- Providing they are of sufficient accuracy!
  (Noting that the comparison process has its own Uc)



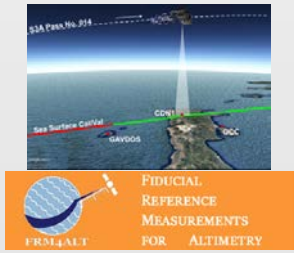
FRM4SAR

fiducial reference temperature measurements

fiducial reference measurements for satellite ocean colour

FRMs <u>MUST</u>:

- have documented evidence of metrological traceability to SI (or appropriate international community standard) including full uncertainty budget (instrumentation and useage), which must be at a level commensurate with the application.
- be independent of any satellite geophysical retrieval process.
- be carried out following community agreed protocols



Working Group on Calibration and Validation

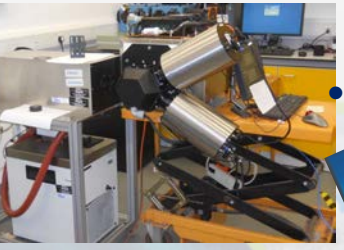
WGCV supported by

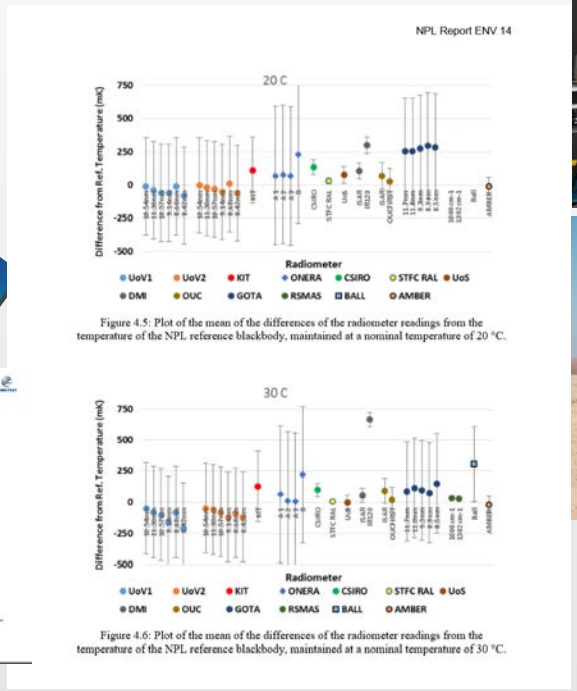
FRM4STS

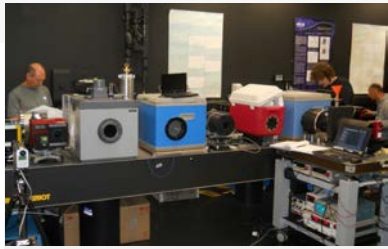
Has delivered to CEOS agencies and sub-bodies

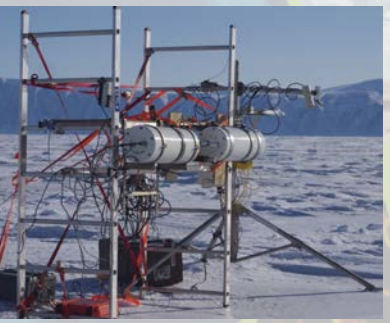
- 10 types of comparison with 12 participants from 4 continents
- 8 best practices or protocols
- Improved confidence, reliability and global consistency in validation of satellite derived Surface Temperature (Ocean, Land and Ice)
- Community Improved knowledge of uncertainty evaluation
- Legacy database to store future results

www.FRM4STS.org









NPL National Physical Laboratory

esa

Working Group on Calibration and Validation

Comparisons of instruments & methods

fiducial reference measurements for satellite ocean colour

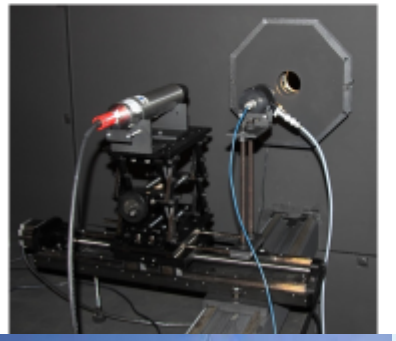
www.frm4soc.org

esa fiducial reference measurements for satellite ocean colour CEOS

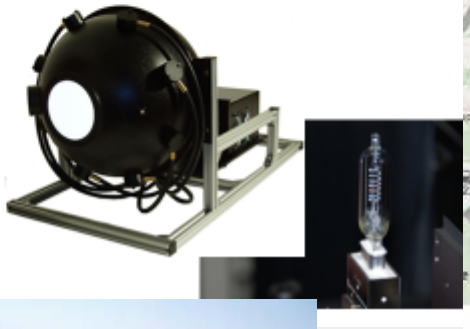
Laboratory Calibration Exercise 2 (LCE-2): Ocean Colour Radiometers (OCRs) 8 – 13 May 2017 at TO, Tõravere, Estonia

Main objective:
Establish and document protocols and best practice to practically verify the performance of FRM OCRs through

1. TO calibrates all participating radiometers



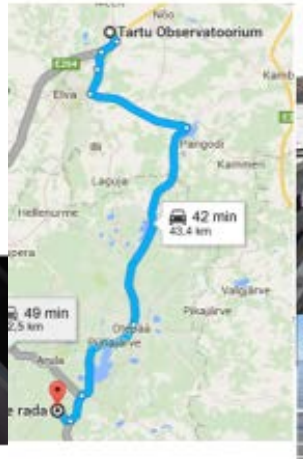
2. Participants measure the targets under controlled laboratory conditions

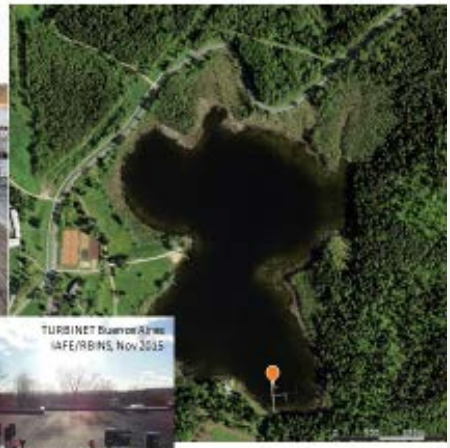


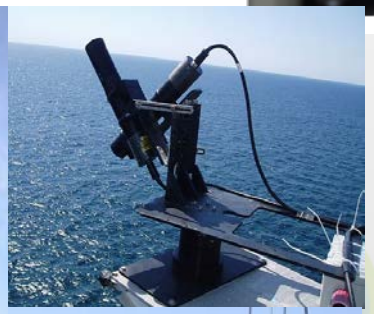
esa fiducial reference measurements for satellite ocean colour CEOS

LCE-2 outdoor intercomparison - Lake Kääriku, 08-13 May 2017

- Controlled outdoor environment near Tartu Observatory, Estonia







Ensuring measurements validating of Ocean colour

Are internationally consistent and traceable to SI

Working Group on Calibration and Validation

Uncertainty analysis with support