



# **IDEAS+ Task 3: Introduction and Current Meeting Objectives**

**Fabrizio Niro**

***11 – 12 October 2017***

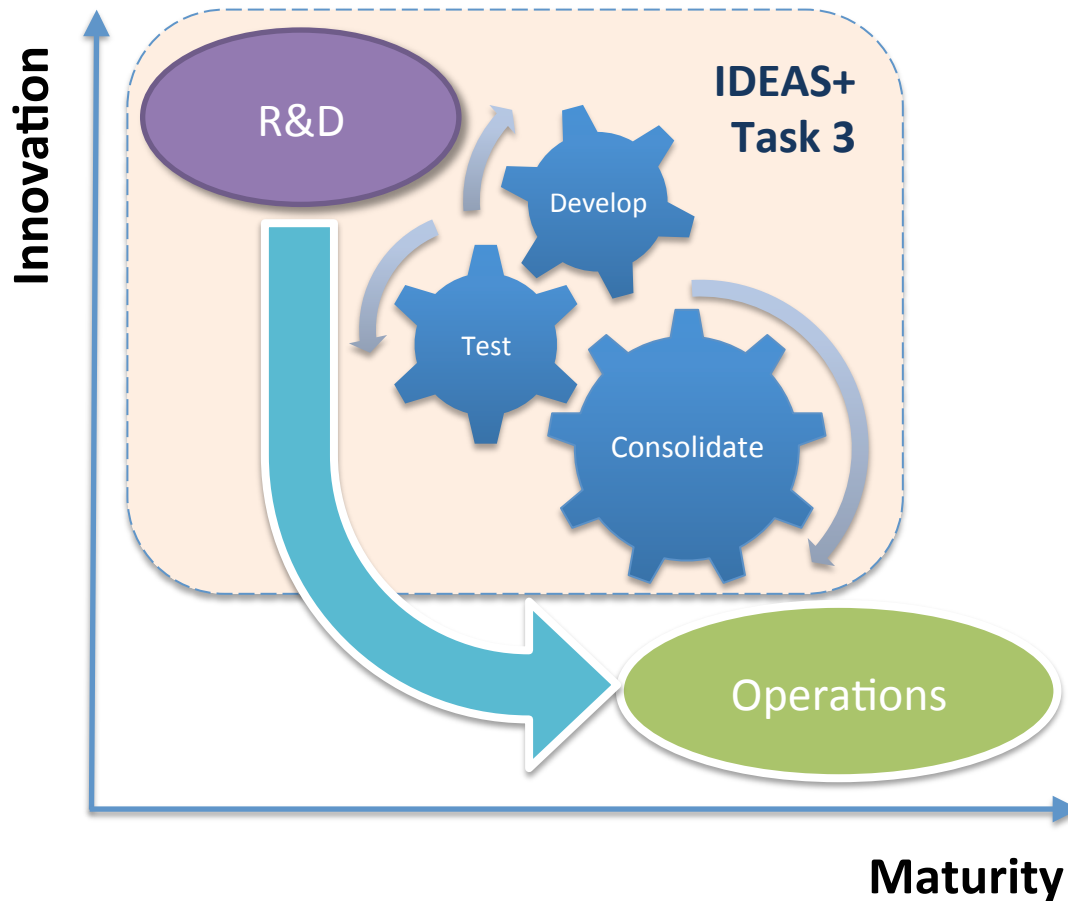
***PMOD, Davos***

# Scope



- The **IDEAS+** consortium is responsible, **on behalf of ESA SPPA** section, for ensuring the best data quality of **ESA EO missions currently in operations**, this includes notably: Routine **Quality Control**, **Algorithm** Development and **Cal/Val** activities
- In the frame of the IDEAS+, **the Task-3** Cal/Val is the place where **innovative** ideas are promoted and prototyped with the goal of fostering the progress of: Algorithm Baseline, Cal/Val protocols, instrument design and approaches for in-situ measurements
- IDEAS+ Task-3 **scope** encompasses all cross-cutting (multi-mission) topics, which are relevant for assessing and improving EO Data Quality and associated Cal/Val
- The underlying **principle** for IDEAS+ Task-3 activities is that R&D activities of today are (potentially) the operations of tomorrow

# Vision and Ambition



- Within IDEAS+ **Task-3**, the **R&D** is strongly **encouraged** in order to elaborate new approaches and methods, e.g., instrument and measurement set-up, algorithm and products definition, Cal/Val techniques and protocols
- The innovative concepts are further consolidated and put into an international (e.g., **CEOS**) and **multi-mission** context
- When R&D has proven to be sufficiently **mature** and **robust** to sustain Operations → the relevant outcome (e.g., prototype processor, validation best practice) is transferred into an operational context

# Framework



## IDEAS+ Service Management (John Swinton)

Task 1 – Quality Control  
(Ruby Mannan & Sabrina Pinori)

Task 2 – IPF & Tools  
(Massimo Cardaci)

Task 3 – Cal/Val  
(Fabrizio Niro)

Task 4 – Web  
(Cristiano De Vincenti)

Task 5 – LTDP  
(Marta De Laurentis,  
Gabriele Brizzi)

IDEAS+ consortium is responsible, on behalf of ESA Sensor Performances Products and Algorithm (SPPA) section, for ensuring the best data quality of ESA EO missions **currently in operations**, this includes: **Quality Control, Algorithm and Cal/Val**

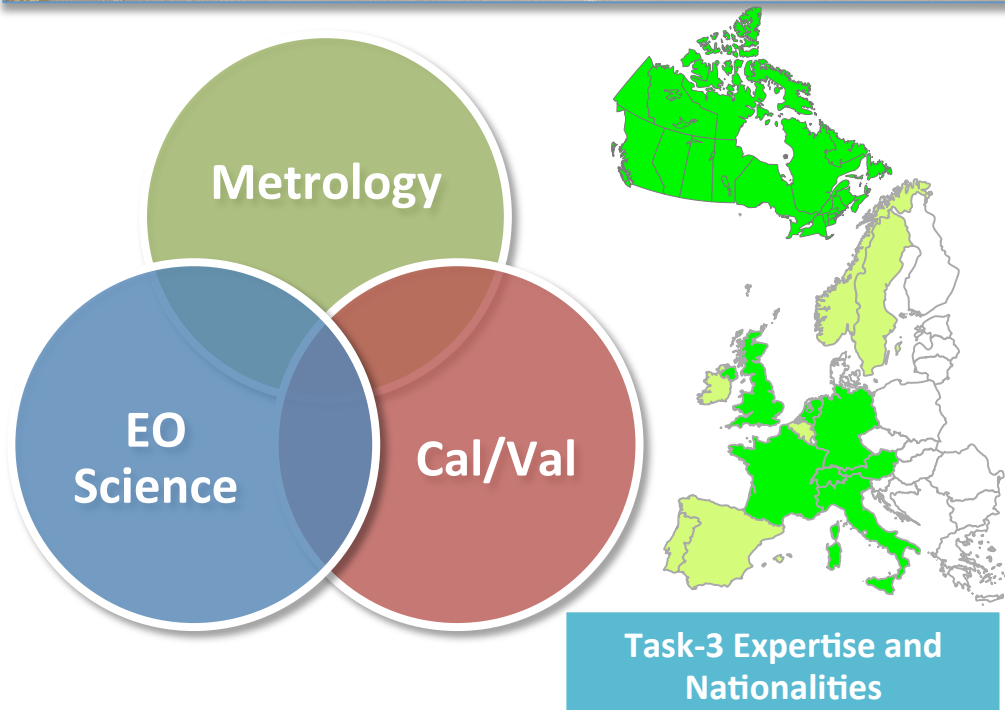
The screenshot displays the ESA SPPA (Sensor Performance, Products and Algorithms) website. The header includes the ESA logo and the SPPA title. Navigation tabs for 'EO Mission Performance', 'Documentation', 'Activities', and 'Meetings & Workshops' are visible. A 'You are here' breadcrumb shows the path to the 'Home' page. A carousel of mission images is featured, including ERS-1, ERS-2, ENVISAT, GOCE, SMOS, CryoSat-2, Sentinel-1, and Sentinel-2. Below the carousel, there are sections for 'Sensor Performance, Products and Algorithms' and 'News'. The 'Sensor Performance' section includes sub-sections for 'Algorithm Development', 'Cal/Val', and 'Routine Quality Control'. The 'News' section contains several articles, including 'SMOS offers new perspective on hurricanes' and 'Stay up-to-date with the ESA SMOS Mission: Newsletter July 2018'. At the bottom, a blue banner contains the URL <https://earth.esa.int/web/sppa/home>.



# Team and Expertise

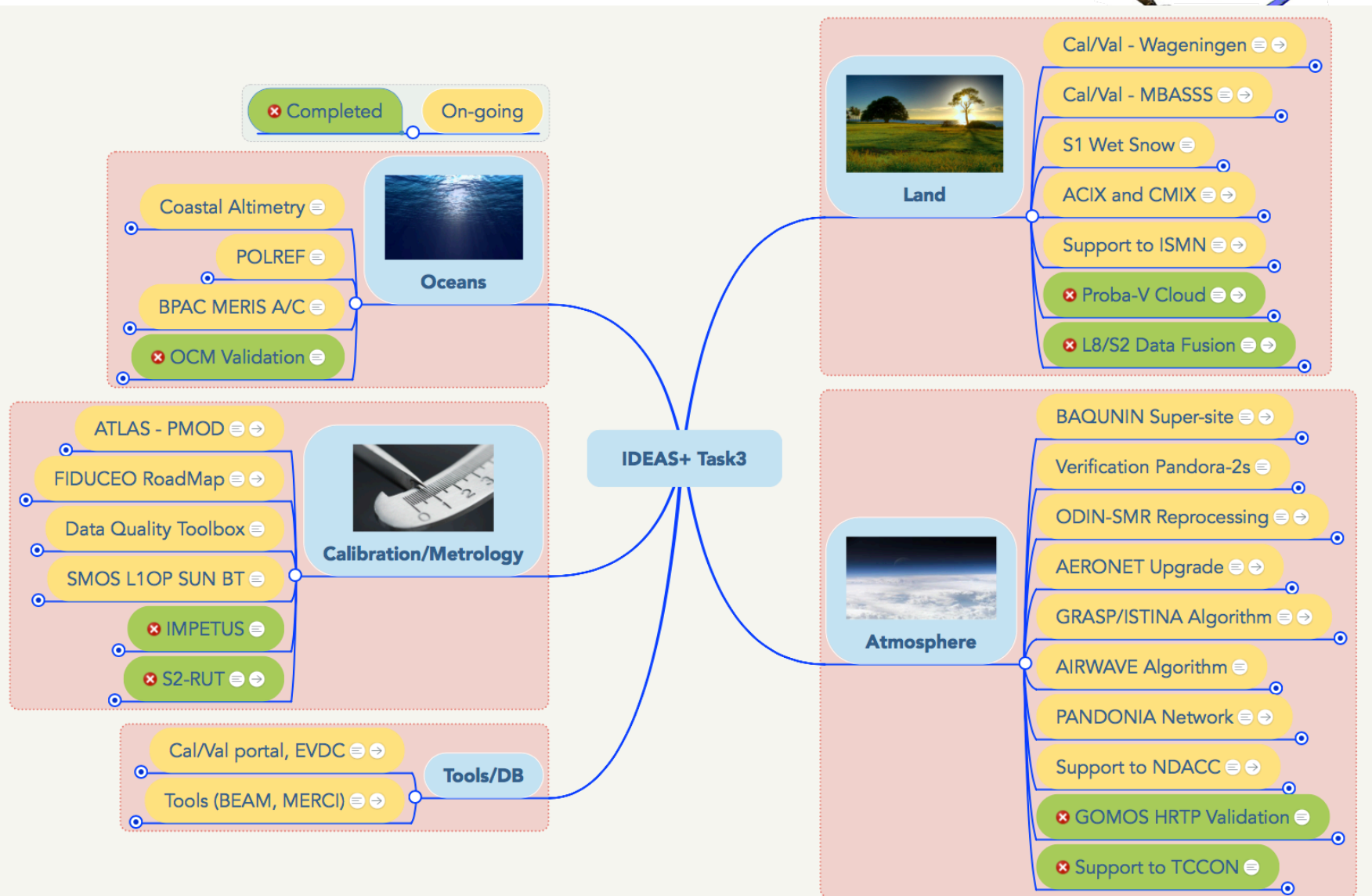


Task-3 Workshop (Lille 2017)

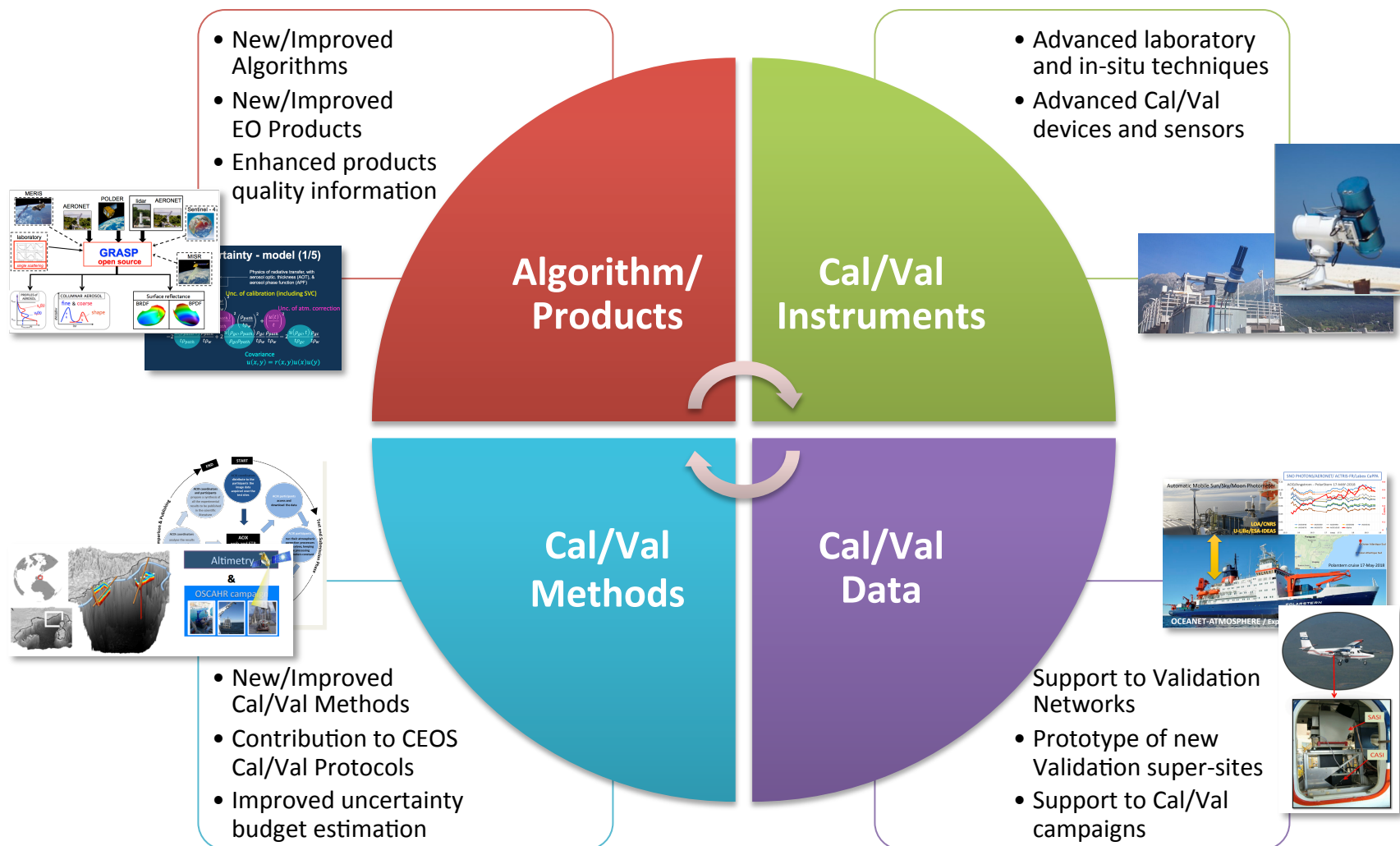


- Task-3 includes scientists and engineers from all over **Europe** and **Canada**
- The expertise cover a wide range of disciplines: **Metrology, Cal/Val, EO Science (Land, Water, Atmosphere)**
- The **metrological** component is strongly represented: NPL and Davos, providing the required focus on **traceability and uncertainty**
- **Synergies** among the various groups is encouraged in the process of testing and verifying new concepts
- Periodic **Workshops** are organized, hosted in the various institutes with the goal of ease collaboration and provide a forum for exchange of ideas

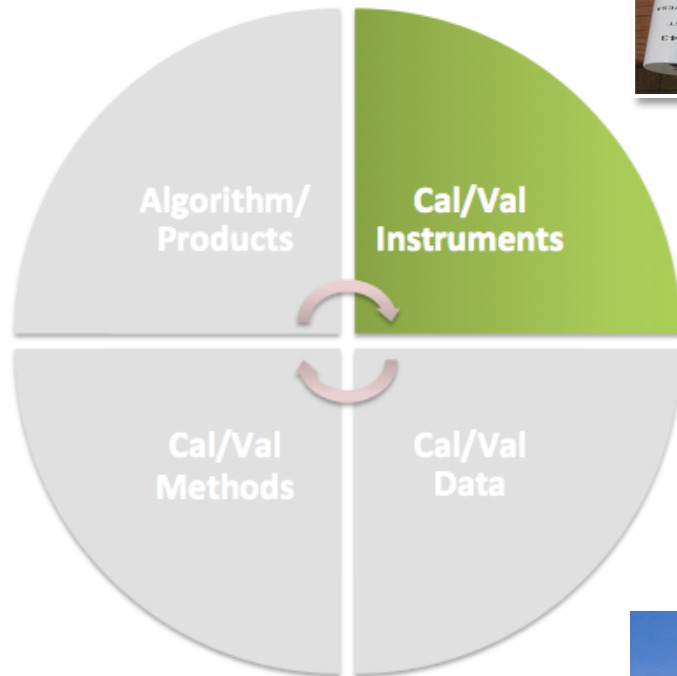
# Projects Map



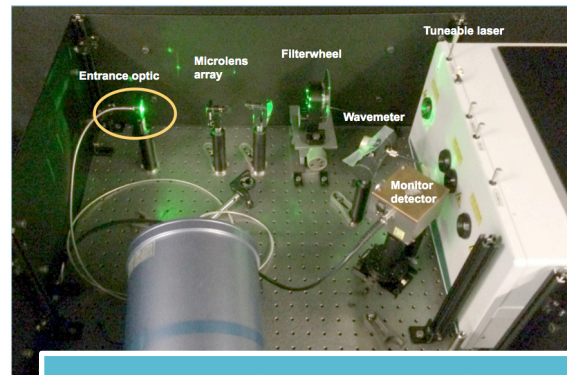
# Outcomes



# Cal/Val Instruments



AERONET Calibration Facilities and Mobile Photometer



ATLAS Laboratory Facility and PSR



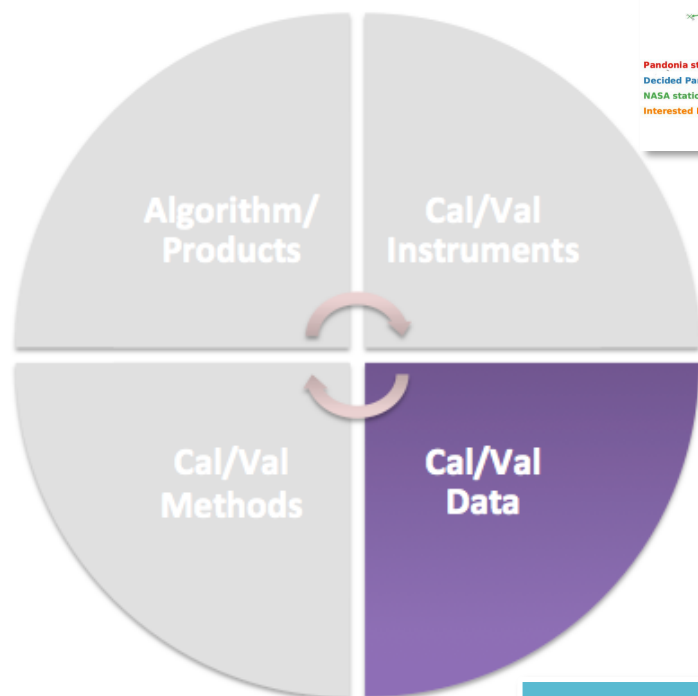
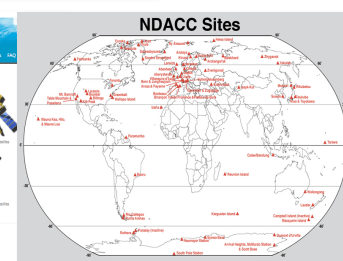
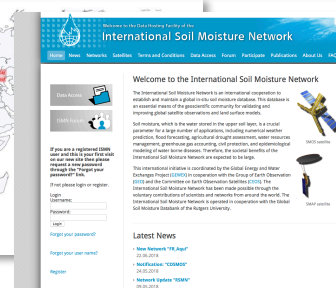
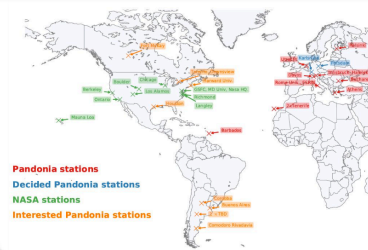
Pandora-2s



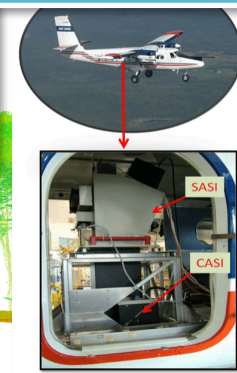
# Cal/Val Data



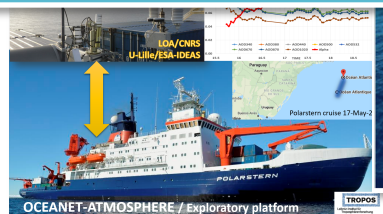
## Support to Cal/Val Networks: Pandonia, ISMN and NDACC



## New Cal/Val Super-sites: Wageningen, MBASSS, Baqunin



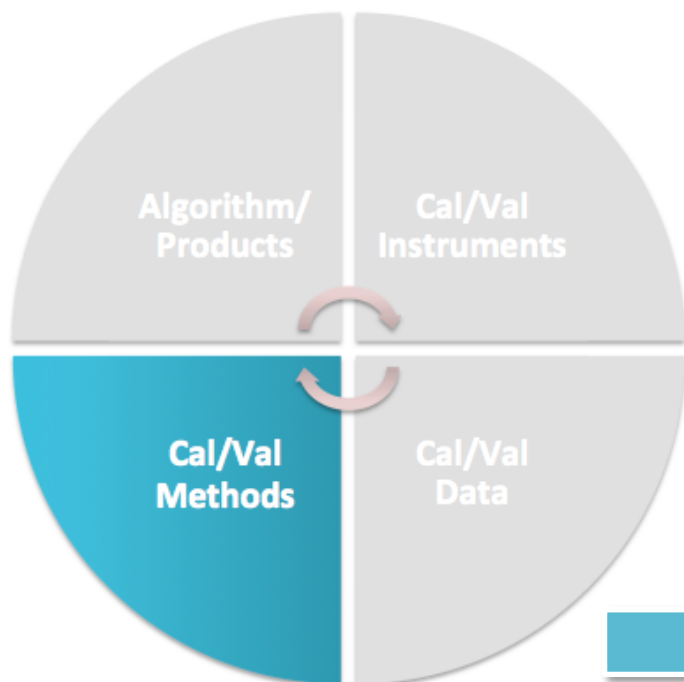
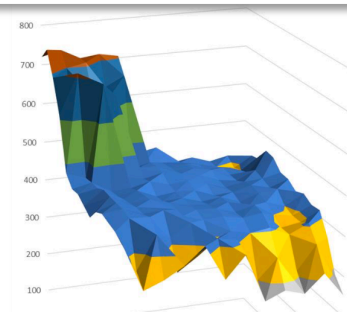
## Support to Cal/Val Campaigns: Polarstern, AQABA



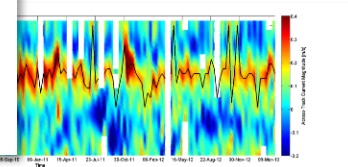
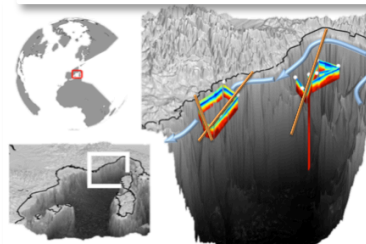
# Cal/Val Methods



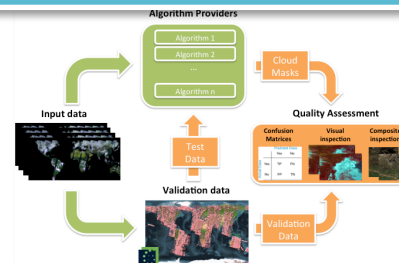
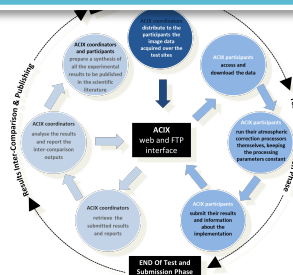
## New Calibration Methods: relative gain and focus



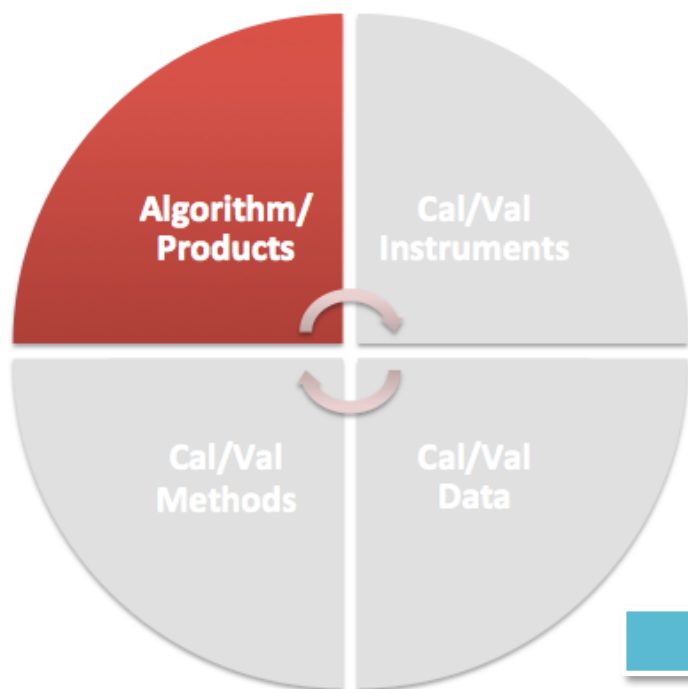
## New Validation Methods: Coastal Altimetry



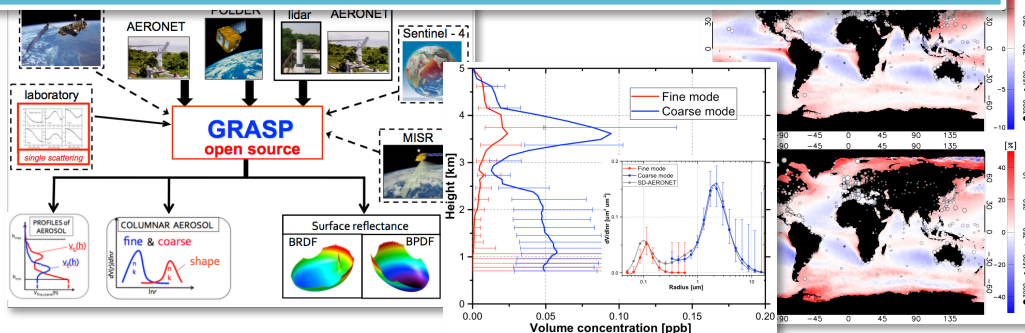
## New Cal/Val Protocols: ACIX and PV-CDRR



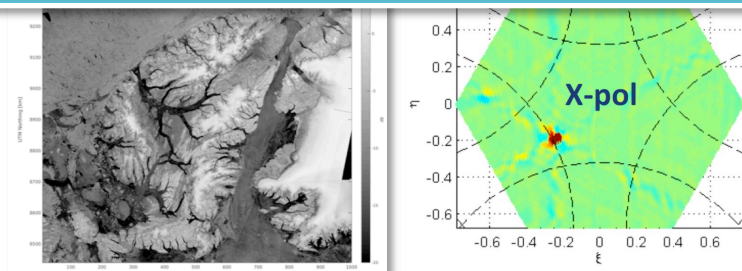
# Algorithms/Products



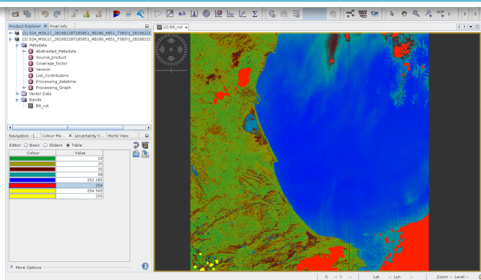
## Advanced Algorithm: GRASP, GARLIC, AIRWAVE



## Advanced Products: S1 Wet snow Map, SMOS Sun



## Enhanced Products Quality Info: S2 RUT, L2 OCR, POLREF



### OCR uncertainty - model (1/5)

Physics of radiative transfer, with aerosol optical thickness (AOT), & aerosol phase function (APF)

$$\rho_w(\lambda) = \frac{\rho_{gc}(\lambda) - \rho_{path}(\lambda)}{t(\lambda)}$$

Unc. of calibration (including SVC)

$$\left( \frac{u(\rho_w)}{\rho_w} \right)^2 \approx \left( \frac{u(\rho_{gc})}{\rho_{gc}} \right)^2 \left( \frac{\rho_{gc}}{t \rho_w} \right)^2 + \left( \frac{u(\rho_{path})}{\rho_{path}} \right)^2 \left( \frac{\rho_{path}}{t \rho_w} \right)^2 + \left( \frac{u(t)}{t} \right)^2$$

Unc. of atm. correction

$$-2 \frac{u(\rho_{path})}{\rho_{path}} \frac{\rho_{path}}{t \rho_w} + 2 \frac{u(\rho_{gc})}{\rho_{gc}} \frac{\rho_{gc}}{t \rho_w} - 2 \frac{u(t)}{t} \frac{\rho_{gc}}{t \rho_w}$$

Covariance

$$u(x, y) = r(x, y) u(x) u(y)$$



# Recommendations from Previous Workshops



Lille, Mar 2017



ESRIN, Dec 2017



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## DOCUMENT

Proceedings Highlights and Recommendations from  
IDEAS+ Cal/Val Workshop, LOA, Lille, 6 – 7 Apr 2017

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## DOCUMENT

Proceedings from IDEAS+ Cal/Val Workshop#5,  
ESRIN, 12 – 13 Dec 2017

Synthesized from detailed workshops recommendations:

- ◆ **Work toward** provision of **uncertainties at L1** for both historical and new missions and provide to users all **information** to support full **traceability**, including **pre-launch** characterization data
- ◆ **Harmonize** methods and best **practices** for **uncertainty** estimation across various communities (Land, Water, Atmosphere)
- ◆ **Support training** and **education** for uncertainty estimate, this includes developing tools for lowering the bar for non-expert users
- ◆ **Demonstrate user benefits** for uncertainty information in L1 and L2 products by identifying simple case studies
- ◆ **Ensure sustained** support to **Cal/Val infrastructure**; this includes maintenance and upgrade of sensors, calibration facilities and algorithms required to process Cal/Val data
- ◆ **Ensure maintenance and upgrade** of **Cal/Val databases** and associated **validation tools** and ease open and free **exchange** of Cal/Val data both within IDEAS+ and with external partners, e.g., MPC
- ◆ **Facilitate synergies** between **metrological** institutes and **Cal/Val data providers** to attain **SI traceability** of ground-based measurements

# Objectives of current Workshop



- Follows on recommendation from previous Workshops and collect new ones for improvements in Cal/Val and algorithms methods
- Review progress since past Workshop and discuss on potential evolution and collaboration in the frame of the future IDEAS+ contract
- Continue discussions from previous meetings on the approaches to:
  - Calibration/Validation
  - Algorithm Improvements
  - Instrument Characterization
  - Traceability and Uncertainty estimates
  - Ground based measurements and Field Campaigns
- Continue to look for and identify synergies between activities, and agree on actions to take advantage of the synergies
- All areas of Task 3 will be presented at this meeting

# Agenda



Introduction  
9:00 – 09:30

Calibration, Traceability and  
Uncertainty  
09:30 – 10:30

Land  
11:00 – 12:40

Lunch Break (12:40 – 14:00)

Oceans and Coastal Zones  
14:00 – 16:00

Visit to PMOD Facilities  
16:00 – 18:00

20:00 – Social Dinner in Davos

Atmosphere 1  
9:00 – 12:40

Lunch Break (12:40 – 14:30)

Closing Session  
14:30 – 16:00

# Food for thought

## Cal/Val



- Which are the gaps in the current Cal/Val measurements? Which variable? Which measurement technique? How we can fill these gaps?
- Is the existing Cal/Val infrastructure addressing current (and future) needs for supporting ESA satellite missions? In particular in terms of characterization, traceability, coverage?
- Is the synergy with metrological institutes fully exploited? How we can foster this to work toward SI traceability?
- Are the current protocols and best practices for Cal/Val mature enough? How we can improve them and make sure that are agreed and adopted within the community?
- Are the Cal/Val tools and databases meeting the needs of algorithm developers? How we can improve them?

# Food for thought

## Algorithm and Products



- Which are the gaps in the current suite of ESA operational products? How we can fill these gaps?
- How mature are the algorithm for ESA L1/L2 products and which are the most priority areas requiring theoretical advances?
- How consistent are the various algorithms and how we can address the remaining inconsistencies, at L1 and L2?
- Is the quality information associated to ESA L1/L2 products appropriate to meet the needs of downstream applications? What is needed?
- Which is the need for uncertainty in the various EO communities? How we can demonstrate user benefits in exploiting uncertainty information?

# How to progress?



- IDEAS+ Workshops are a good occasion to provide your opinion on these topics, in particular identifying missing (or evolution) requirements for Cal/Val methods/techniques and for Algorithms/Products
- Concrete recommendations and actions will be gathered and merged with the ones collected in other workshops (e.g., LPVE, ACVE, ...)
- These recommendations will be the guidelines around which ESA will develop the future Cal/Val and Algorithm evolution Strategy