DIMITRI overview and evolution

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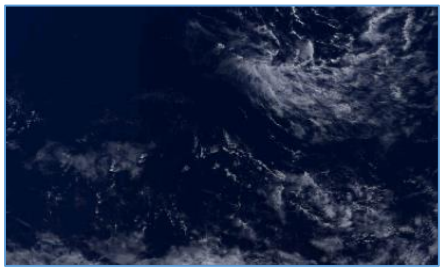
Outline

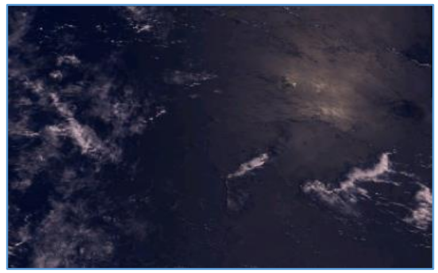
- Overview of DIMITRI
- Examples of results from DIMITRI for S3/OLCI A&B and S2/MSI A&B
- Ongoing work on the next version DIMITRI V4

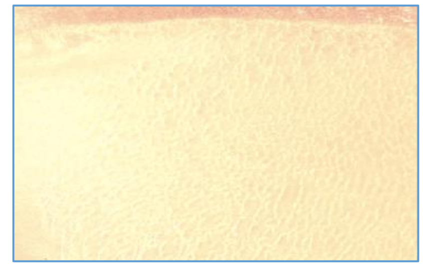
DIMITRI: what for?

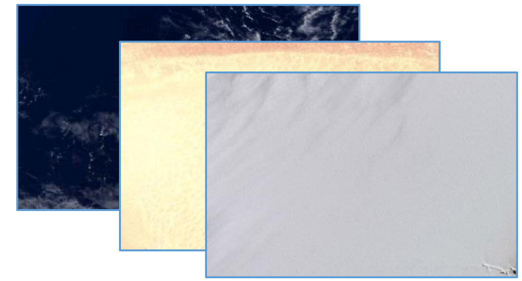
- DIMITRI: Database for Imaging Multispectral Instruments and Tools for Radiometric Intercomparison
- Sensor-to-sensor comparisons
- Sensor to simulation comparisons
- Sensors: (A)ATSR, MERIS, MODIS-A, Proba-V, OLCI, SLSTR, S2/MSI, LANDSAT-8/OLI
- Used in commissioning phase and during routine operations at ESA

Overview of DIMITRI (V3): the methodologies





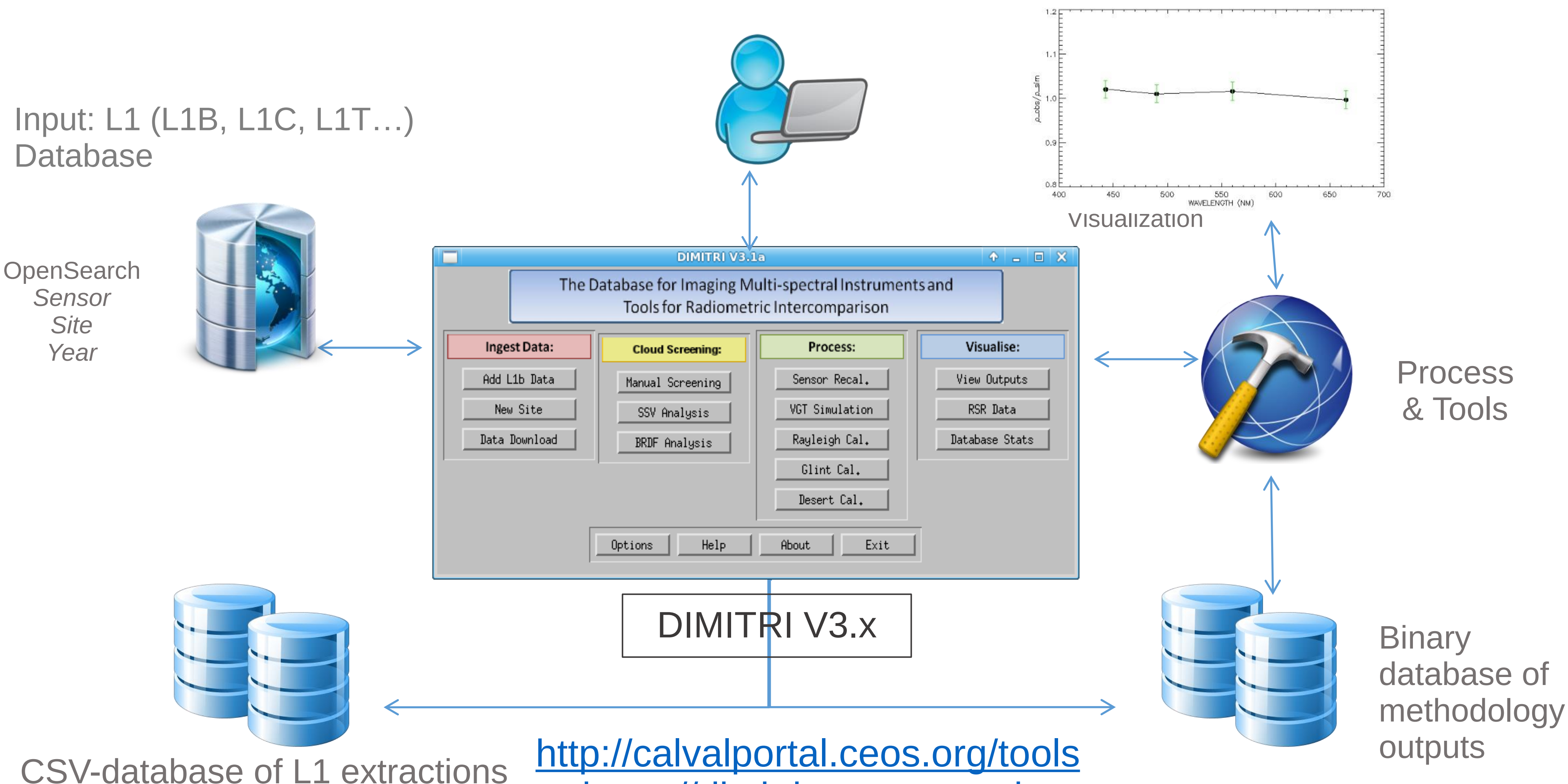




Rayleigh scattering calibration	Sun-Glint inter-bands calibration	Desert (PICS) calibration	Sensor-to-Sensor intercalibration
Absolute calibration coefficient: as ρ^{obs}/ρ^{sim}	Absolute Inter-band calibration coefficient: as $\rho^{B(i)}/\rho^{B(ref)}$	Absolute calibration coefficient: as ρ^{obs}/ρ^{sim}	Absolute inter-calibration coefficient: as ρ^{obs}/ρ^{REF}
Vermote et al (1992); Hagolle et al (1999)	Hagolle et al (1999; 2004); Nicolas et al (2006)	Bouvet (2014)	Bouvet et al. (2006)
- Over VIS bands - Uncertainty <5% - Very stringent criteria	- Over VNIR bands - Uncertainty <2% - Very stringent criteria	- Over VNIR bands - Uncertainty <5% - Uses surface BRDF	- VIS, NIR & SWIR bands - Uncertainty <5% - Limited matchups

http://calvalportal.ceos.org/tools
https://dimitri.argans.co.uk

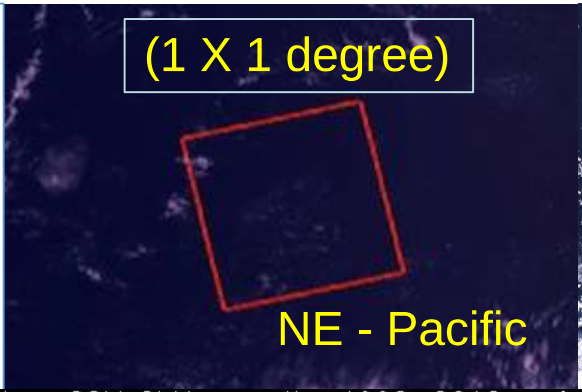
Overview of DIMITRI (V3): the software architecture

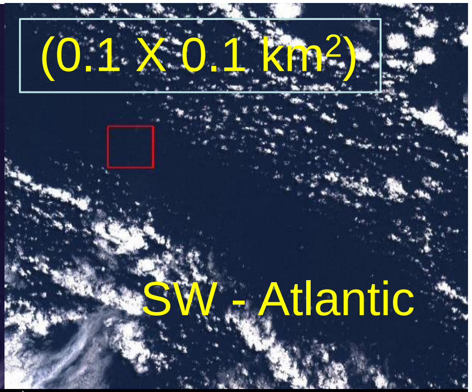


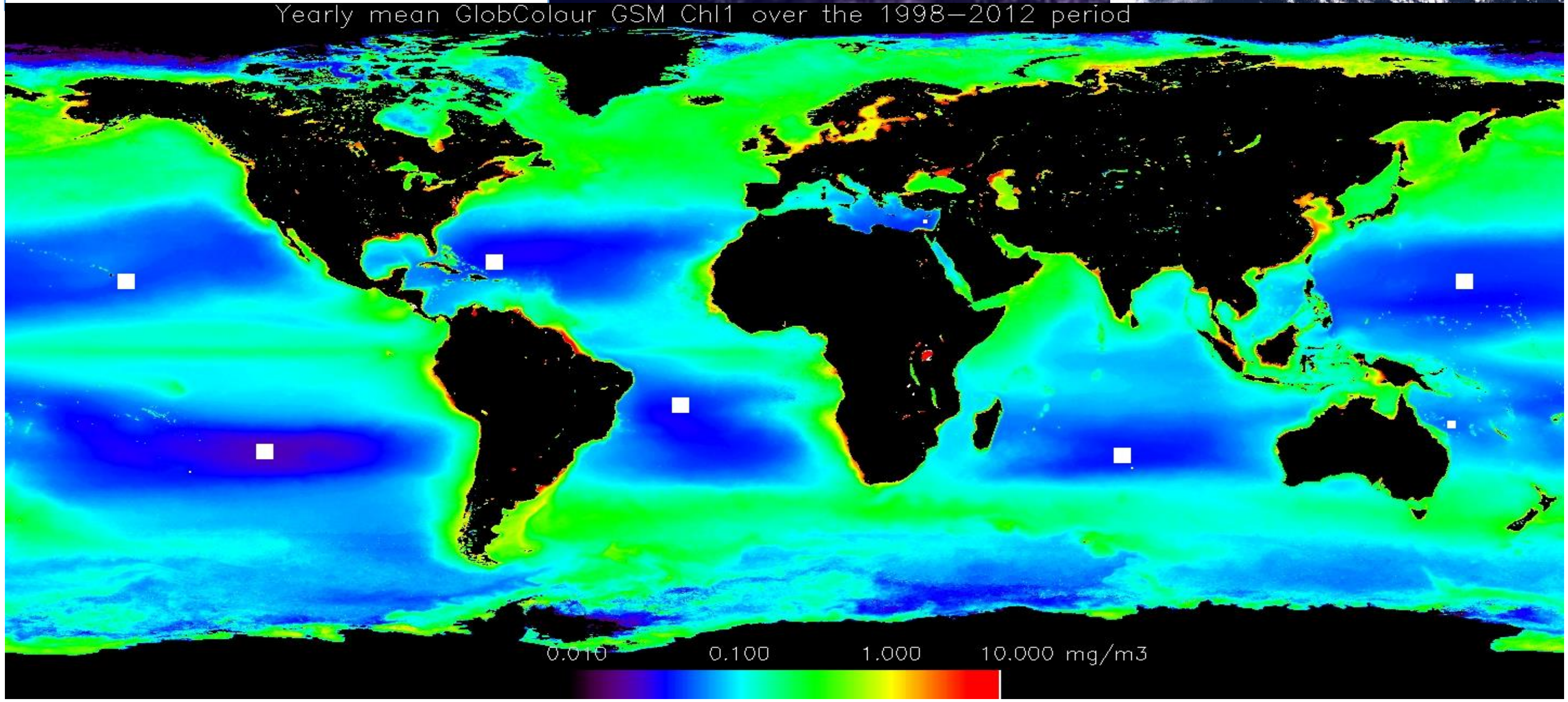
http://calvalportal.ceos.org/tools
https://dimitri.argans.co.uk

Overview of DIMITRI: ocean sites

- Acquisitions over 6 ocean sites
- Small sites for S2-MSI

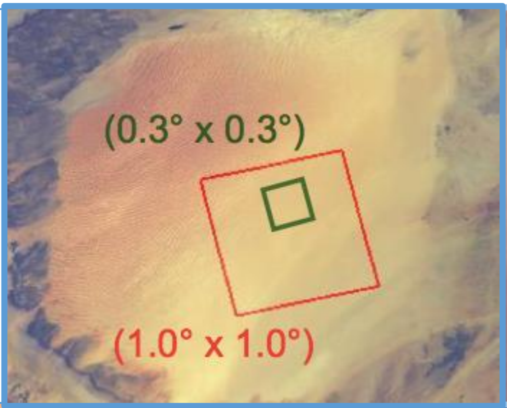


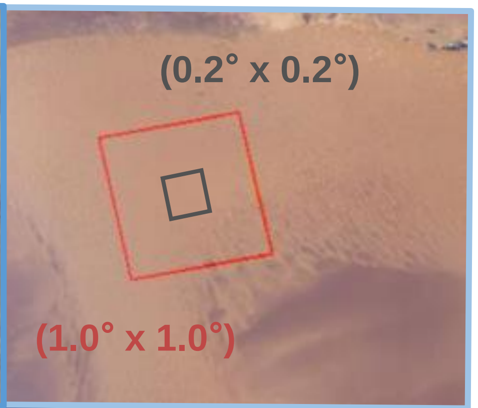


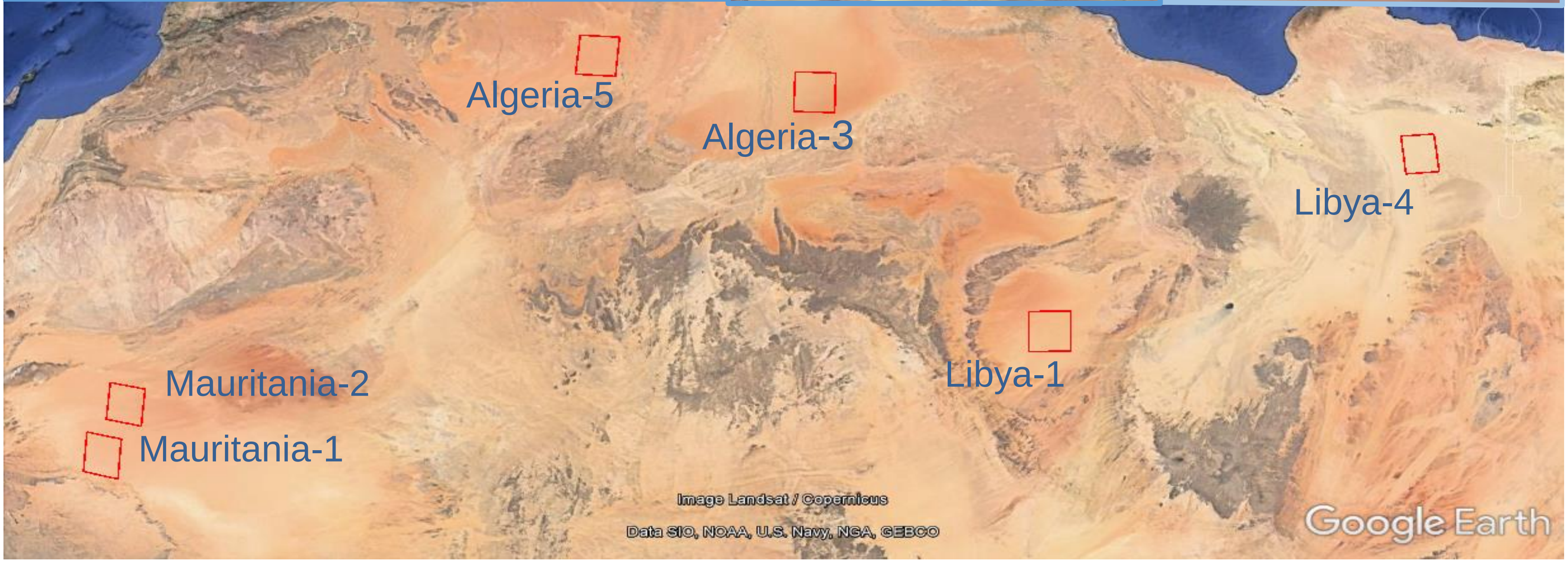


Overview of DIMITRI toolbox : desert sites

- **Acquisitions over 6 CEOS-PICS sites**
- **Subsampling for S2-MSI & LS8-OLI**

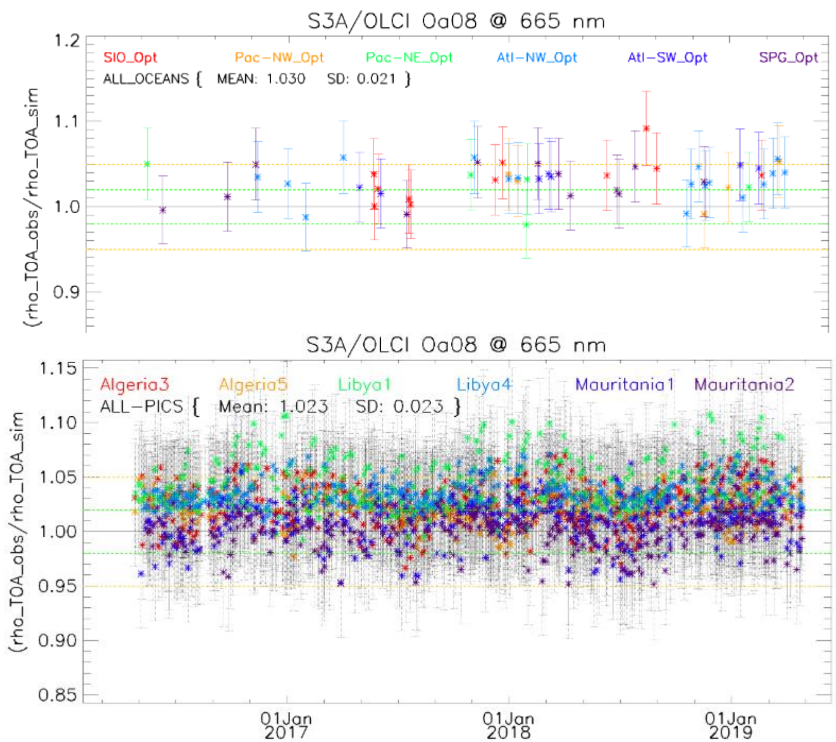


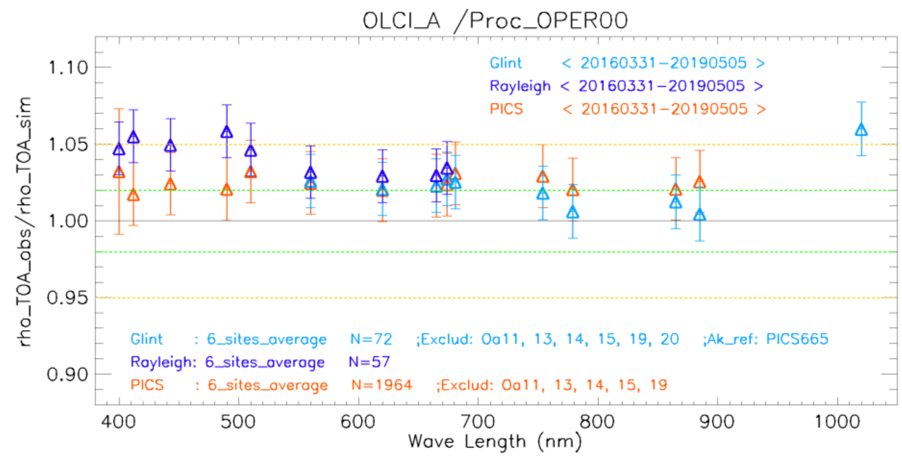




Results over Sentinel-3A/OLCI (L1b):

SENTINEL 3 Mission Performance Centre

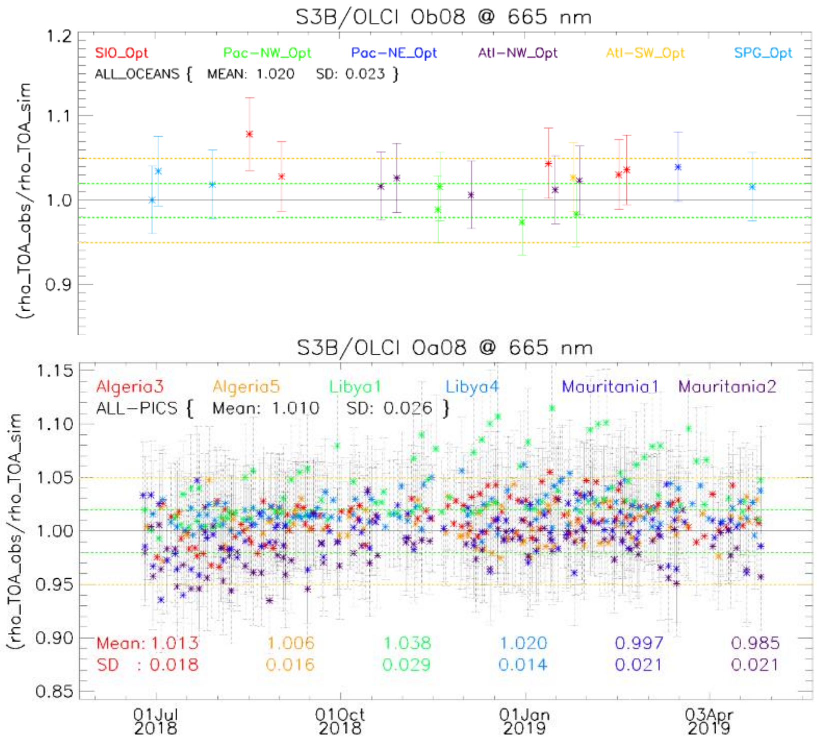


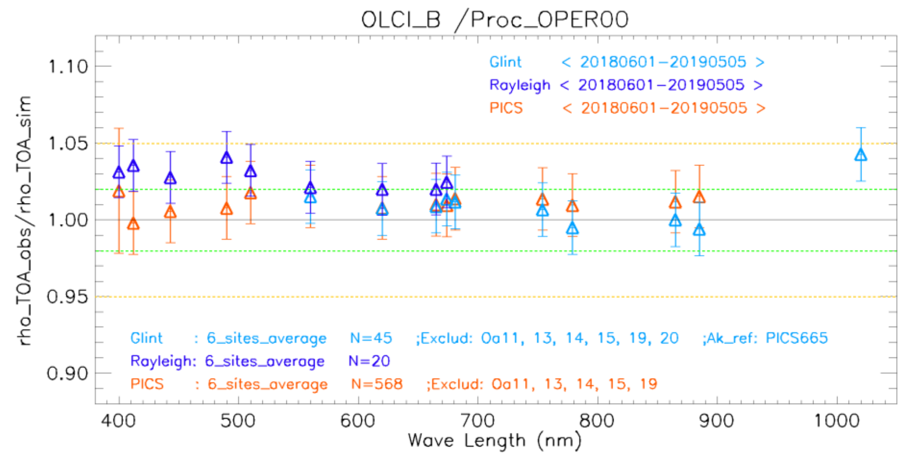


- *Good consistency*
- *Very good stability (trend <0.3%/y)*
- *Gain coefficients are higher than the mission reqs. (2%)*

Alhammoud et al. (LPS-2019)

Results over Sentinel-3B/OLCI (L1b):





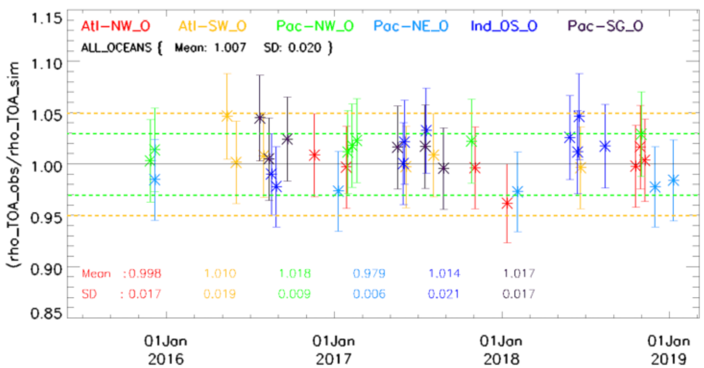
- *Good consistency*
- *Good stability (no trend detectable)*
- *Gain coefficients are within the mission reqs. (2%)*
- *OLCI-A TOA-reflectance is brighter than OLCI-B one (~2-3%)*

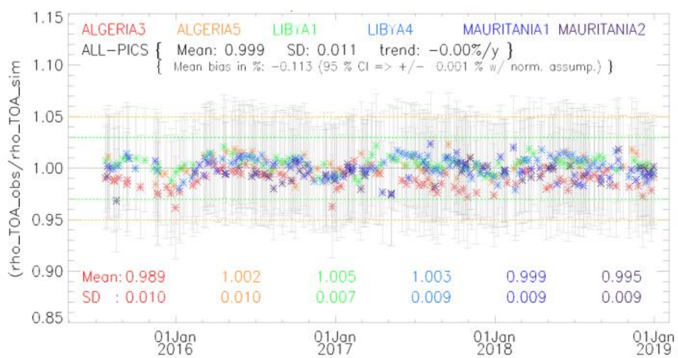
Alhammoud et al. (LPS-2019)

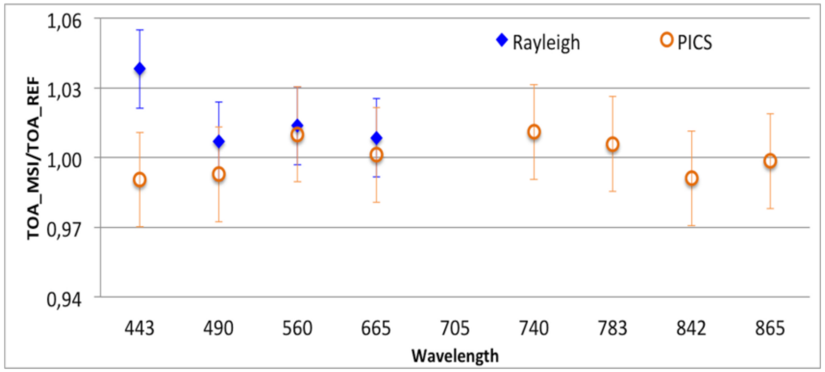
Results over Sentinel-2A/MSI (L1C):

SENTINEL 2
Mission Performance Centre

Sunglint methodology has not been considered in S2MPC yet.







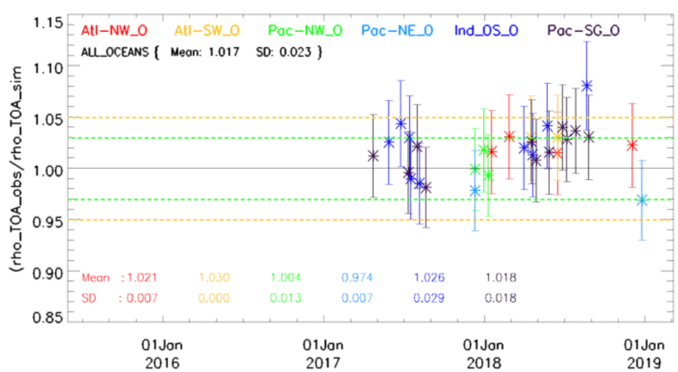
- *Good consistency*
- *Good stability (no trend detectable)*
- *Gain coefficients are within the mission reqs. 5% (target 3%)*
- *OLCI-A TOA-reflectance is brighter than OLCI-B one*

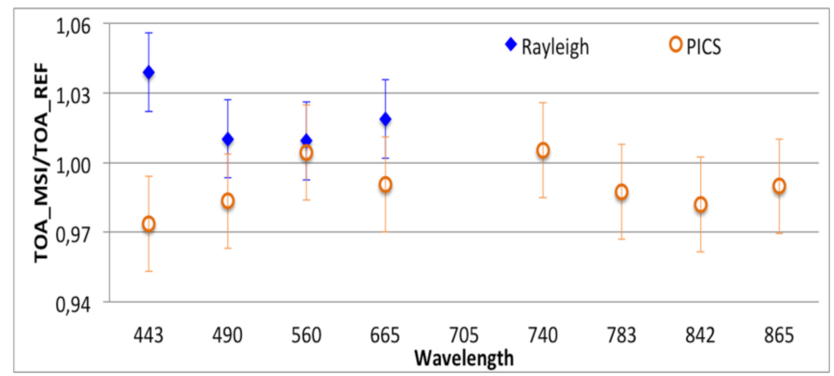
(Alhammoud et al. IEEE-JSTARS 2019)

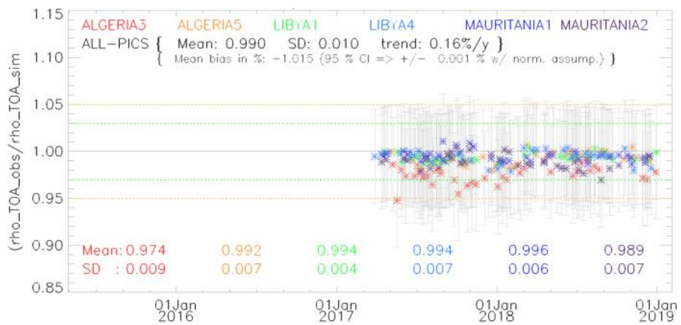
Results over Sentinel-2B/MSI (L1C):

SENTINEL 2
Mission Performance Centre

Sunglint methodology has not been considered in S2MPC yet.







- *Good consistency*
- *Good stability (no trend detectable)*
- *Gain coefficients are within the mission reqs. 5% (target 3%)*
- *MSI-A TOA radiometry is “brighter” than MSI-B radiometry (~1-2%)*

(Alhammoud et al. IEEE-JSTARS 2019)

Conclusion

- OLCI-A & B Level-1 radiometry show a good consistency and stability
- The observed OLCI-A TOA-reflectance is brighter than the OLCI-B one 2-3%
- Radiometric performance is nominal and stable for S2A and for S2B.
- Good agreement between S2A and S2B radiometry within 1 or 2%.

Improvement implemented in DIMITRI V4

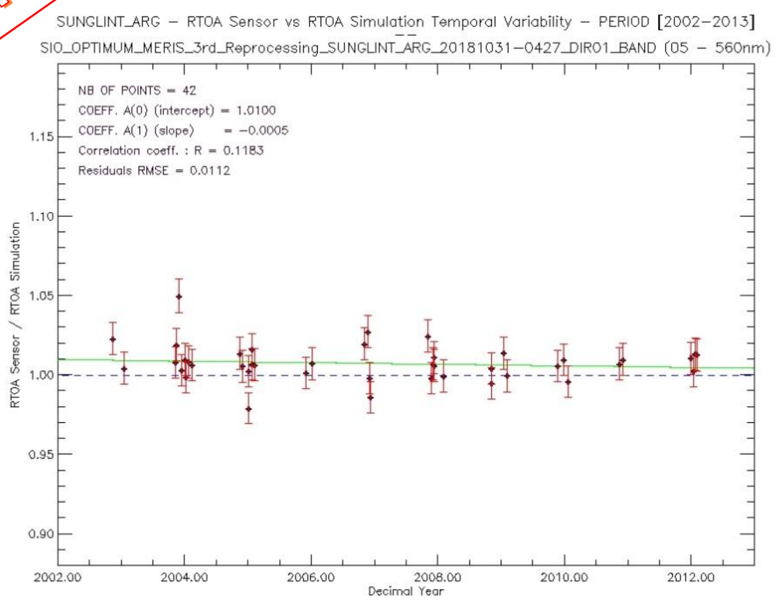
- Improved architecture and data format (done)
- Improvements to the Rayleigh and Glint methodologies (done):
  - Hyperspectral LUT based on MYSTIC simulations
  - Surface pressure adjustment based on the Rayleigh optical thickness following Bodhaine et al. 1999
  - Water leaving BRDF modelling based on Hydrolight simulations
- Parallel implementation of the Rayleigh and Glint methodologies by Magellium based on 6S radiative transfer (ongoing)
- Parallel implementation of the PICS methodology using MODIS BRDF products and 6S radiative transfer (ongoing)
- Implementation of the Deep Convective Clouds methodology (ongoing)
- Extension of the PICS methodology of Bouvet 2014 to snow covered sites (ongoing)

Preliminary results over MERIS 3RP: SUNGLINT; SIO-OPT

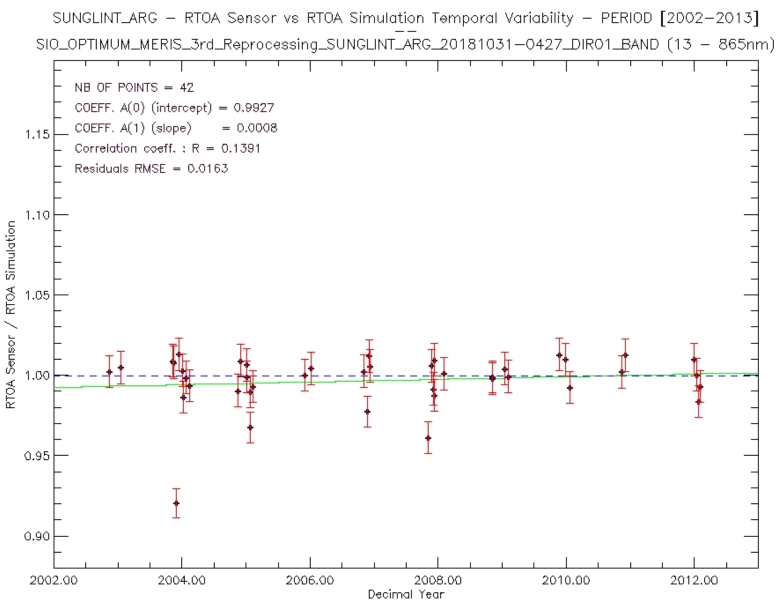
Preliminary results

Before : HS-LUTs + Atmos-P-adjustment

(N: 42)



(560 nm)



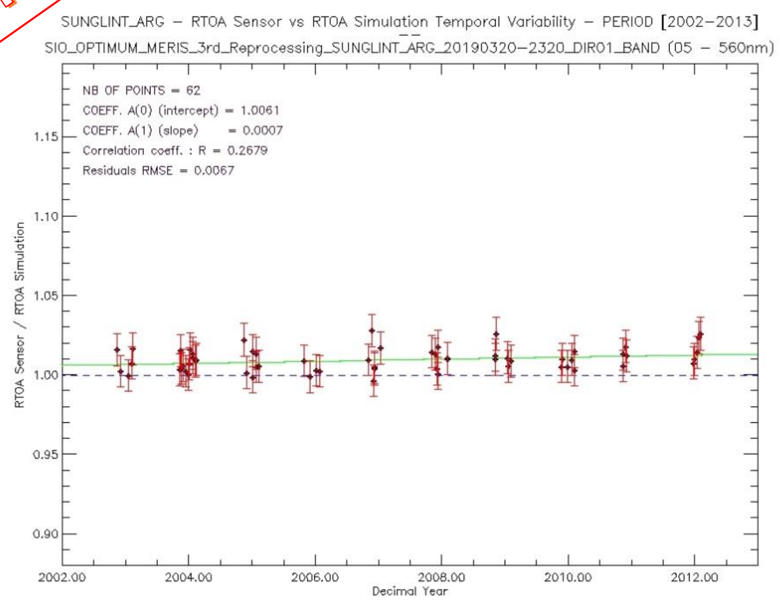
(865 nm)

Preliminary results over MERIS 3RP: SUNGLINT; SIO-OPT

Preliminary results

After : HS-LUTs + Atmos-P-adjustment

(N: 62)



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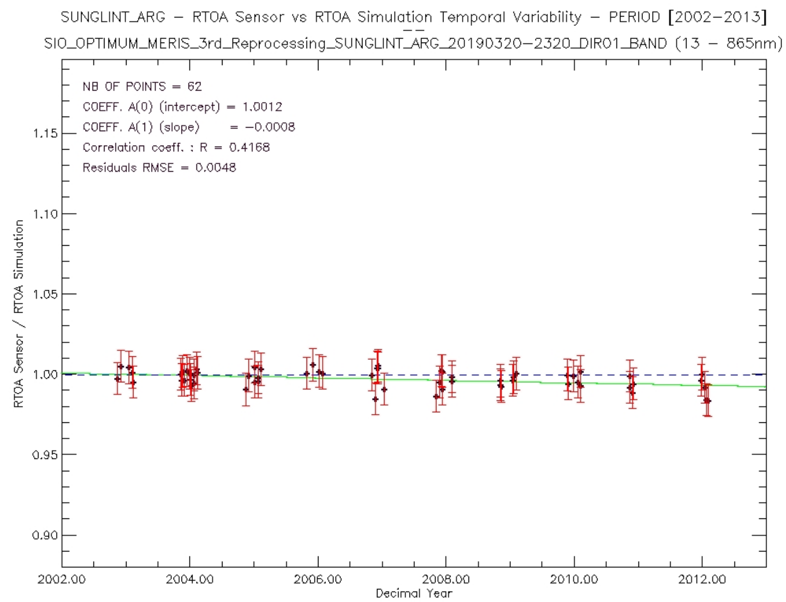

(865 nm)

Concluding remarks

- DIMITRI V3 is used for the in-flight radiometric monitoring and assessment of a number of ESA EO optical imagers
- It is available from http://calvalportal.ceos.org/tools (or https://dimitri.argans.co.uk)
- A new version DIMITRI V4 is functional, nevertheless it is still under development and testing. It will supersede in the long run the current version V3.