



DIMITRI

Database for Imaging Multi-spectral Instruments and Tools for
Radiometric Intercomparison



DIMITRI-DATABASE FOR IMAGING MULTISPECTRAL INSTRUMENT AND TOOLS FOR RADIOMETRIC INTERCOMPARISON: QA4EO DIMITRI-EVOLUTION PROJECT OUTCOMES

B. Alhammoud, C. Mackenzie (ARGANS)

B. Berthelot (Magellium)

J. Hedley (Numerical Optics)

M. Bouvet (ESA/ESTEC)



Agenda



PROGRAMME OF THE
EUROPEAN UNION



co-funded with



- ❖ DIMITRI-Tool history & improvements
- ❖ Applications & Results
- ❖ Conclusions

Funded by the EU and ESA



European Union



*The views expressed herein can in no way be taken to reflect
the official opinion of the European Space Agency or the European Union.*



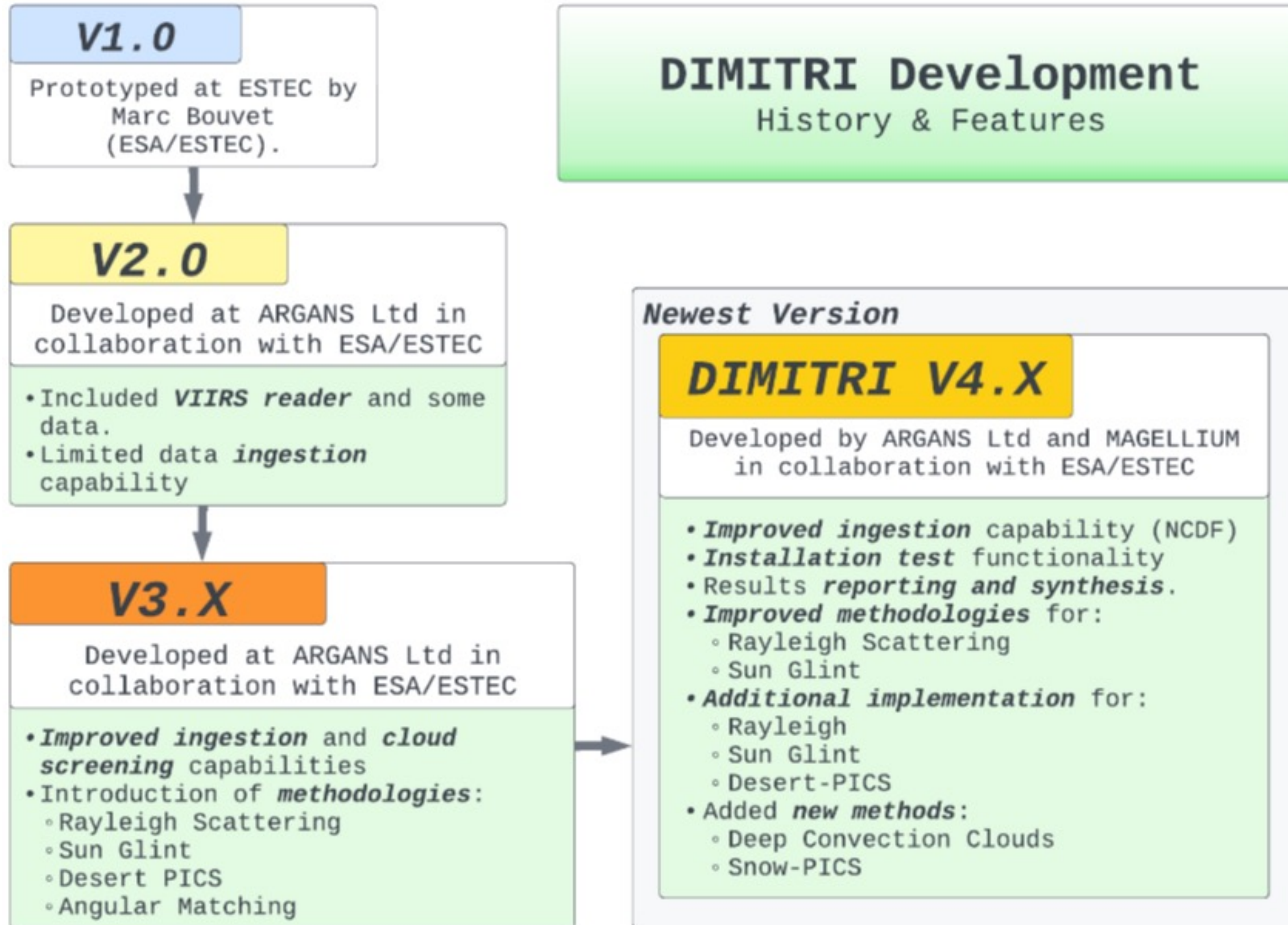
DIMITRI-Tools history & improvements



PROGRAMME OF THE
EUROPEAN UNION



co-funded with



CalVal-sites Location

13 Land; 8 Water; DCC (where available)

Bright sites:

Desert/Salt:

- 6 CEOS-PICS
- Gobabeb
- RRVP
- BSCN
- TuzGolu
- Uyuni

Ice/Snow

- DOME-C

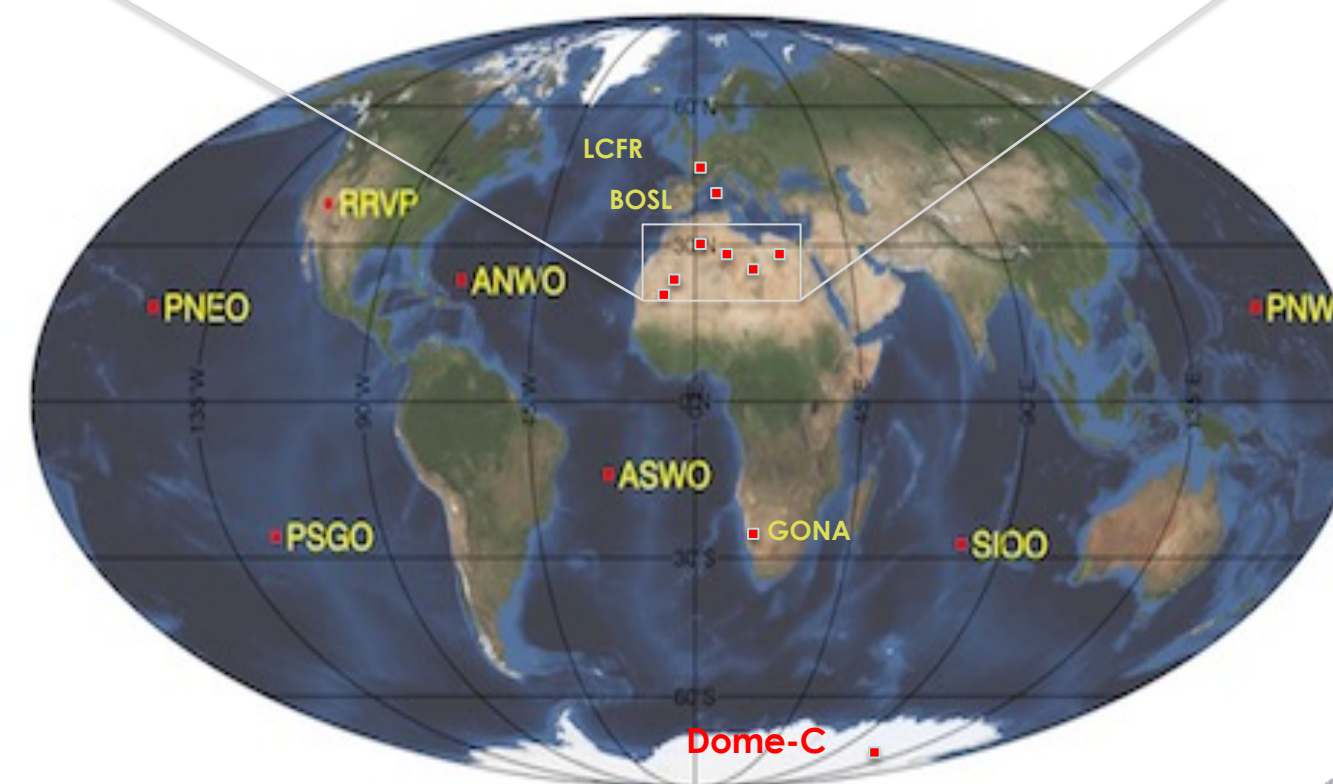
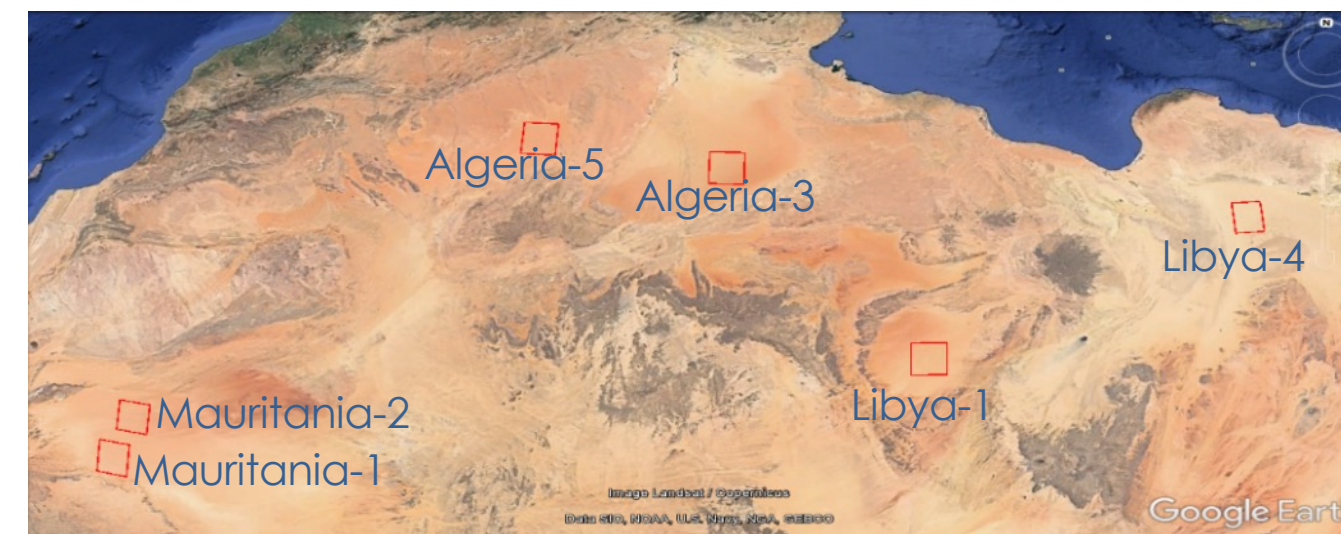
Dark sites:

Land:

- La Crau
- Amazon

Water

- 6 Open Ocean
- Boussole & MedSea



DIMITRI-Tools history & improvements



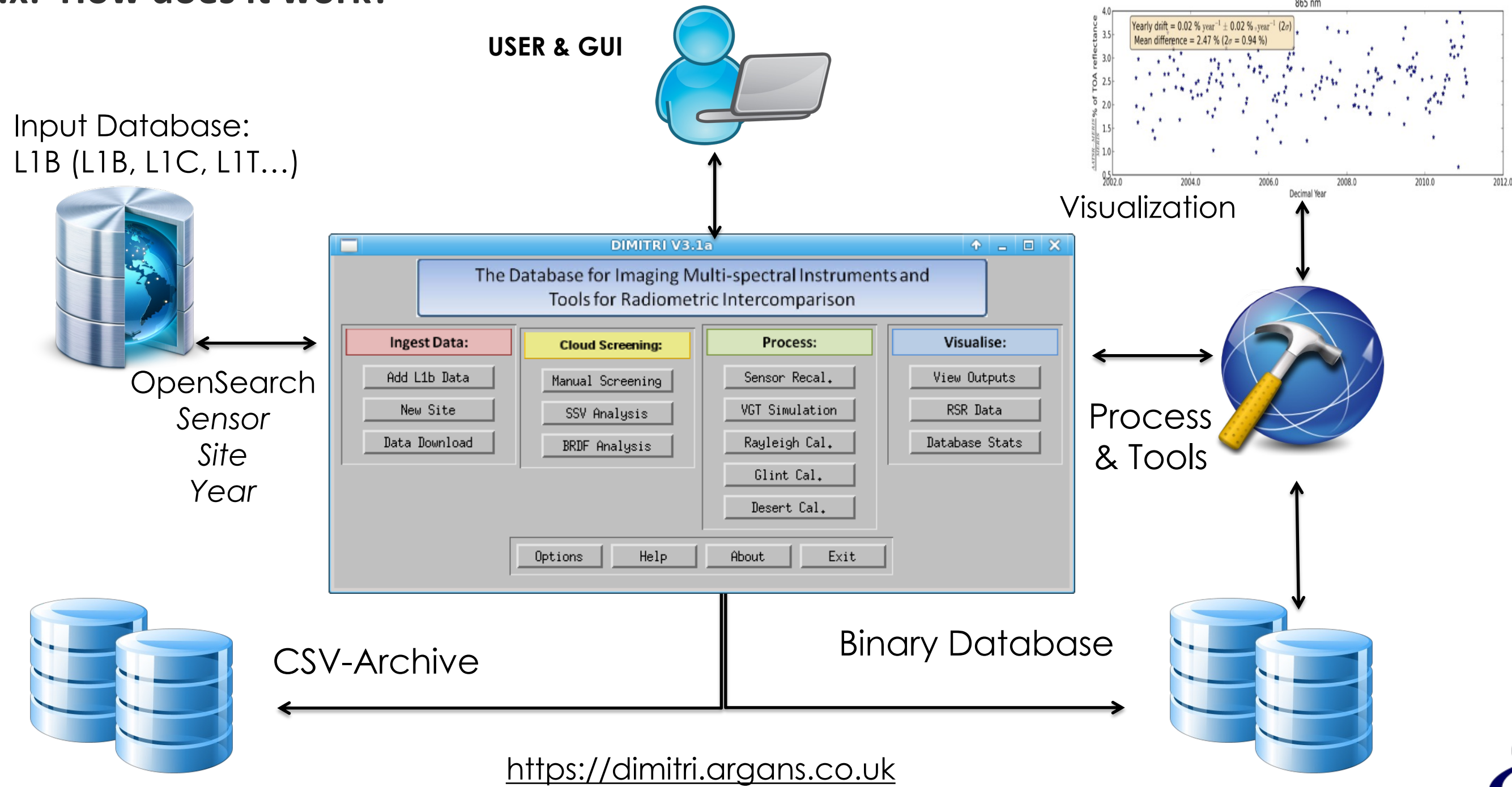
PROGRAMME OF THE EUROPEAN UNION



co-funded with



❖ DIMITRI V3.x: How does it work?



DIMITRI-Tools history & improvements



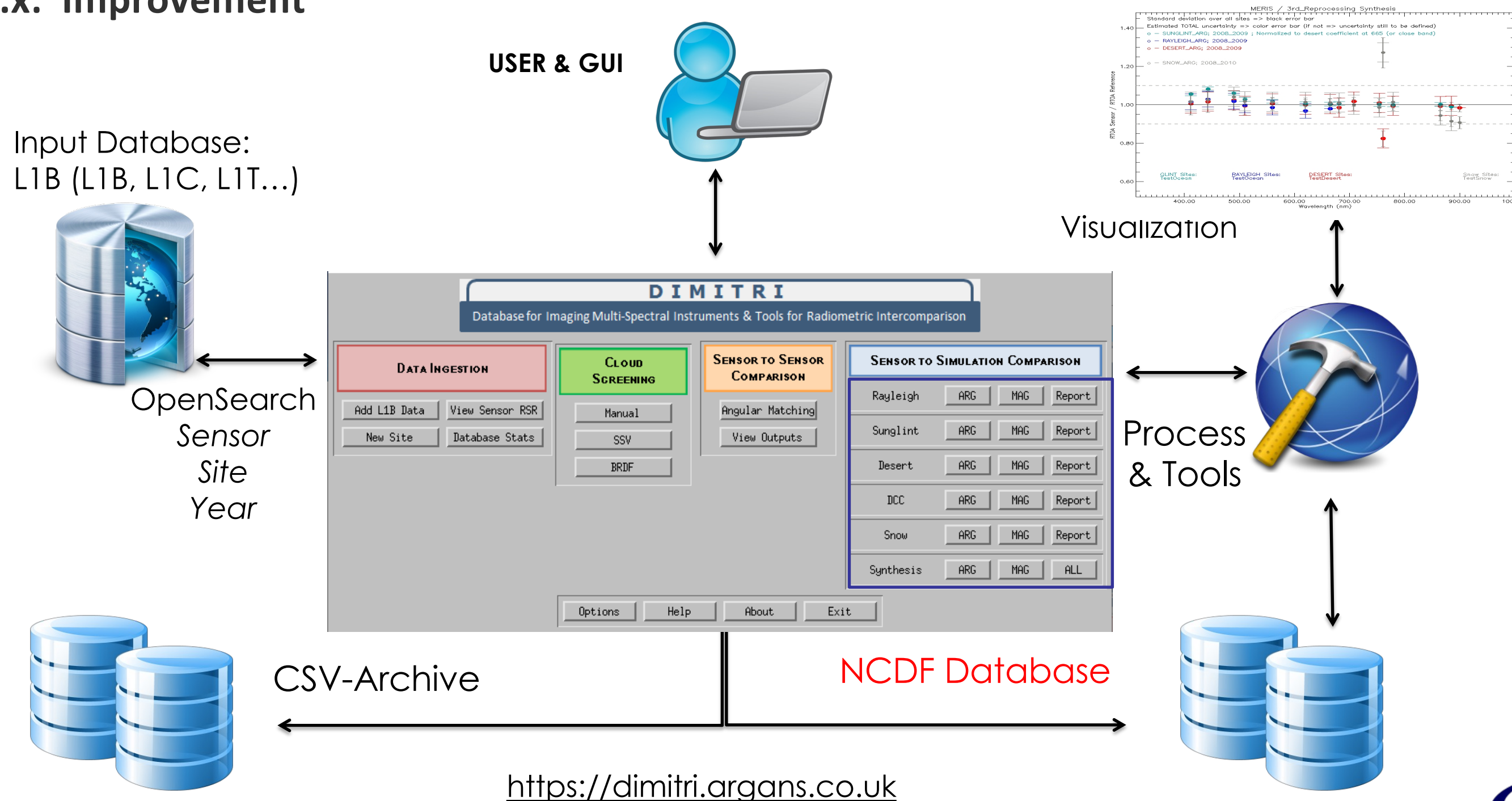
PROGRAMME OF THE EUROPEAN UNION



co-funded with



❖ DIMITRI V4.x: Improvement



❖ Rayleigh Scattering method: Improvements

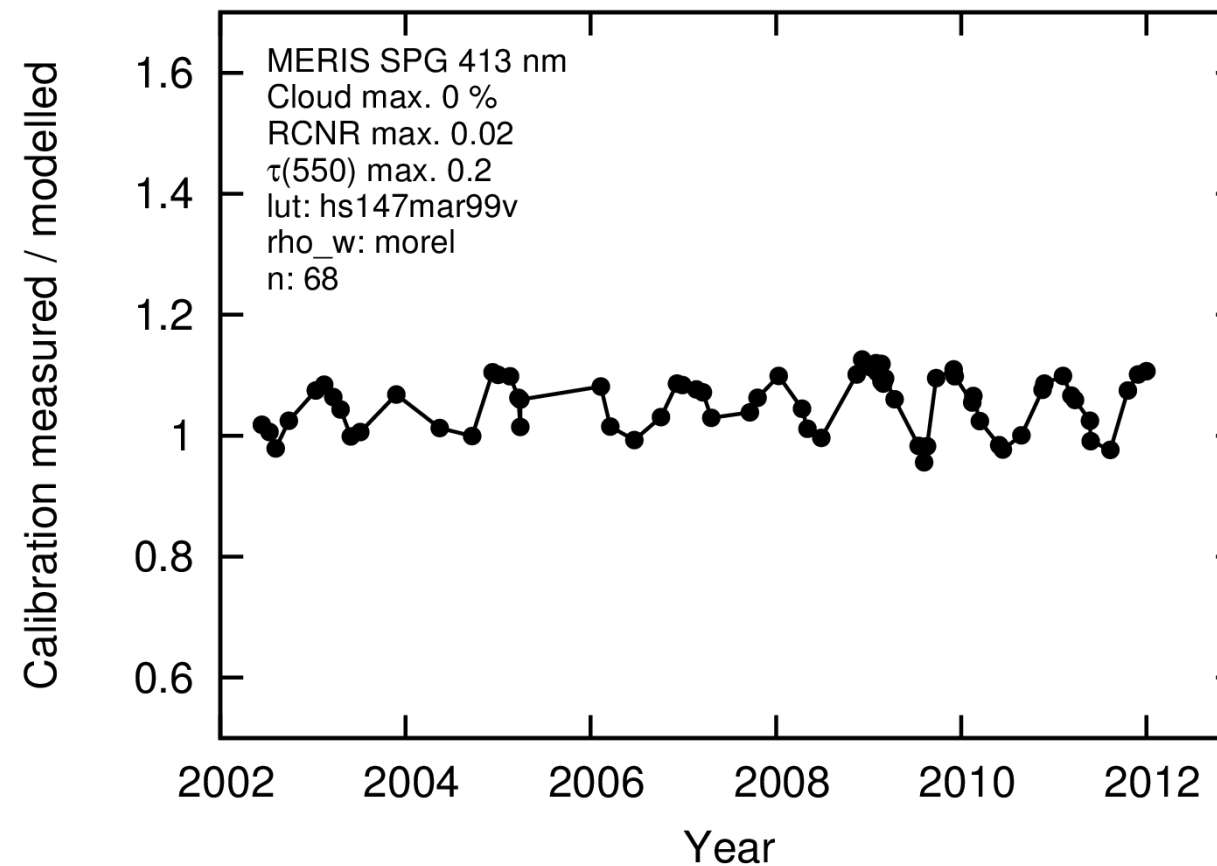
✓ Marine-reflectance BRDF improvement

$$\rho_w(\lambda)$$

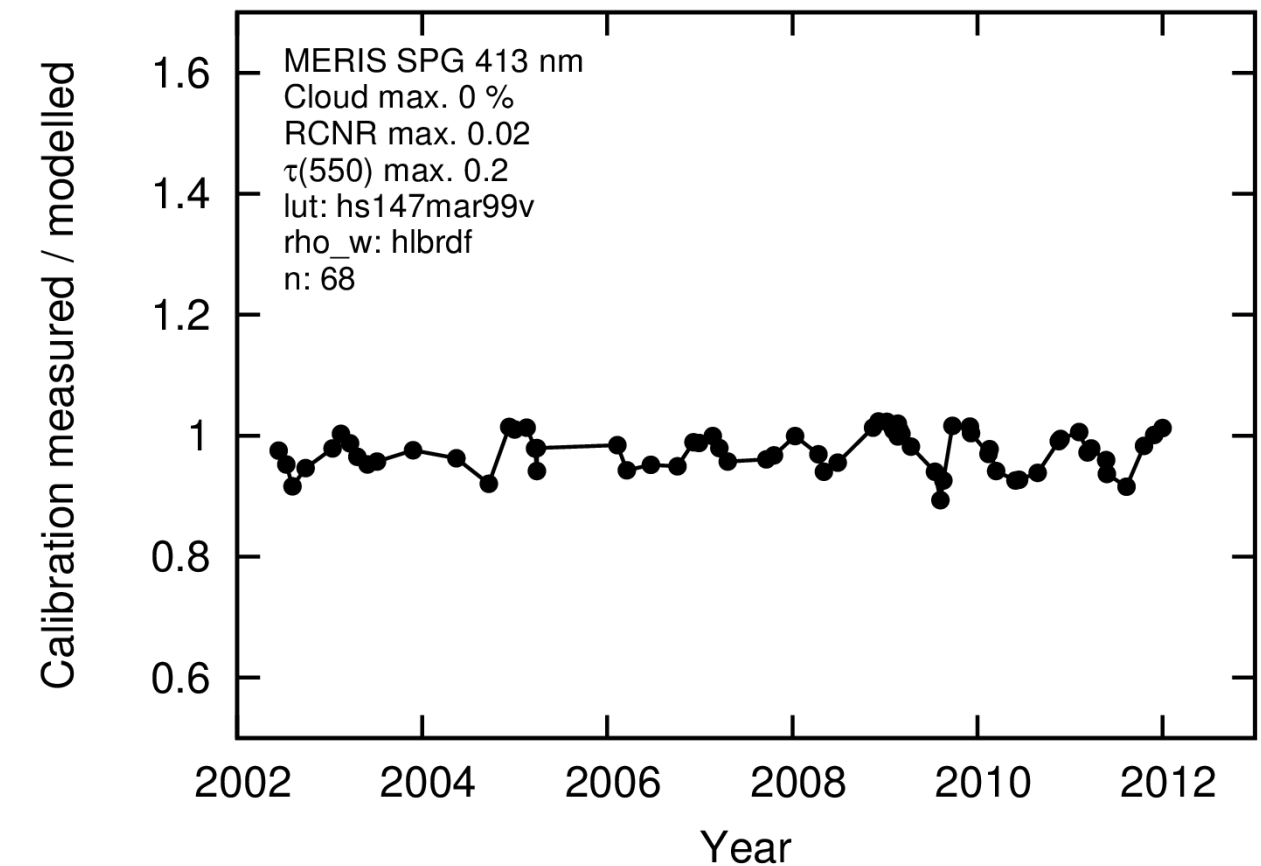
Aim is to replace rho_w with version that is dependent on solar-view geometry (using **BRDF**)

$$\rho_w(\lambda, \theta, \theta_0, \Delta\Phi)$$

Original water-leaving reflectance



New BRDF



✓ SPG-Site: : MERIS 3rd RP

✓ Slight improvement

DIMITRI-V4.x: Application & Results



PROGRAMME OF THE EUROPEAN UNION

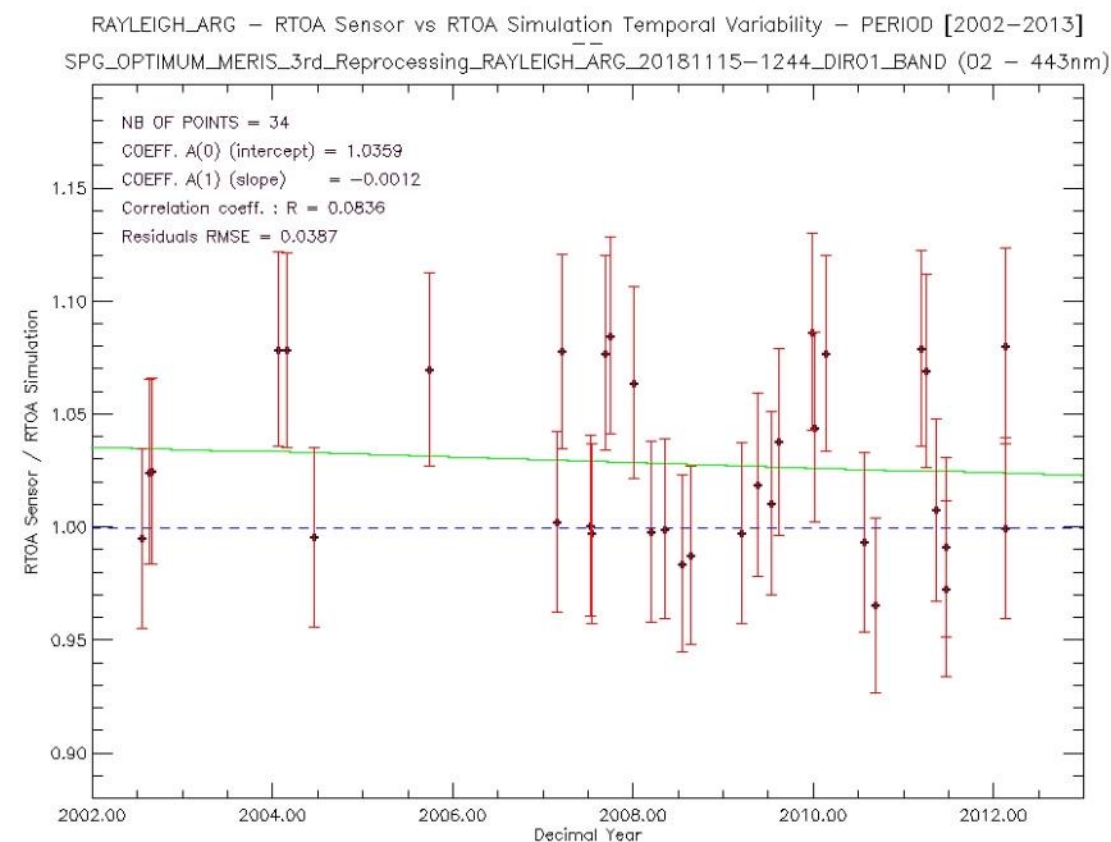


co-funded with

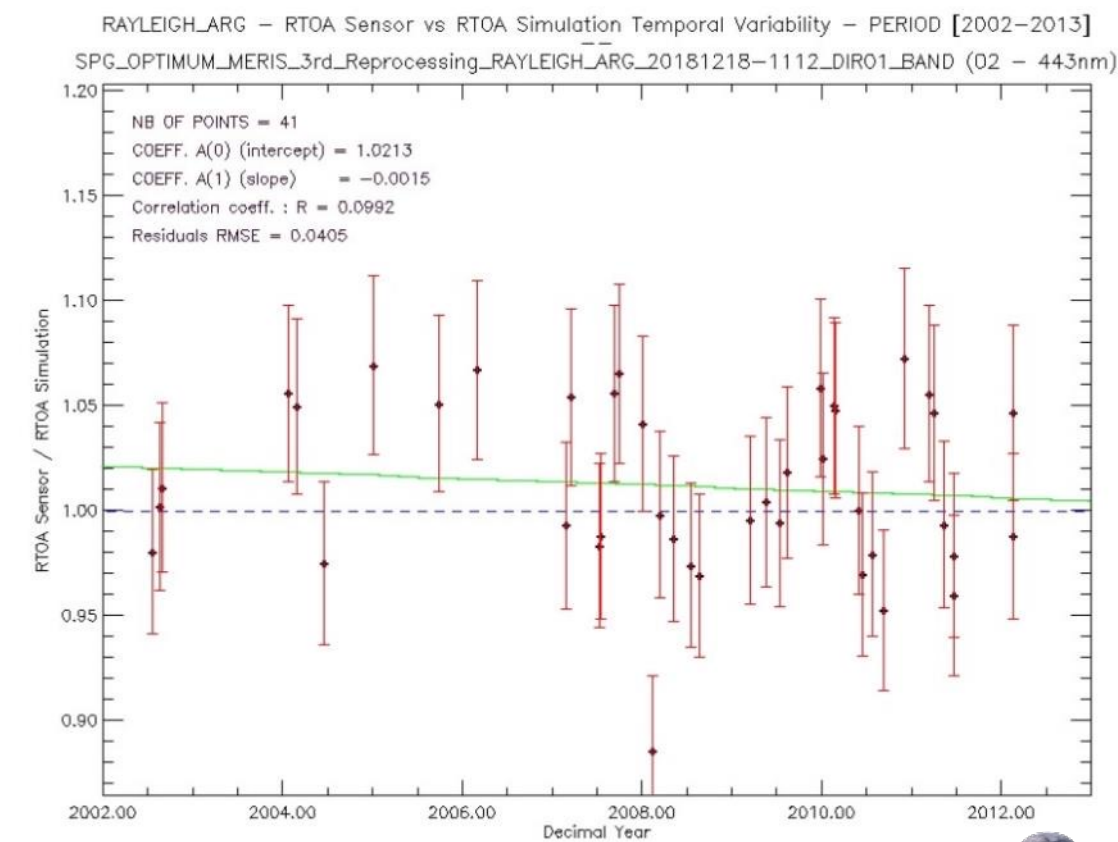


- ❖ Rayleigh Scattering method: Improvements
- ✓ Hyperspectral-LUTS + Atmos Pressure adjustment

Before (443 nm)



After (443 nm)



- ✓ SPG-Site: MERIS 3rd RP
- ✓ Good improvement

These results are for Software functionalities verification purpose only, not for the sensor performance



DIMITRI-V4.x: Application & Results



PROGRAMME OF THE
EUROPEAN UNION



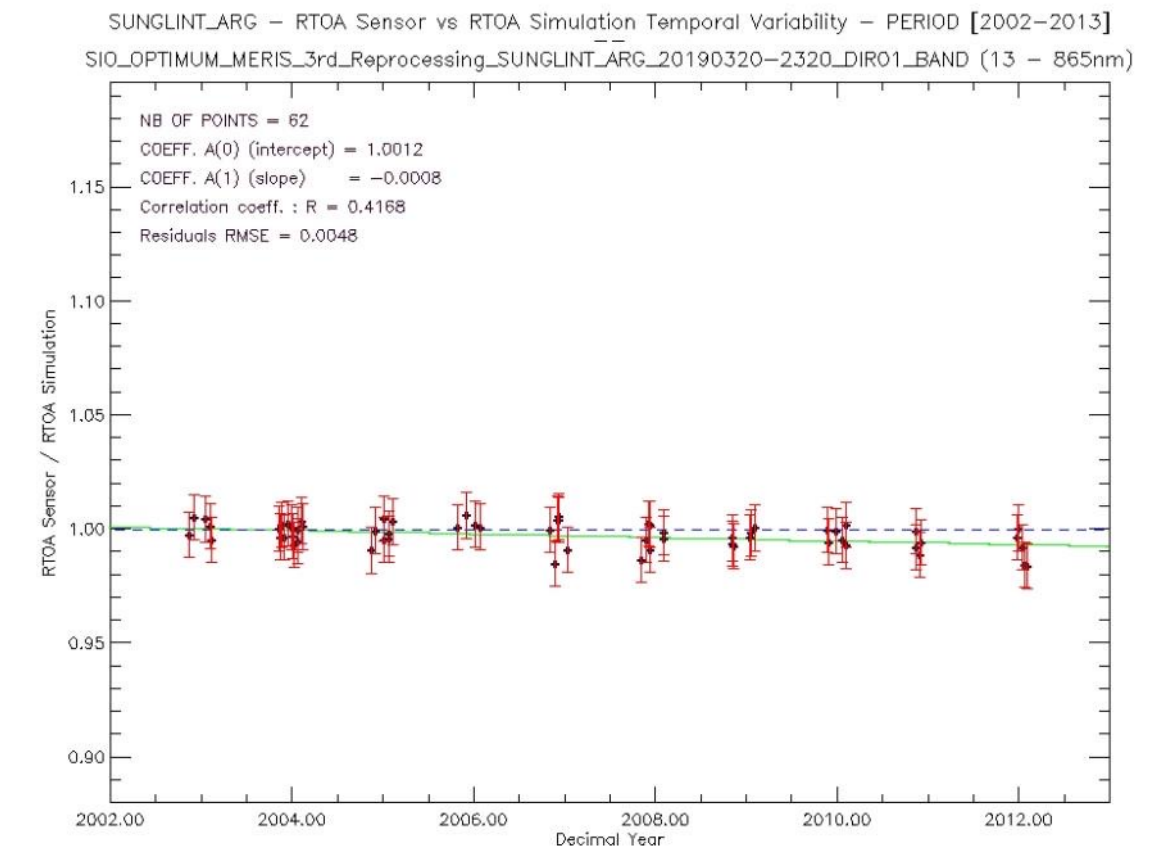
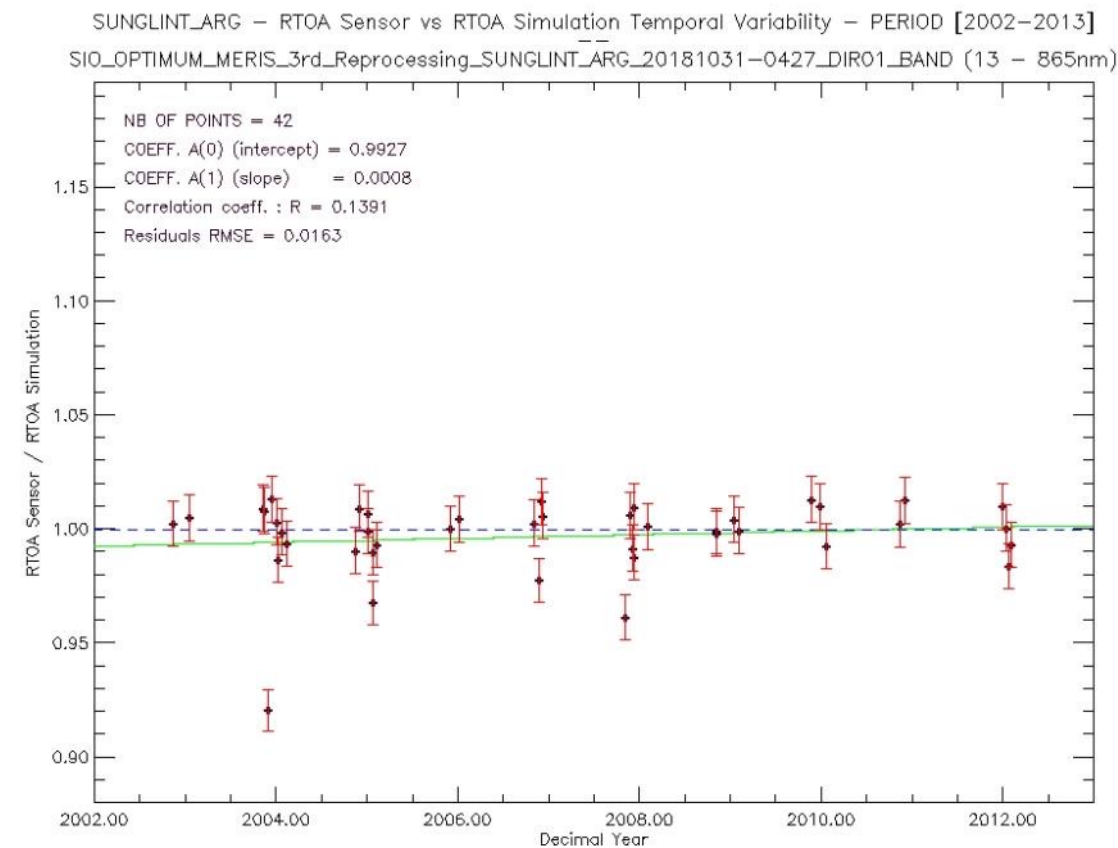
co-funded with



- ❖ Sun-glint method: Improvements
- ✓ Hyperspectral-LUTS + Atmos Pressure adjustment

Before (865 nm)

After (443 nm)



- ✓ SPG-Site: MERIS 3rd RP
- ✓ Good improvement

These results are for Software functionalities verification purpose only, not for the sensor performance



DIMITRI-V4.x: Application & Results



PROGRAMME OF THE EUROPEAN UNION

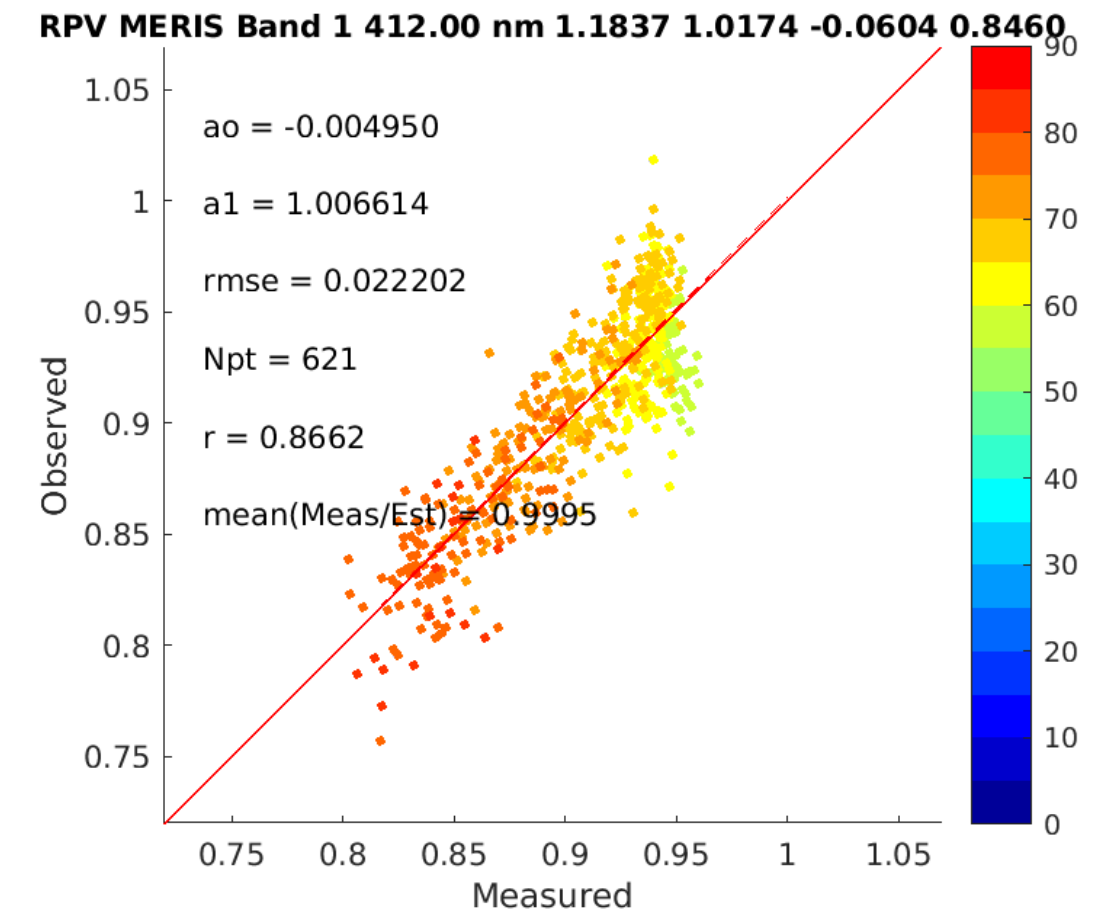
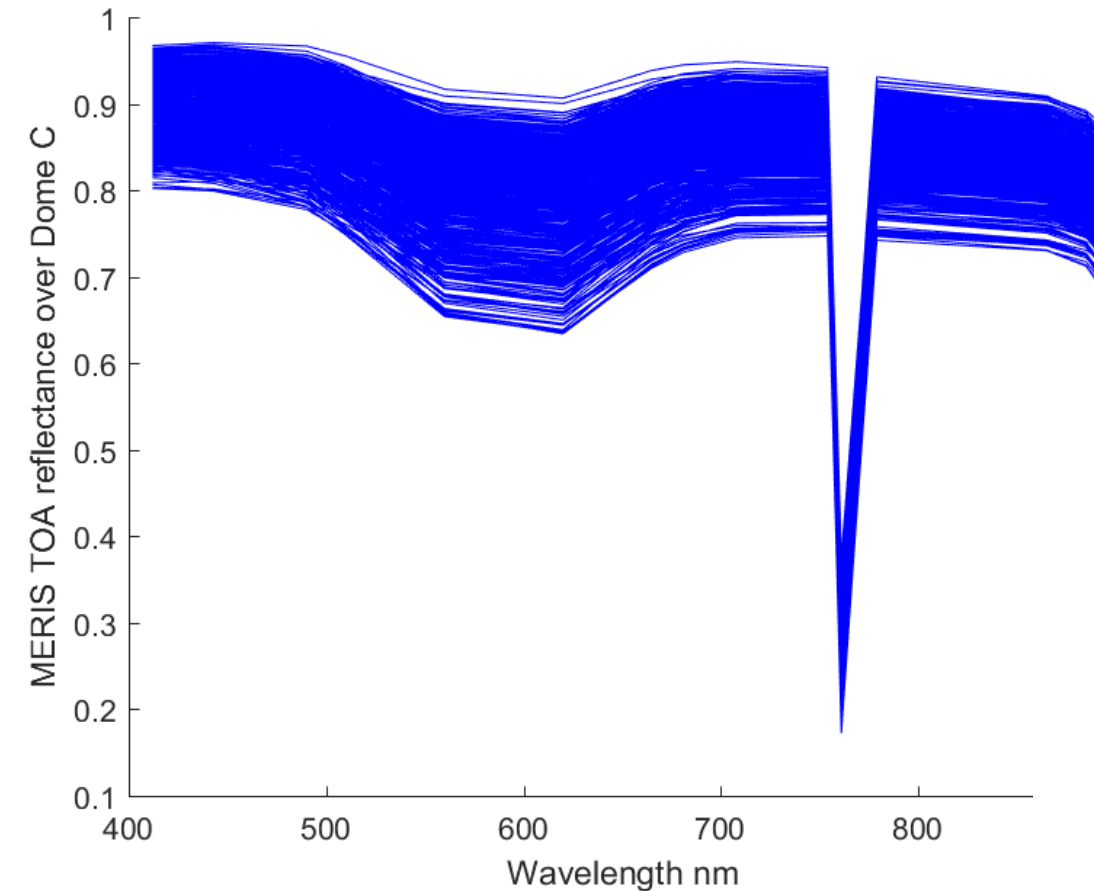
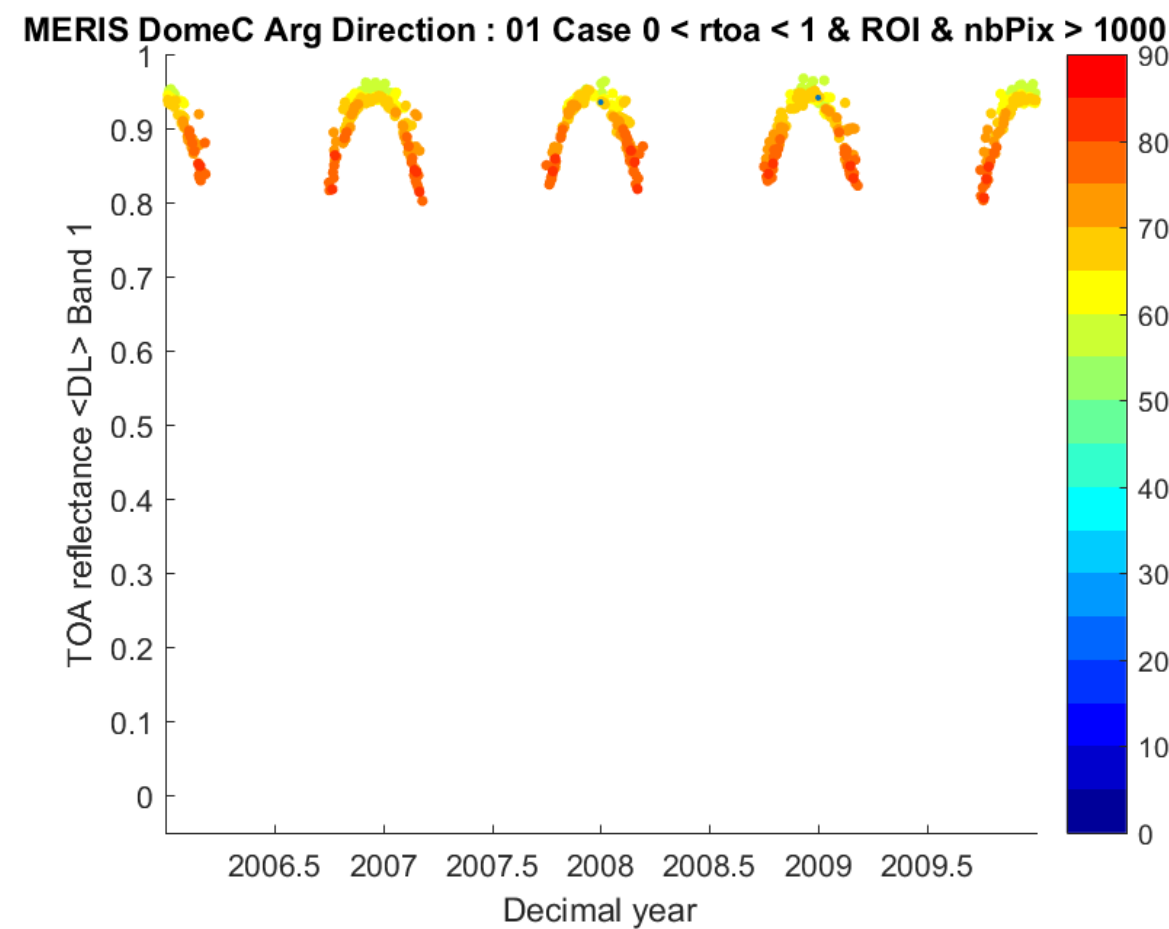


co-funded with



❖ Snow-PICS method: Improvement

- ✓ Snow-BRDF modelling
- ✓ Dome-C-Site: MERIS 3rd RP



RPV-model inversion of Band B01



DIMITRI-V4.x: Application & Results



PROGRAMME OF THE
EUROPEAN UNION

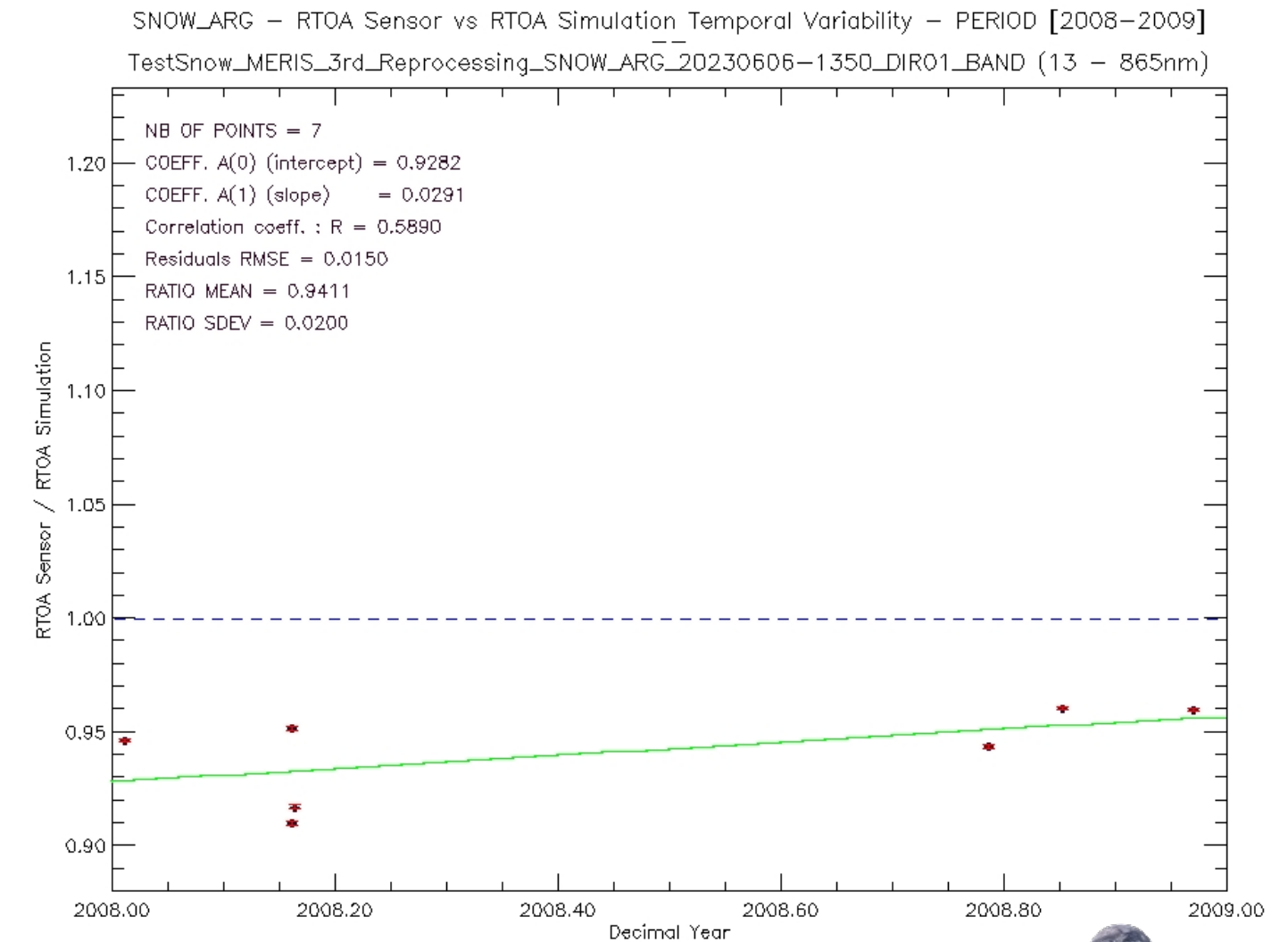
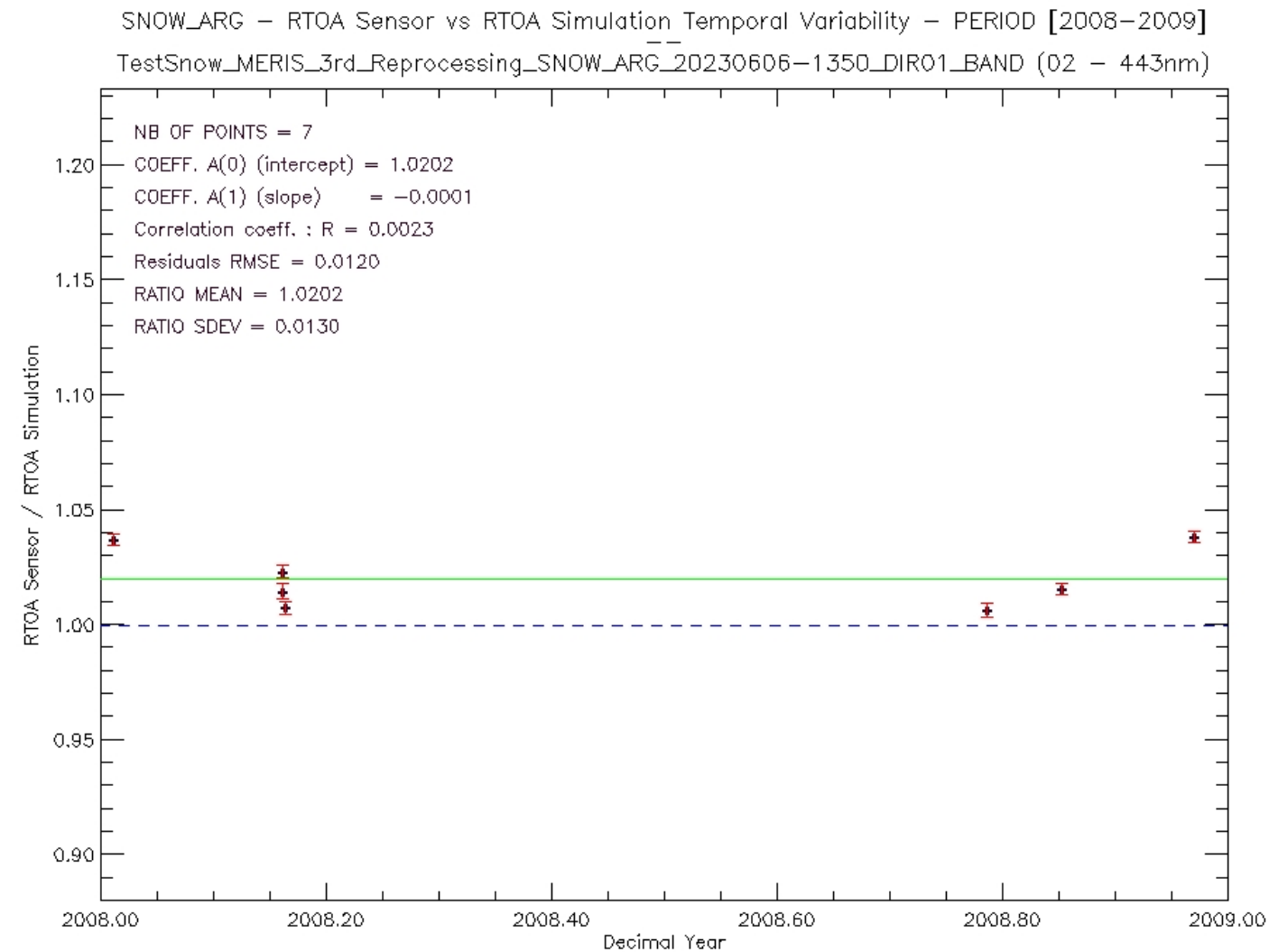


co-funded with



❖ Snow-PICS method: Improvements

- ✓ Snow-BRDF modelling
- ✓ Dome-C-Site: MERIS 3rd RP; Good results up to 800 nm (<3% error).

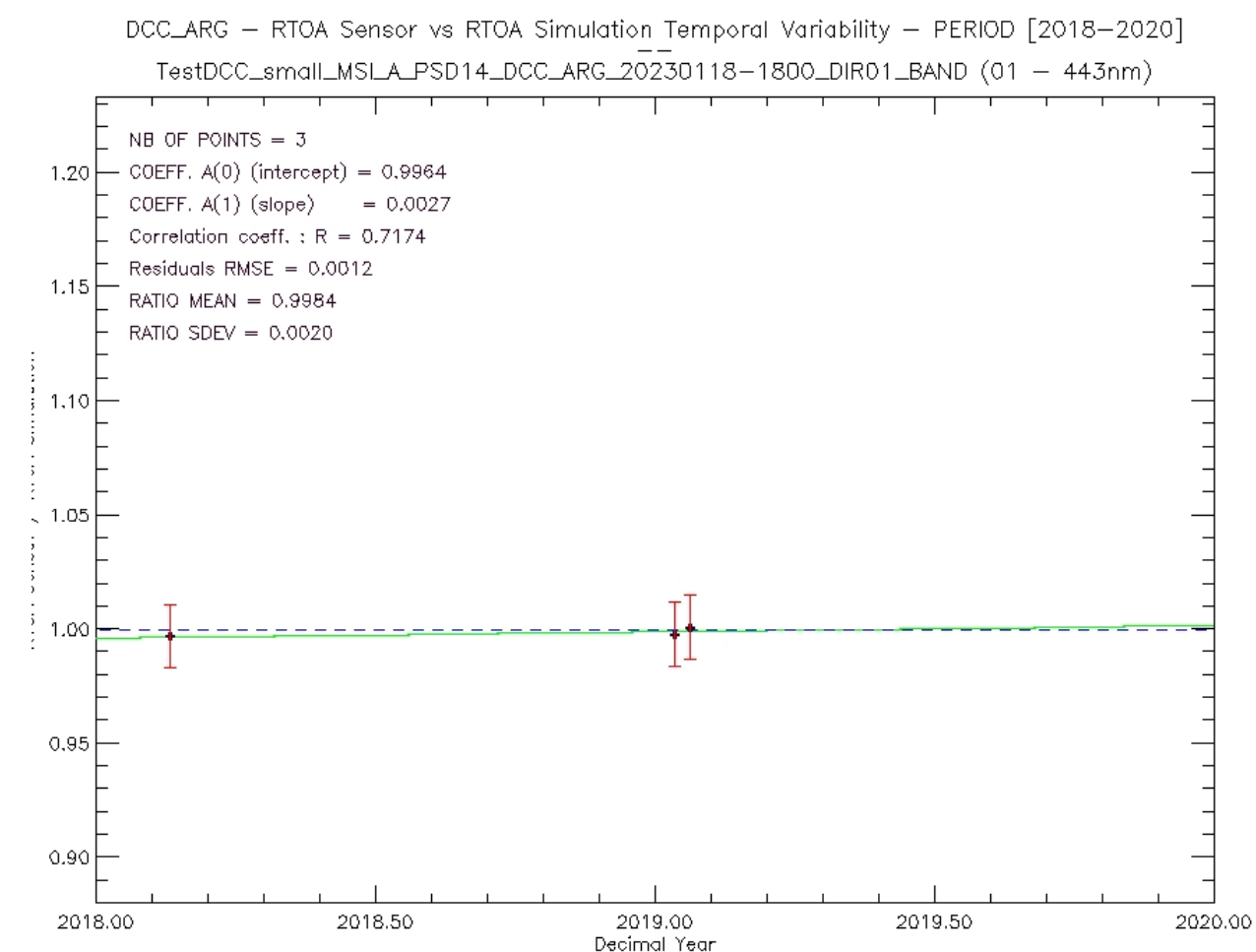
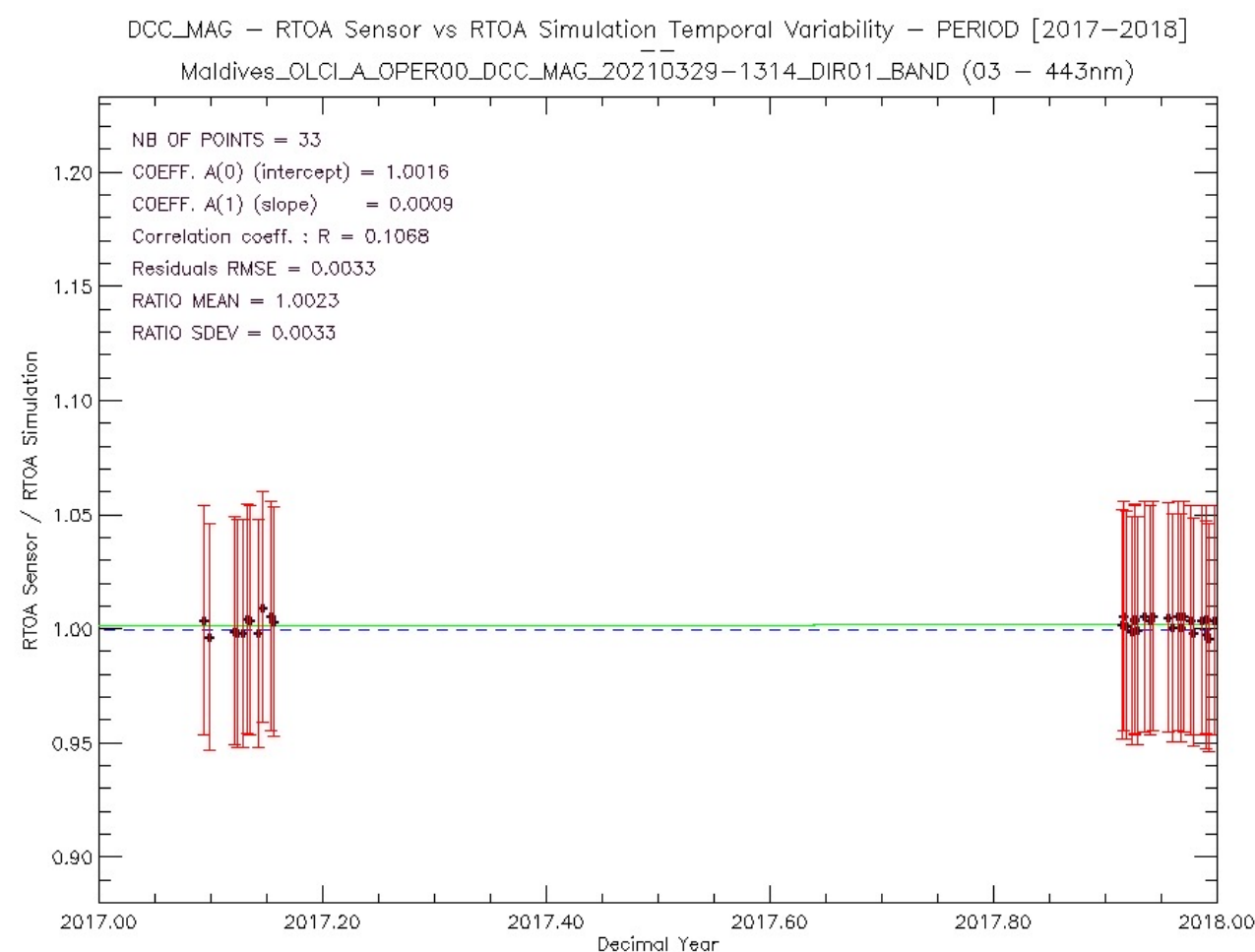


These results are for Software functionalities verification purpose only, not for the sensor performance



❖ DCC methods: Implementation

- ✓ DCC-ARG following Lamquin et al. 2018 (Applicable on Sentinel-2/MSI ; <3% error).
- ✓ DCC-MAG following Fougne and Bach 2009 (Applicable on Sentinel-3/OLCI (<5% error)).



These results are for Software functionalities verification purpose only, not for the sensor performance



DIMITRI-V4.x: Application & Results



PROGRAMME OF THE EUROPEAN UNION

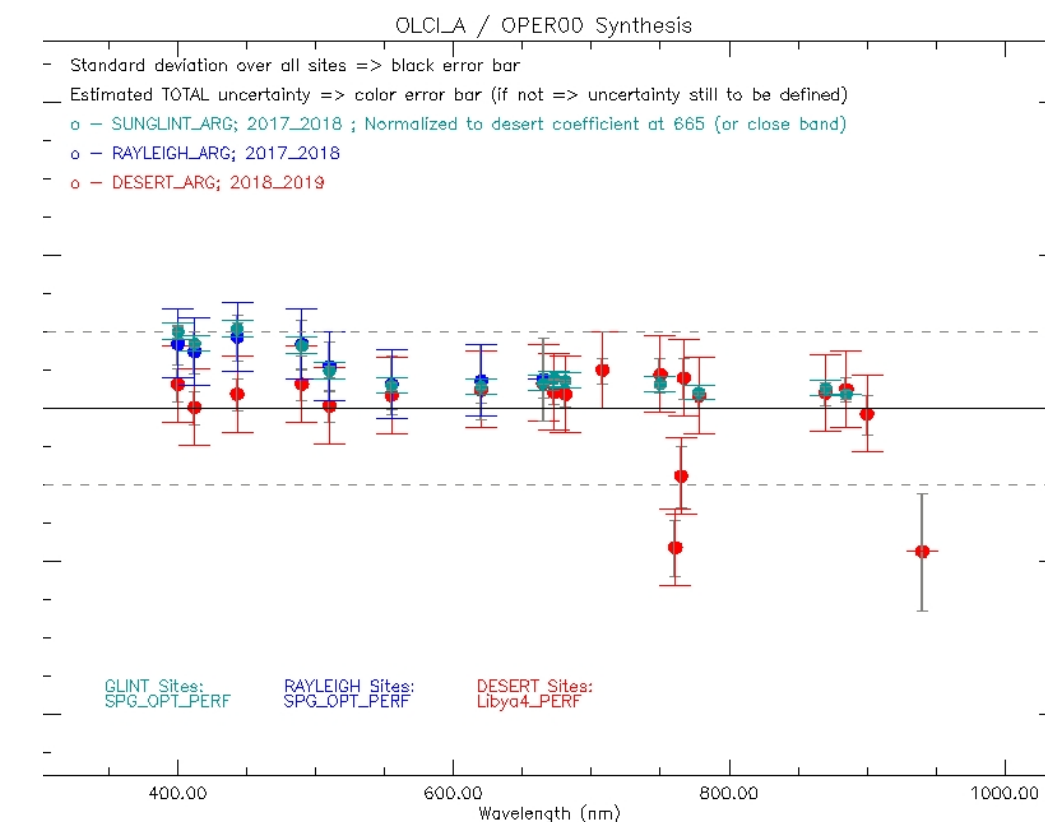
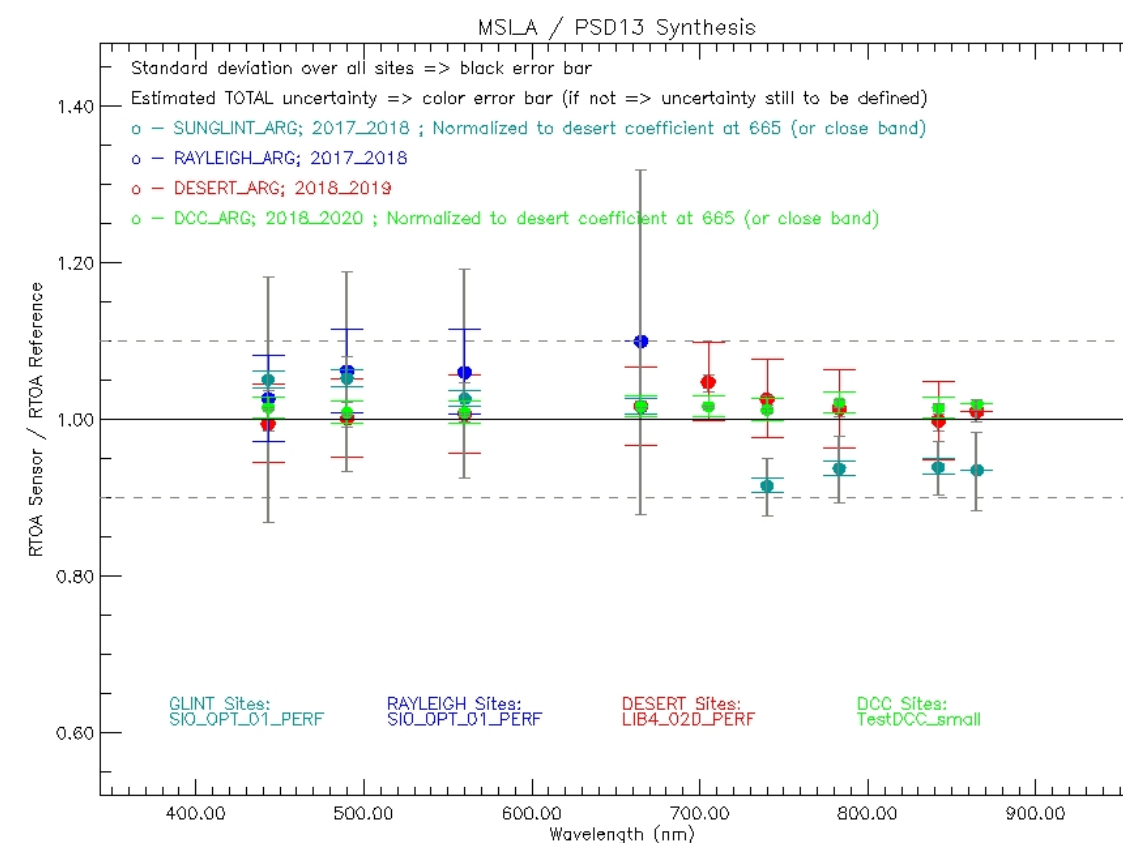
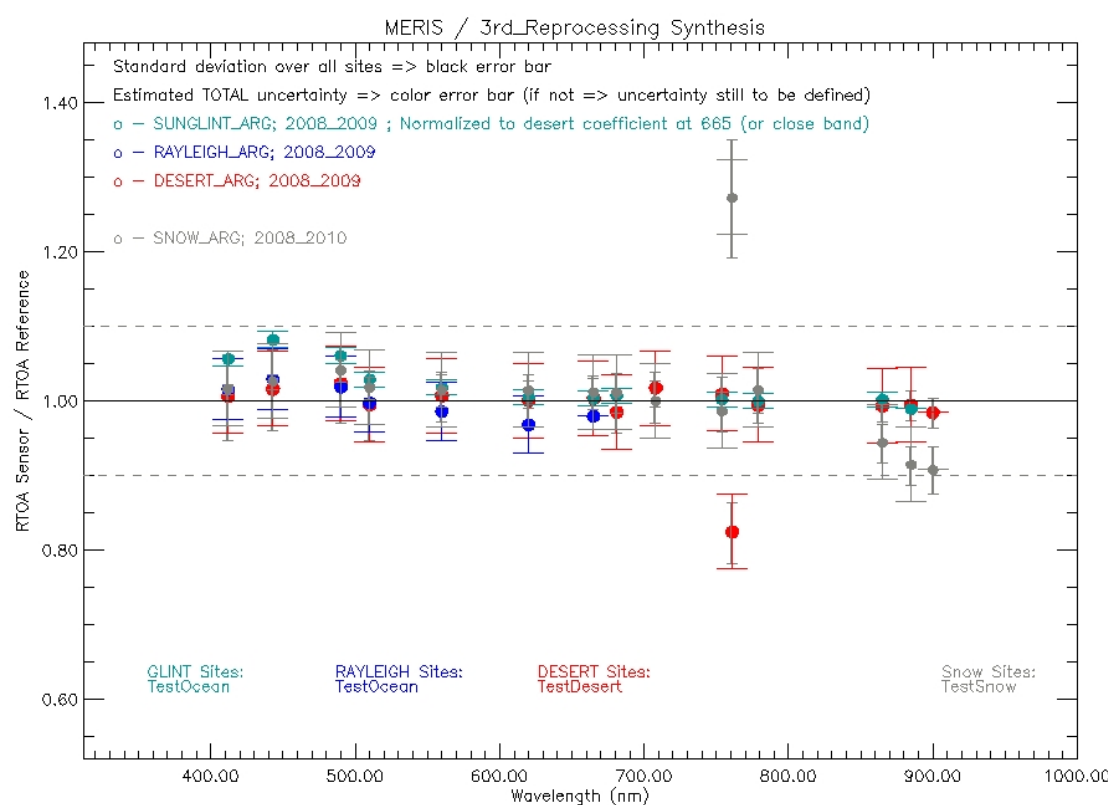


co-funded with



❖ Synthesis module results:

✓ MERIS, MSI & OLCI: ARGANS methods.



These results are for Software functionalities verification purpose only, not for the sensor performance



DIMITRI-V4.x: Application & Results



PROGRAMME OF THE
EUROPEAN UNION

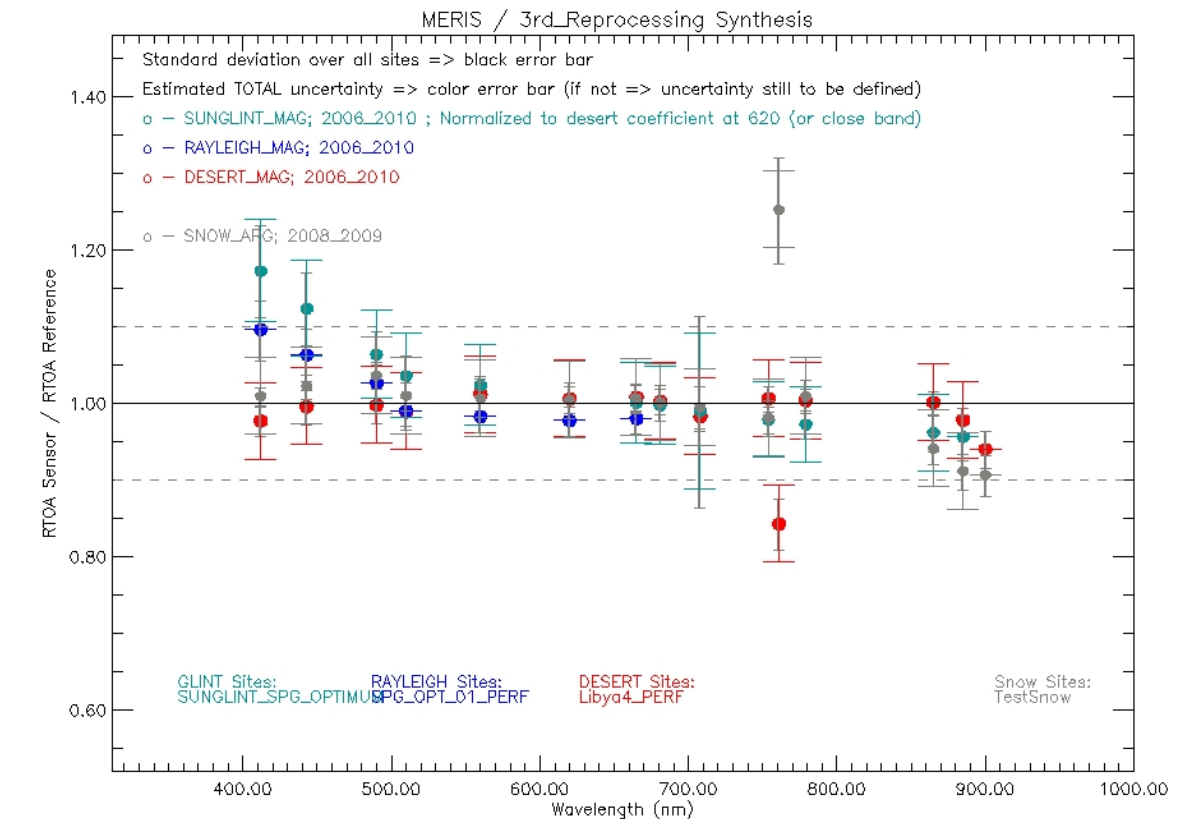
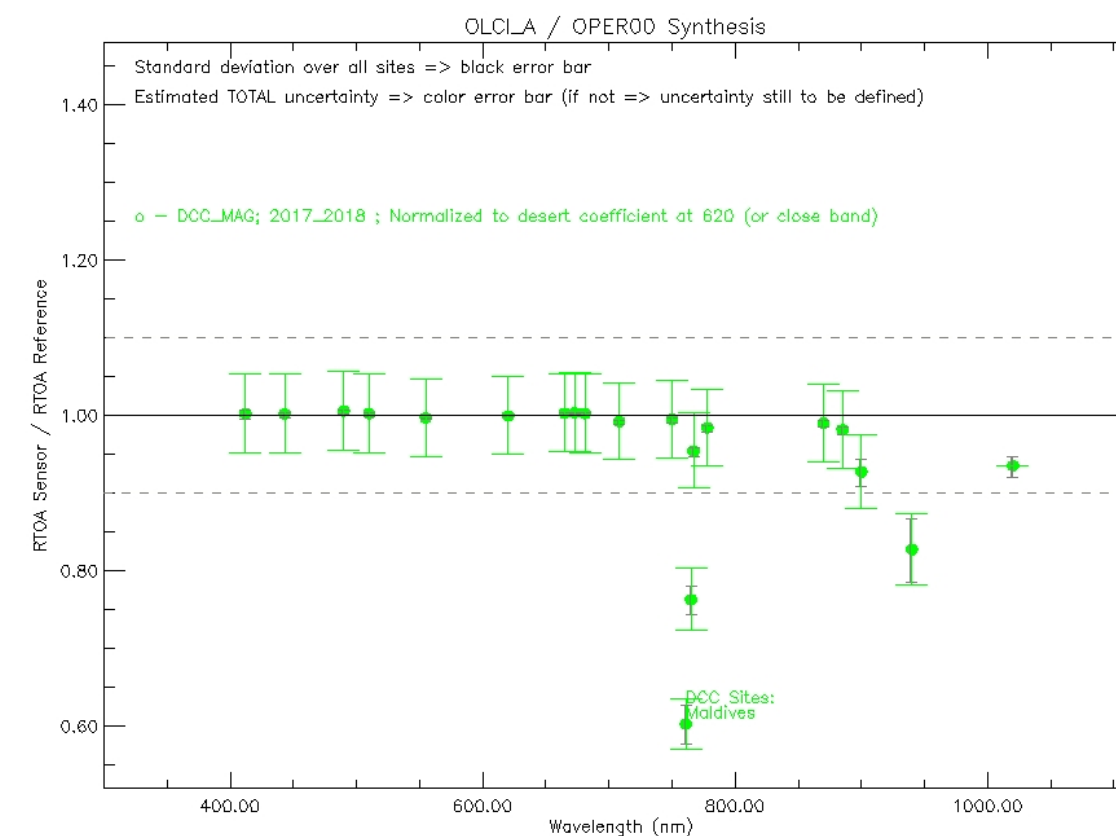
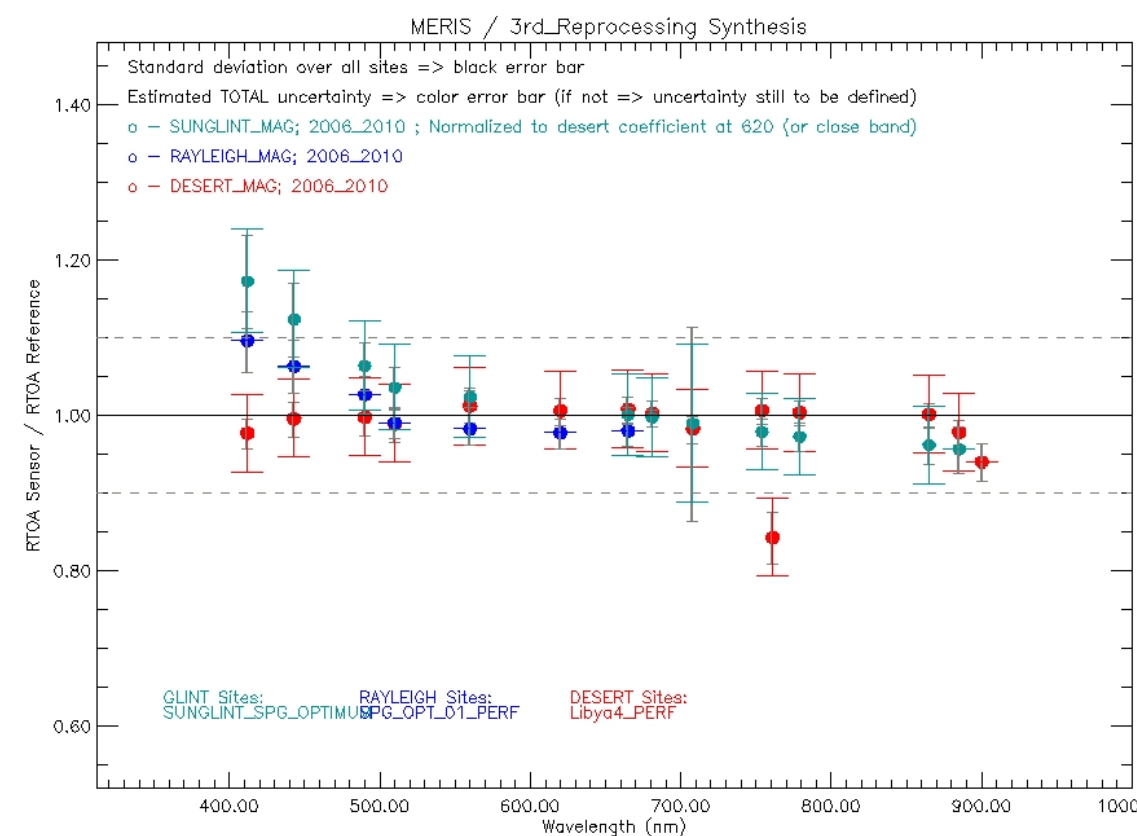


co-funded with



❖ Synthesis module results:

✓ **MERIS & OLCI: MAGELLIUM and Mixed.**



These results are for Software functionalities verification purpose only, not for the sensor performance



DIMITRI-V4.x: Application & Results



PROGRAMME OF THE
EUROPEAN UNION



co-funded with



❖ Installation/Performance test unit results:

✓ Log-reports.

```
20230511_123705: Test_main: Test started
20230511_123705: Test_main: DIMITRI V4.7.0
20230511_123705: Test_main: Existing DB backed up
20230511_123705: Test_main: Test DB created
20230511_123705: Test_file_list: All files present
20230511_123705: Test_check_db_files_present: Checking existence of test database file
20230511_123705: Test_check_db_files_present: All files in reference DB found
20230511_124049: Test_ingest: Successfully ingested L1b Data from OLCI_A TestDCC OPER00 2017
20230511_124128: Test_ingest: Successfully ingested L1b Data from AATSR TestDesert 3rd Reprocessing 2008
20230511_124132: Test_ingest: Successfully ingested L1b Data from MERIS SUNGLINT_Test 3rd Reprocessing 2008
20230511_124152: Test_ingest: Successfully ingested L1b Data from MERIS TestDesert 3rd Reprocessing 2008
20230511_124154: Test_ingest: Successfully ingested L1b Data from MERIS TestOcean 3rd Reprocessing 2008
20230511_124157: Test_ingest: Successfully ingested L1b Data from MERIS TestSnow 3rd Reprocessing 2008
20230511_124158: Test_ingest: Successfully ingested L1b Data from MERIS TestSnow 3rd Reprocessing 2009
20230511_124158: Test_ingest: Successfully ingested L1b Data from MODISA TestDesert Collection 6 2008
20230511_124200: Test_ingest: Successfully ingested L1b Data from PARASOL TestDesert Calibration 2 2010
20230511_124733: Test_ingest: Successfully ingested L1b Data from MSI A TestDCC_small PSD14 2019
20230511_124733: Test_compare_dbs: Database field "SITE_NAME" ingested successfully
20230511_124733: Test_compare_dbs: Database field "SITE_TYPE" ingested successfully
20230511_124733: Test_compare_dbs: Database field "SITE_COORDINATES" ingested successfully
20230511_124733: Test_compare_dbs: Database field "SENSOR" ingested successfully
20230511_124733: Test_compare_dbs: Database field "PROCESSING_VERSION" ingested successfully
20230511_124733: Test_compare_dbs: Database field "YEAR" ingested successfully
20230511_124733: Test_compare_dbs: Database field "MONTH" ingested successfully
20230511_124733: Test_compare_dbs: Database field "DAY" ingested successfully
20230511_124733: Test_compare_dbs: Database field "DOY" ingested successfully
20230511_124733: Test_compare_dbs: Database field "DECIMAL_YEAR" ingested successfully
20230511_124733: Test_compare_dbs: Database field "L1_FILENAME" ingested successfully
20230511_124733: Test_compare_dbs: Database field "L1_INGESTED_FILENAME" ingested successfully
20230511_124733: Test_compare_dbs: Database field "ROI_STATUS" ingested successfully
20230511_124733: Test_compare_dbs: Database field "ROI_PIX_NUM" ingested successfully
20230511_124733: Test_compare_dbs: Database field "THETA_N_MEAN" ingested successfully
20230511_124733: Test_compare_dbs: Database field "THETA_R_MEAN" ingested successfully
20230511_124733: Test_compare_dbs: Database field "AUTO_CS_1_NAME" ingested successfully
20230511_124733: Test_compare_dbs: Database field "AUTO_CS_1_MEAN" ingested successfully
20230511_124733: Test_compare_dbs: Database field "ROI_CS_1_CLEAR_PIX_NUM" ingested successfully
```

```
20230511_124733: Test_compare_dbs: Database field "AUTO_CS_2_NAME" ingested successfully
20230511_124733: Test_compare_dbs: Database field "AUTO_CS_2_MEAN" ingested successfully
20230511_124733: Test_compare_dbs: Database field "BRDF_CS_MEAN" ingested successfully
20230511_124733: Test_compare_dbs: Database field "SSV_CS_MEAN" ingested successfully
20230511_124733: Test_compare_dbs: Database field "MANUAL_CS" ingested successfully
20230511_124733: Test_compare_dbs: Database field "ERA_WIND_SPEED_MEAN" ingested successfully
20230511_124733: Test_compare_dbs: Database field "ERA_WIND_DIR_MEAN" ingested successfully
20230511_124733: Test_compare_dbs: Database field "ERA_OZONE_MEAN" ingested successfully
20230511_124733: Test_compare_dbs: Database field "ERA_PRESSURE_MEAN" ingested successfully
20230511_124733: Test_compare_dbs: Database field "ERA_WATERVAPOUR_MEAN" ingested successfully
20230511_124733: Test_compare_dbs: Database field "ESA_CHLOROPHYLL_MEAN" ingested successfully
20230511_124733: Test_compare_dbs: Database field "AUX_DATA_1" ingested successfully
20230511_124733: Test_compare_dbs: Database field "AUX_DATA_2" ingested successfully
20230511_124733: Test_compare_dbs: Database field "AUX_DATA_3" ingested successfully
20230511_124733: Test_compare_dbs: Database field "AUX_DATA_4" ingested successfully
20230511_124733: Test_compare_dbs: Database field "AUX_DATA_5" ingested successfully
20230511_124733: Test_compare_dbs: Database field "AUX_DATA_6" ingested successfully
20230511_124733: Test_compare_dbs: Database field "AUX_DATA_7" ingested successfully
20230511_124733: Test_compare_dbs: Database field "AUX_DATA_8" ingested successfully
20230511_124733: Test_compare_dbs: Database field "AUX_DATA_9" ingested successfully
20230511_124733: Test_compare_dbs: Database field "AUX_DATA_10" ingested successfully
20230511_124804: Rayleigh_arg_test: calculated successfully
20230511_124906: Sunlint_arg_test: calculated successfully
20230511_125811: Desert_arg_test: calculated successfully
20230511_125904: DCC_arg_test: calculated successfully
20230511_130053: Snow_arg_test: calculated successfully
20230511_130226: Rayleigh_mag_test: calculated successfully
20230511_130245: Sunlint_mag_test: calculated successfully
20230511_130246: Desert_mag_test: Getting brdfs
20230511_130406: Desert_mag_test: desert mag interface complete
20230511_130406: Desert_mag_test: All files in reference DB found, ingestion can now begin
20230511_130406: Desert_mag_test: calculated successfully
20230511_130406: Desert_mag_test: Moving output to report folder
20230511_130532: DCC_mag_test: calculated successfully
20230511_130543: Test_main: Backup DB restored
```





- ❖ **DIMITRI V4 is there and functional**
- ❖ **Main improvement feature is the Output Database management (NetCDF format)**
- ❖ **Hyperspectral Atmospheric LUTs; and Atmos-pressure adjustment.**
- ❖ **Introducing the directional effects (BRDF) to the estimation of the marine reflectance.**
- ❖ **Clear improvement over Rayleigh and Sunglint results from MERIS.**
- ❖ **Desert-PICS method is extended to Snow-Ice sites**
- ❖ **Development/implementation of DCC-methods**
- ❖ **Implementation of results synthesis module and installation test-unit**
- ❖ **Addition of Sentinel-2C/D and Sentinel-3C/D**
- ❖ **Full documentations (ATBDs and SUM) will be on the website shortly**





- ❖ **Extension of Desert/Snow PICS methods to the SWIR wavelength range**
- ❖ **Provide an error budget and uncertainty analysis for each method**
- ❖ **Readers development of new missions such as FLEX, CHIME, EnMAP etc.**
- ❖ **Feeding the database with new acquisitions**
- ❖ **Run DIMITRI as operational service**
- ❖ **Development/implementation of new vicarious methodologies**





DIMITRI

Database for Imaging Multi-spectral Instruments and Tools for
Radiometric Intercomparison



THANK YOU FOR YOUR ATTENTION

Thanks to OPT-MPC team for their support

<https://dimitri.argans.co.uk>
dimitri@argans.co.uk
balhammoud@argans.co.uk



1000100100101001010101010111
0100100100100100100101010001
010001010010101001110010101010
100010010100100101001001001001
001001001100101001001000100110
01111010010010010010010101101
001001001001100100100100100101
Numerical Optics Ltd