Update on S3 SYN-VGT algorithm status

PROBA-V

QWG 5 – 09/05/2017

- **Status of the L1 input data**
- **SYNERGY processing @PDGS and data availability**
- **Verification and evolution of the SYN L2 processing**
  - Updated SYN L2 IPF
  - Official Release of SYN L2 product
  - Remaining Issues
- **Status of SYN VGT-like**

- **Status of the L1 input data**
- *SYNERGY processing @PDGS and data availability*
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  - *Updated SYN L2 IPF*
  - *Official Release of SYN L2 product*
  - *Remaining Issues*
- *Status of SYN VGT-like*

Inputs of SYNERGY Level 2

- **Quality of SYN L2 products** directly linked to :
  - Quality of OLCI/SLSTR L1 radiometric measurements
    - ➔ Ensured by S3 MPC experts
  - Quality of OLCI and SLSTR geometric calibration
    - ➔ Correction of OLCI and SLSTR nadir geometric calibration on IPF processing baseline 2.5 (13/10/2016)
    - ➔ Correction of SLSTR VIS/SWIR channels co-registration on IPF processing baseline 2.13 (30/03/2017)
    - ➔ First correction of SLSTR oblique geometric calibration on IPF processing baseline 2.13 (30/03/2017)

Validation of the oblique geometric calibration

(@S3 MPC – GEOCAL Assessment – SNR > 8) =

From IPF - PB 2.8

View	Direction	Mean	Std Dev
Nadir	Across	0,42 px	1,4 px
	Along	-0,26 px	1,24 px
Oblique	Across	1,29 px	1,15 px
	Along	-1,67 px	1,64 px

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    - ➔ First correction of SLSTR oblique geometric calibration on IPF processing baseline 2.13 (30/03/2017)

Validation of the oblique geometric calibration (@S3 MPC – GEOCAL Assessment – SNR > 8) = From IPF - **PB 2.13**

Better co-registration on average
Still some displacements on oblique view of 1-2 pixels observed on some images

View	Direction	Mean		Std Dev	
Nadir	Across	0,42 px	-0,03 px	1,4 px	0,59 px
	Along	-0,26 px	0,07 px	1,24 px	0,95 px
Oblique	Across	1,29 px	0,02 px	1,15 px	0,26 px
	Along	-1,67 px	-0,11 px	1,64 px	0,35 px

Inputs of SYNERGY Level 2

- **Quality of SYN L2 products** directly linked to :
  - Quality of OLCI/SLSTR L1 radiometric measurements
    - ➔ Ensured by S3 MPC experts
  - Quality of OLCI and SLSTR geometric calibration
    - ➔ Correction of OLCI and SLSTR nadir geometric calibration on IPF processing baseline 2.5 (13/10/2016)
    - ➔ First correction of SLSTR oblique geometric calibration on IPF processing baseline 2.13 (30/03/2017)
    - ➔ Correction of SLSTR VIS/SWIR channels co-registration on IPF processing baseline 2.13 (30/03/2017)
  - Quality of SLSTR Basic Cloud tests
    - ➔ First Improvement and correction of the SLSTR Basic cloud tests on IPF PB 2.7 (03/11/2016)
    - ➔ Improvement regularly included (last one in V06.09 – PB 2.13 (30/03/2017)

- **Quality of SYN VGT products** directly linked to :
  - Quality of SYN L2 aerosol retrieval
    - ➔ Focusing on Validation of SYN L2 processing

Verification, debugging and evolutions included in SYN L2 IPF – PB 2.14 (28/04/2017)

- *Status of the L1 input data*
- **SYNERGY processing @PDGS and data availability**
- *Verification and evolution of the SYN L2 processing*
  - *Updated SYN L2 IPF*
  - *Official Release of SYN L2 product*
  - *Remaining Issues*
- *Status of SYN VGT-like*

SYN L2 @PDGS

1. 26/10/2016 = Production stopped on PDGS/PAC because of performance issues (SYN products too heavy, impact on others offline products)

2. Compression on SYN intermediate files (60%) implemented in PB 2.10

3. 01/03/2017 = SYN Production restarted but not fully stable – still OFFLINE

Month (@S3MPC – DATA)	SY_2_SYN	SY_2_VGP	SY_2_VG1	SY_2_V10
January	0	0	0	0
February	27/02 + 28/02	27/02 + 28/02	27/02 + 28/02	22/02
March	5 products (19 – 30)	6 products (19 – 30)	5 products (18 – 27)	14/03
April	24 products (2 – 30)	24 products (2 – 30)	4 products (02 – 10)	
May	to be transfered	01/05	To be transfered	

- *Status of the L1 input data*
- *SYNERGY processing @PDGS and data availability*
- **Verification and evolution of the SYN L2 processing**
  - **Updated SYN L2 IPF**
  - **Official Release of SYN L2 product**
  - **Remaining Issues**
- *Status of SYN VGT-like*

Several debugging / verification work focused on SYN L2:

- SYN cloud masking
- SYN aerosol interpolation (transfer from macro-pixel to 300m pixels
- SYN cosmetic filling

+ evolutions implemented :

- defined in collaboration with SWANSEA and ESRIN

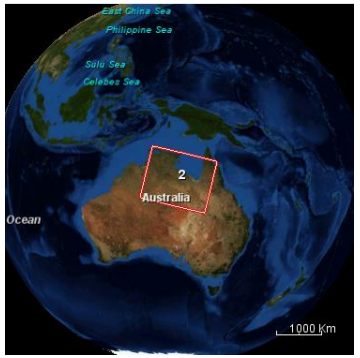
Delivery of updated SYN L2 IPF in processing baseline 2.14

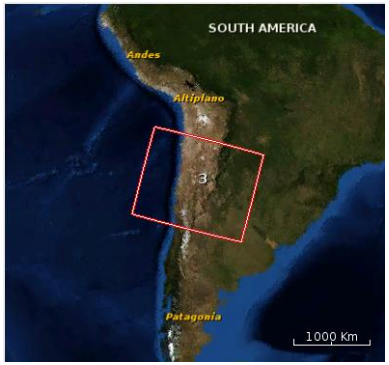
Official Release of few SYNERGY products at the end of Ramp-up phase (12/05)

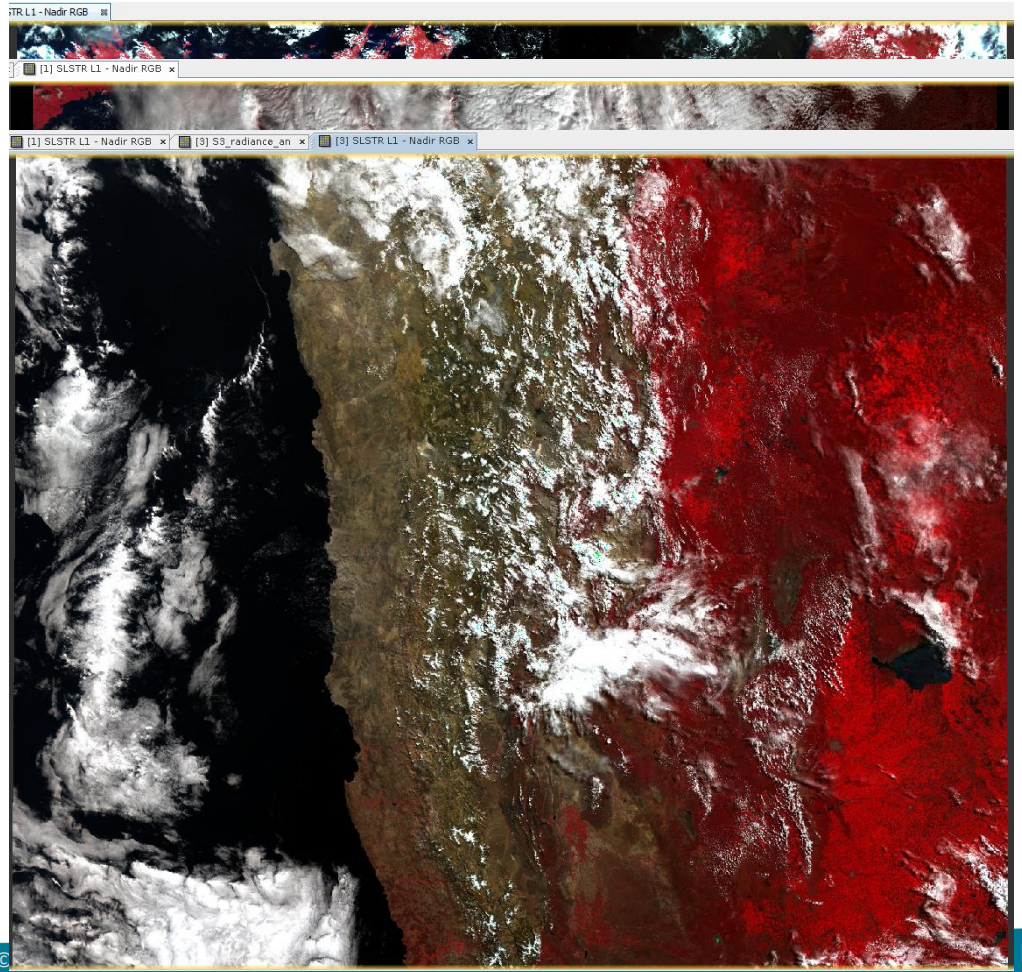
1. **Description of corrections and evolutions**
2. **Examples on 3 different products**

3 different scenes on 27/02/2017

- Australia –
- Over Europe (very Cloudy)
- Over South America (less cloudy)







RGB image of the S3 radiances

Summary of all corrections /evolutions included

1. Investigation and correction of the SYN L2 flags

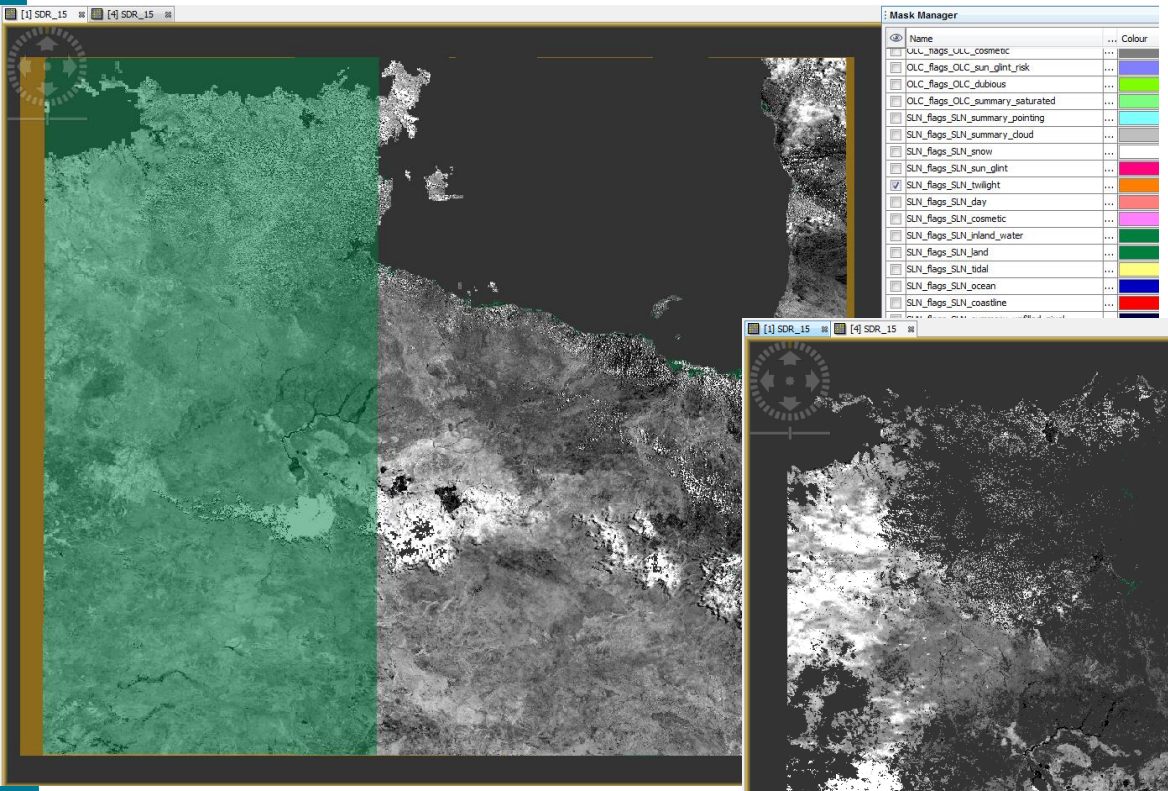
- Correction of the initialization of SLN and SLO flags
- Consolidation of the handling of **SLSTR L1 cloud flags**
- Inclusion of **OLCI bright flag in SYN cloud pixels**

  - **Cloud mask = OLCI bright pixels +**
    SLSTR nadir view summary cloud +
    SLSTR oblique summary cloud

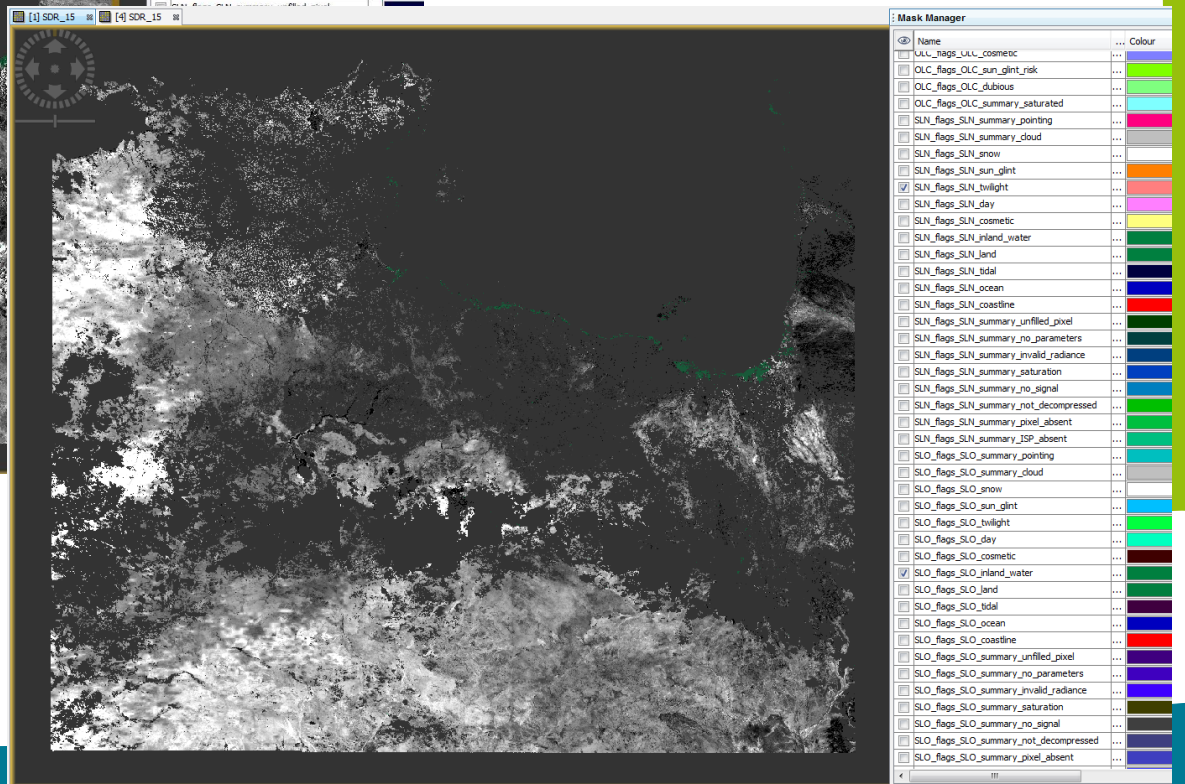
  - **Large cloud mask compensate by flexibility in aerosol retrieval**

SLN_twilight
SLO_inland_water

IPF PB 2.13



IPF PB 2.14



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1. Investigation and correction of the SYN L2 flags

- Correction of the initialization of SLN and SLO flags
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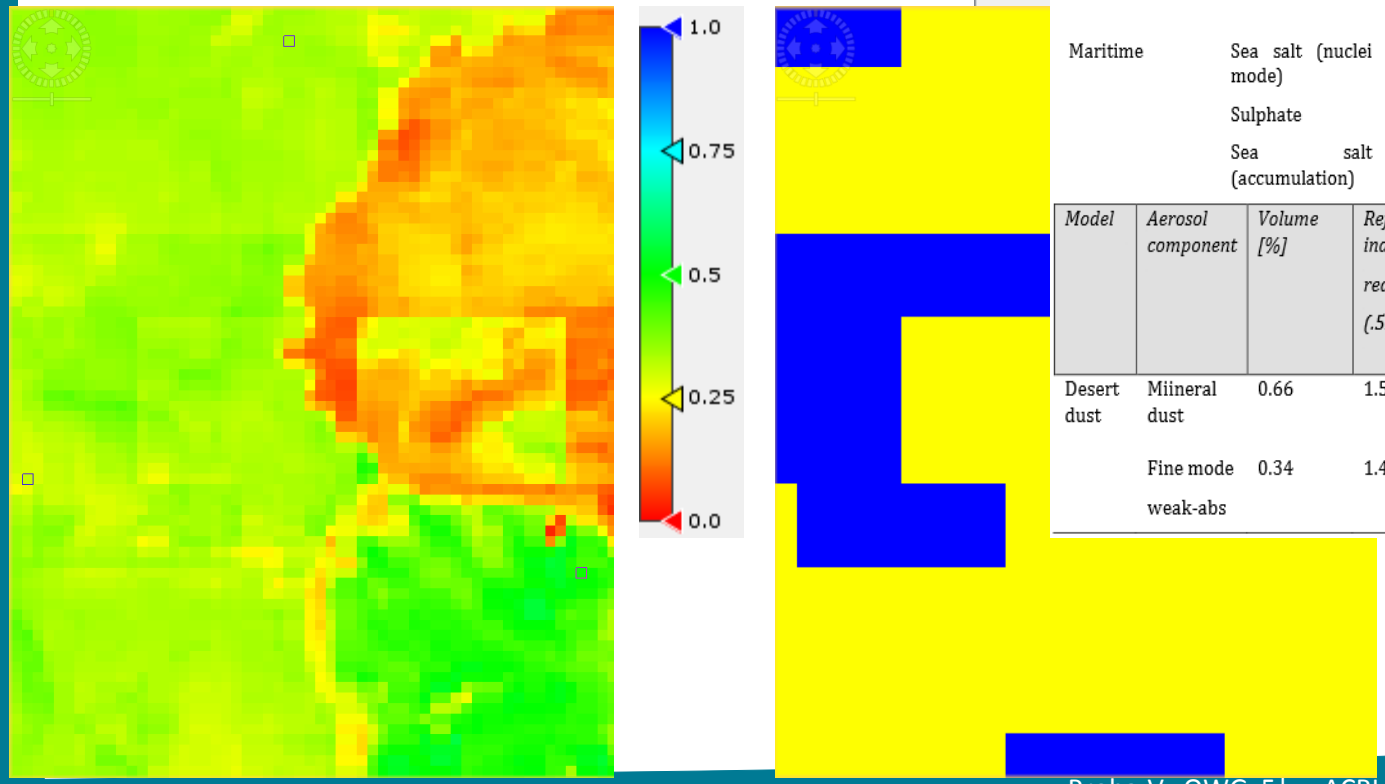
2. Investigation on the « rectangular patterns »

- Connection made with the number of aerosol models
- Production of an updated ADF **with only one continental model**

3 Aerosol models in SYN ADF = Continental /Maritime / Desert Dust

PB 2.13 product – SDR@865 nm and Aerosol model

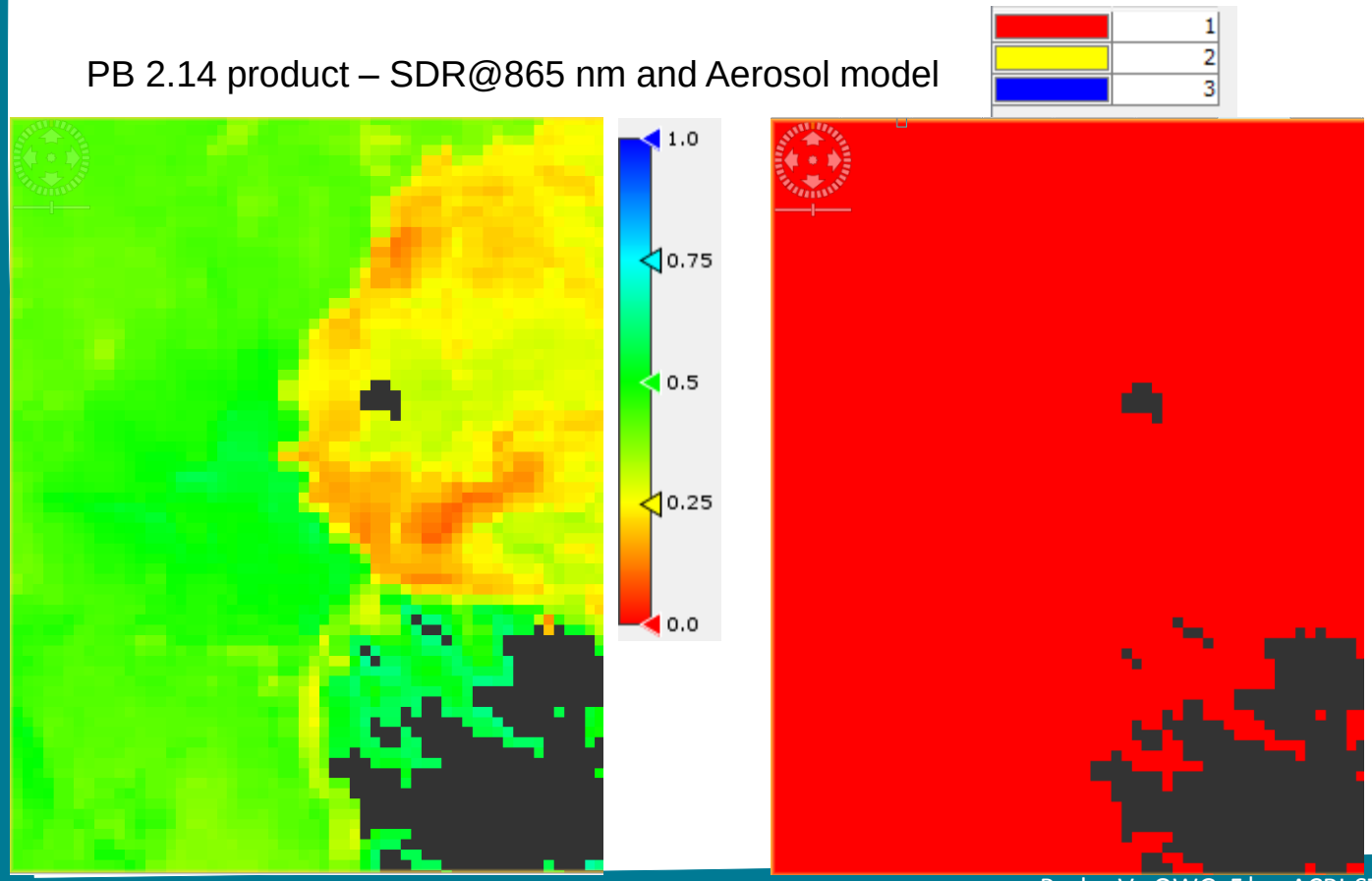


Model	Aerosol component	Volume [%]	Mean radius (μm)	s.d (μm)
Continental	Dustlike	0.70	0.471	2.512
	Water soluble	0.29	0.0285	2.239
	Soot	0.01	0.0118	2.0
Maritime	Sea salt (nuclei mode)	0.538	0.05	2.03
	Sulphate	0.457	0.0695	2.03
	Sea salt (accumulation)	0.005	0.4	2.03

Model	Aerosol component	Volume [%]	Refr. index, real part (.55μm)	Refr. Index, imag part (.55μm)	Reff (μm)	Geom. st dev (σ_i)	Variance (ln σ_i)	Mode. radius (μm)
Desert dust	Miineral dust	0.66	1.56	0.0018	1.94	1.822	0.6	0.788
	Fine mode weak-abs	0.34	1.4	0.003	0.140	1.7	0.53	0.07

Using only 1 continental model ➔

PB 2.14 product – SDR@865 nm and Aerosol model



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1. Investigation and correction of the SYN L2 flags

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3. Improvement and correction of the Aerosol retrieval

- **Enabling the aerosol retrieval over non-perfect Macro-pixels** = including more than X % of valid pixels, Land and clear-sky pixels, data averaged only over valid pixels
- Investigation about acceptable threshold and size of the macro-pixels
  - » Nominal configuration : 50%

    15 x 15 macro-pixels (compliant with future AOD product – New Product activity)

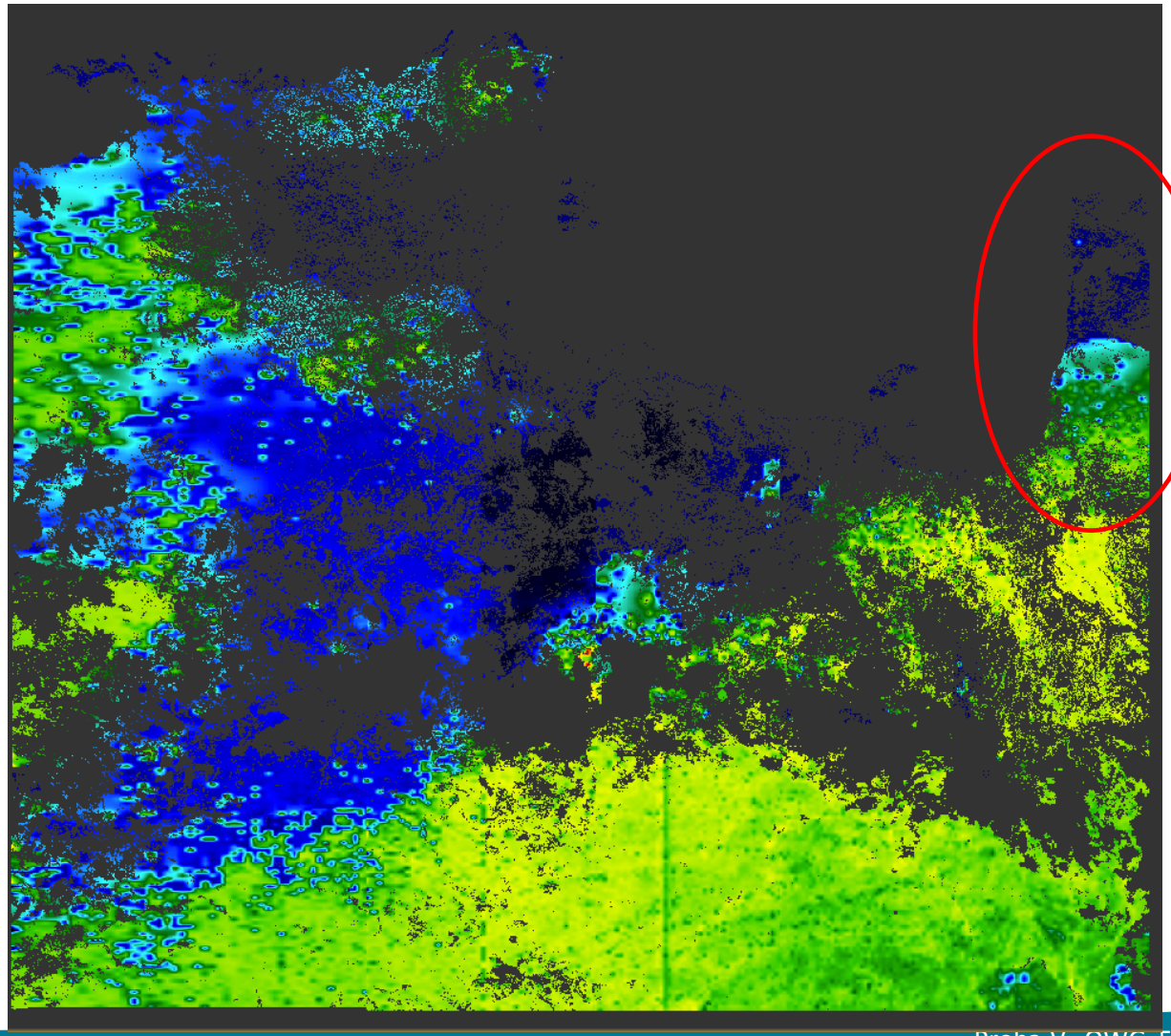
Summary of all corrections /evolutions included

4. Improvement and Correction of the cosmetic filling

- Correction of a numerical issue with AOT initialization
- Investigation on **the neighboring radius** and inclusion of this parameter as a PCP parameter
  - Nominal configuration = **20** instead of 120

- Inclusion of a PCP threshold **to disable the cosmetic filling if the number of valid neighbor is too low**
  - Nominal configuration = **10%**
  - If not enough neighbor, AOT = climatological values dependent on latitude
    AMIN = 1
  - Definition of an AOT_climato flag (replacement of SYN_cloud_filled)

PB 2.14 T550 over Australia



Summary of all corrections /evolutions included

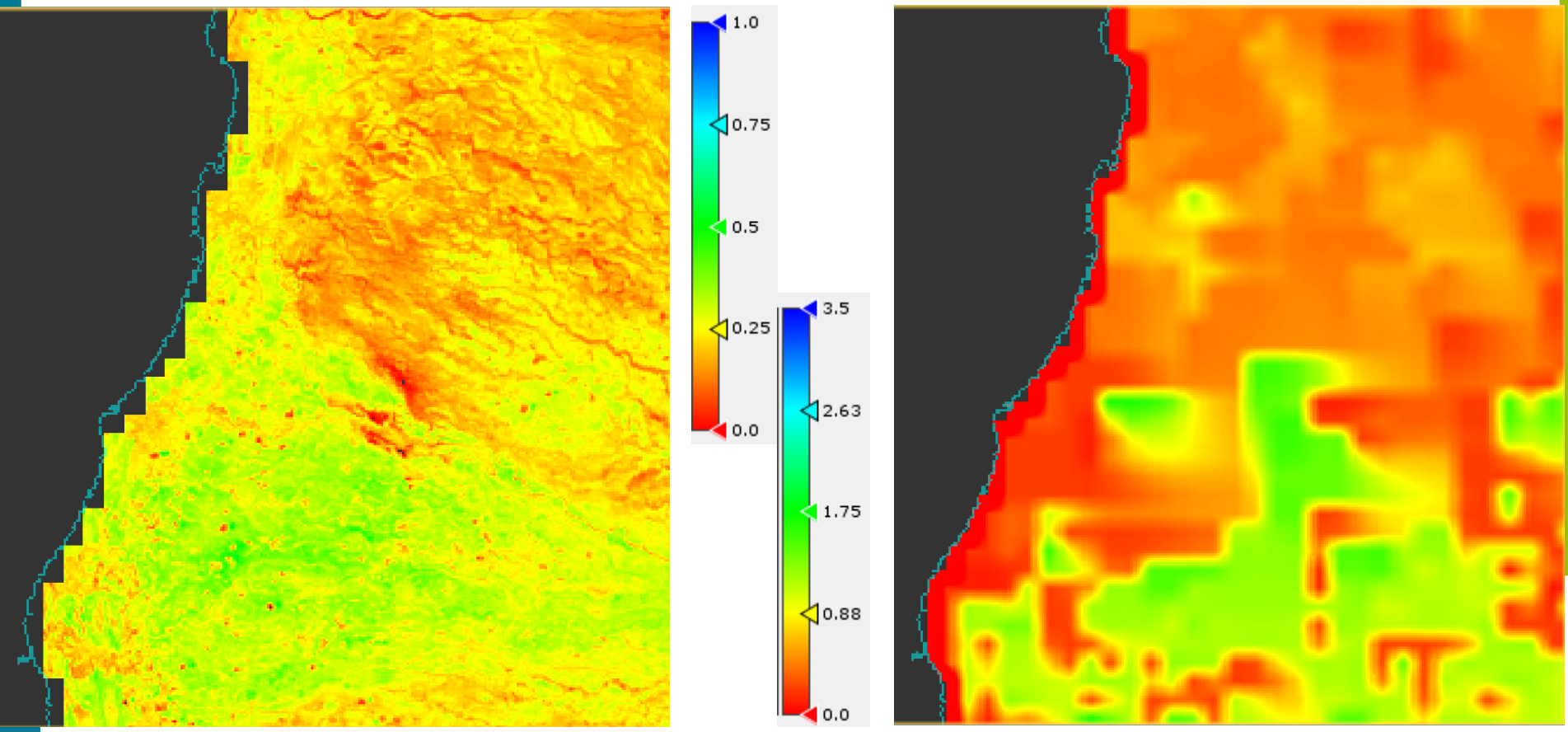
4. Improvement and Correction of the aerosol interpolation

- **Correction of the aerosol interpolation** by discarding invalid parameters
  - _FillValue and outliers were taken into account in aerosol interpolation
  - Correction of the filling near coastline

- Flags associated with 300 m pixel are only set to SYN_success if the 4 macro-pixels used during “Aerosol interpolation” are set to SYN_Success

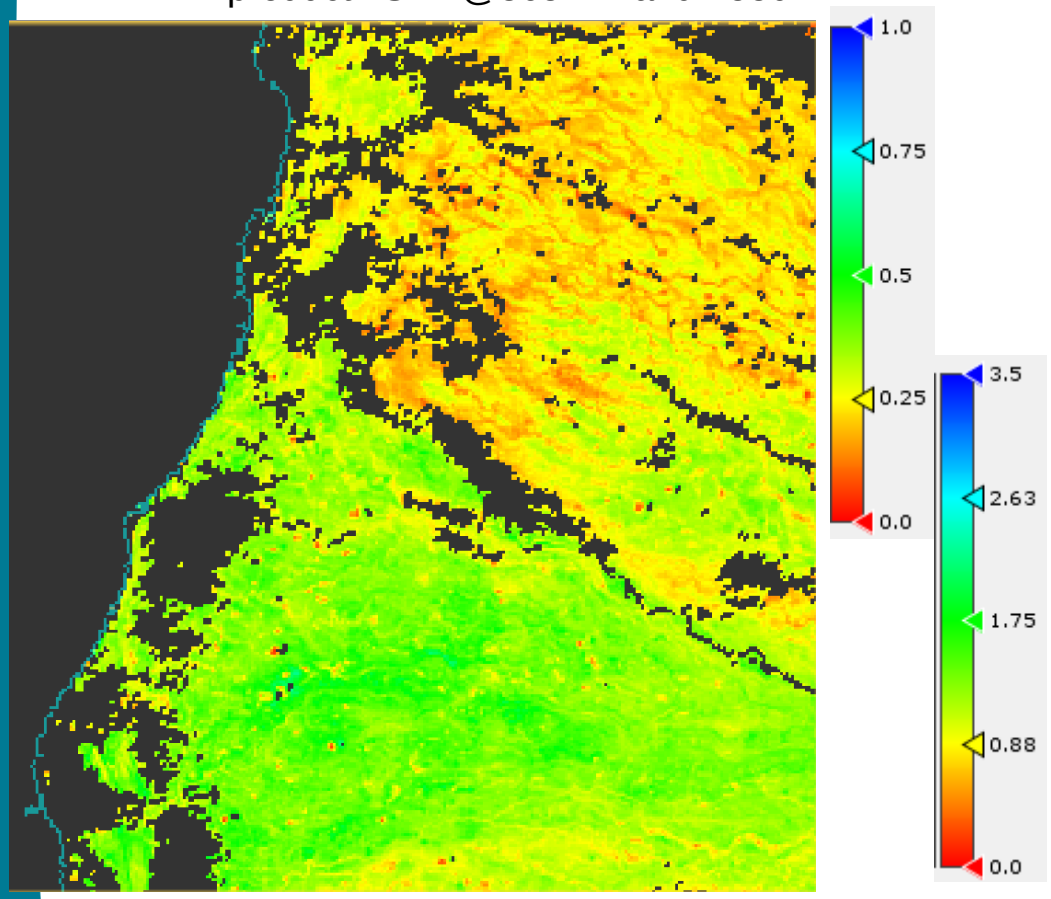
Rectangular filling for SDR + decrease of T550 close to the coastline

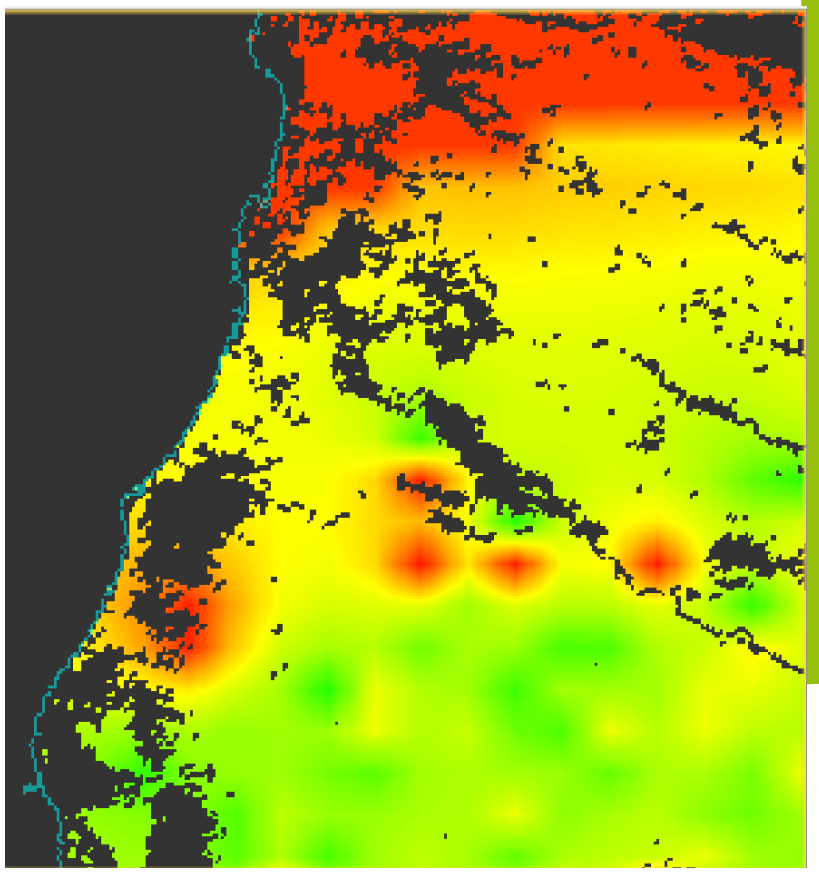
PB 2.13 product –SDR@865 nm and T550



All land pixels are filled in SDR + corrected behavior of the T550 close to the coastline

PB 2.14 product –SDR@865 nm and T550





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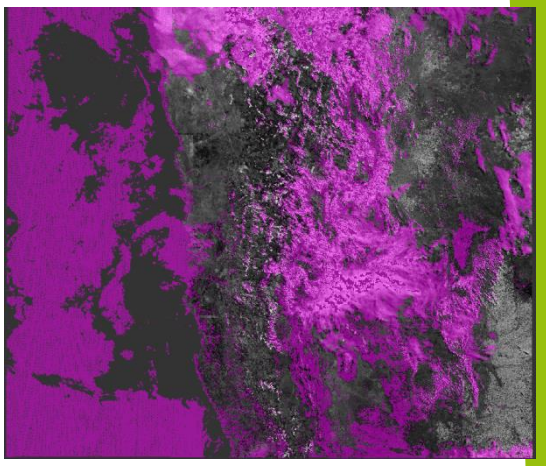
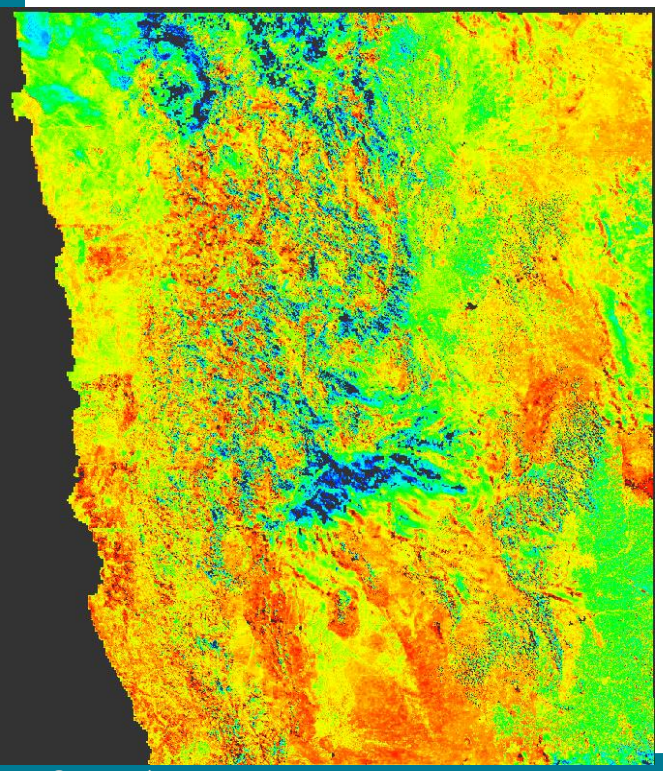
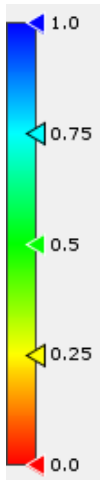
SYN L2 IPF PB 2.13 – South America

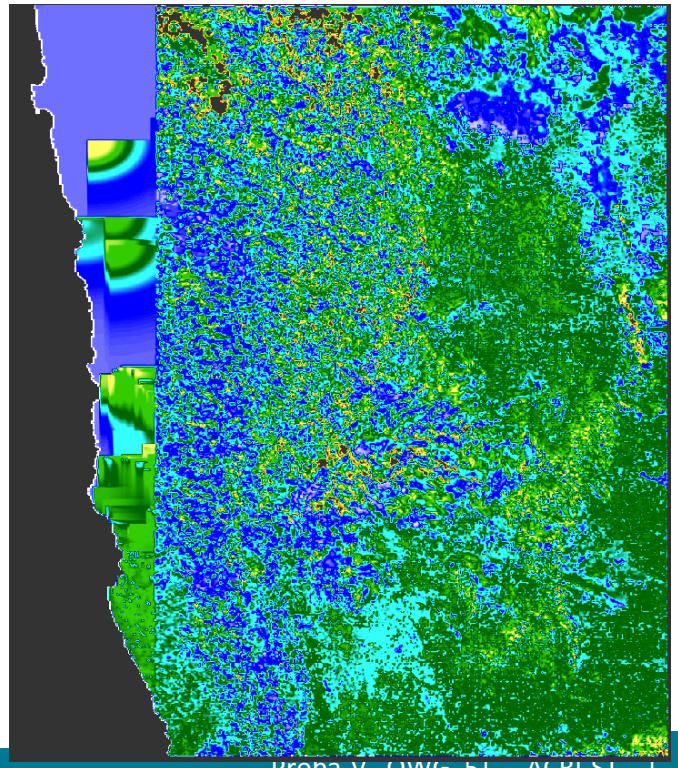
All land pixels filled in SYN L2 products – using aerosol retrieval result + cosmetic filling

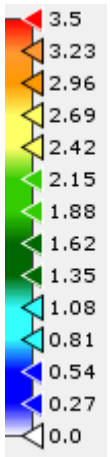
PB 2.13 product – SDR@865 nm and AOT@550
Syn_cloud flag in Purple







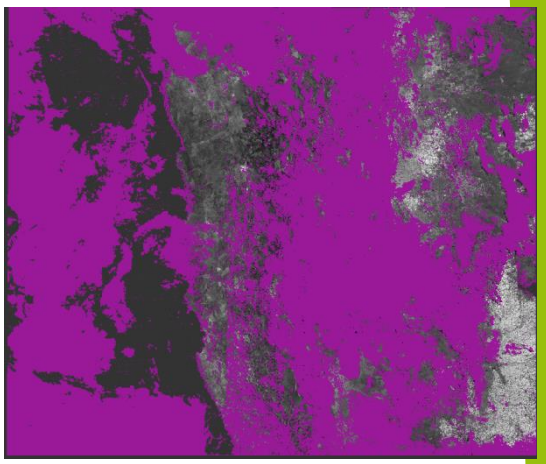


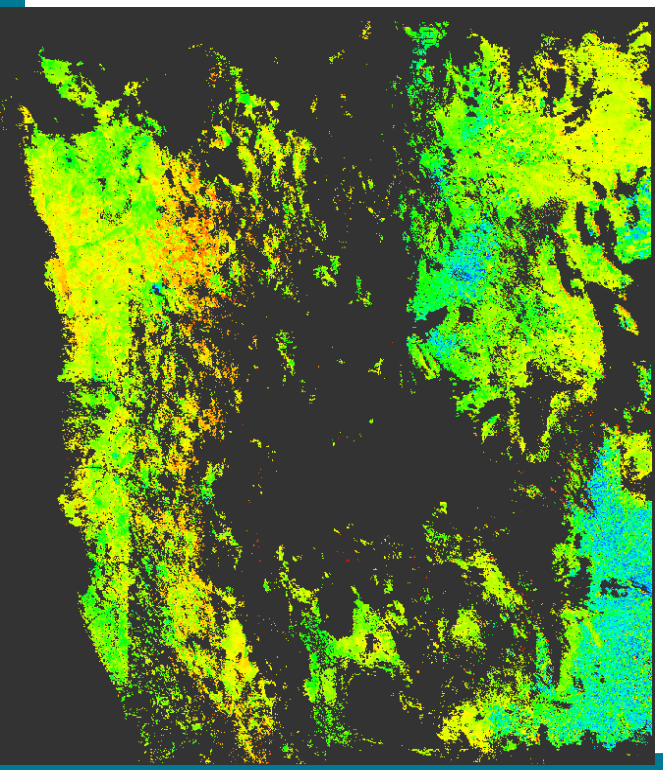


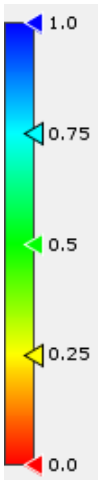
SYN L2 IPF PB 2.14 – South America

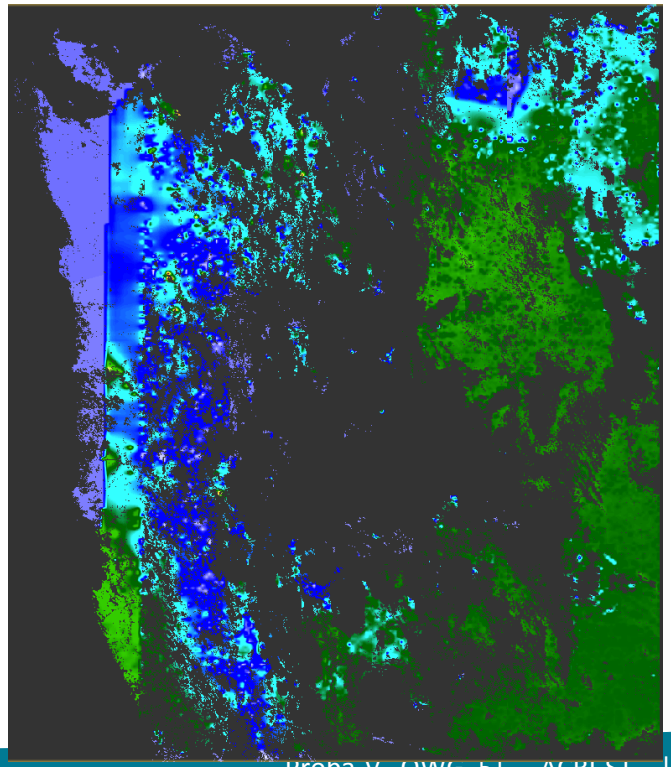
Only clear-sky pixels filled in SYN L2 products

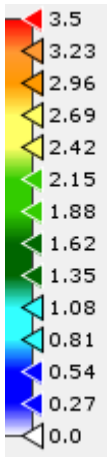
PB 2.14 product – SDR@865 nm and AOT@550
Syn_cloud flag in Purple







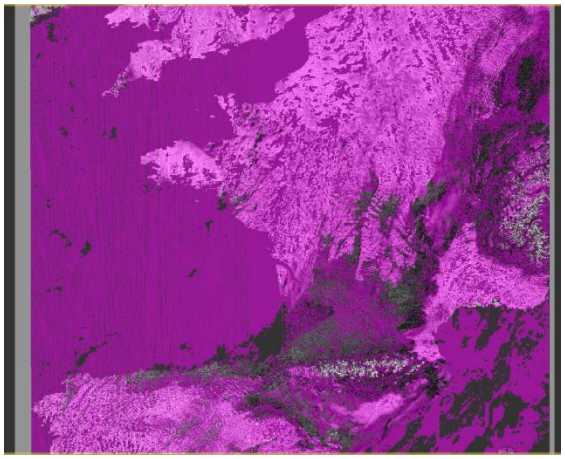


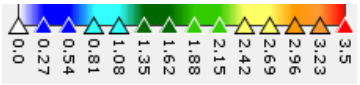


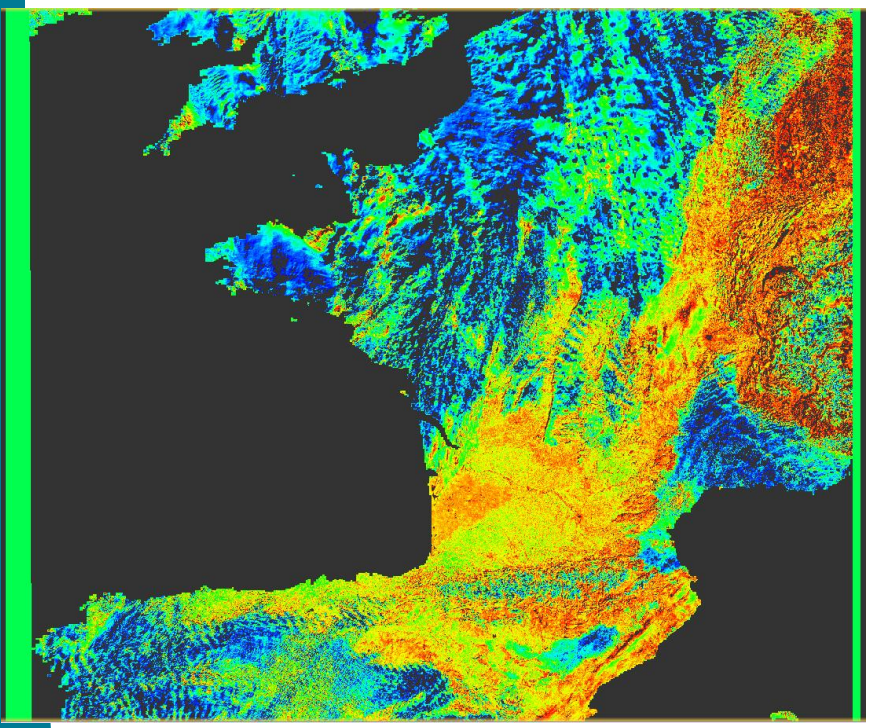
SYN L2 IPF PB 2.13 – Europe

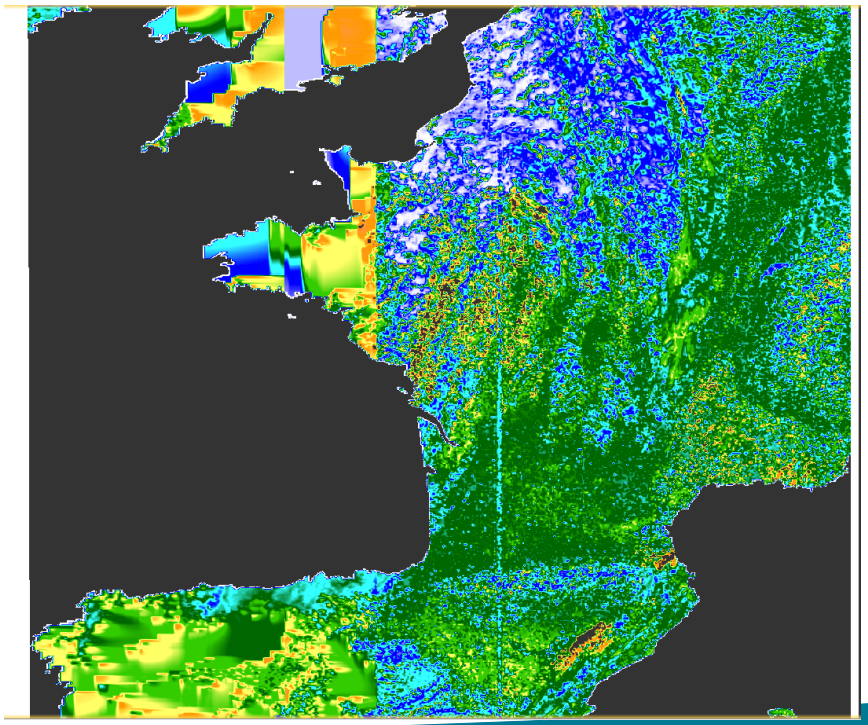
All land pixels filled in SYN L2 products – using aerosol retrieval result + cosmetic filling

PB 2.13 product – SDR@865 nm and AOT@550
Syn_cloud flag in Purple





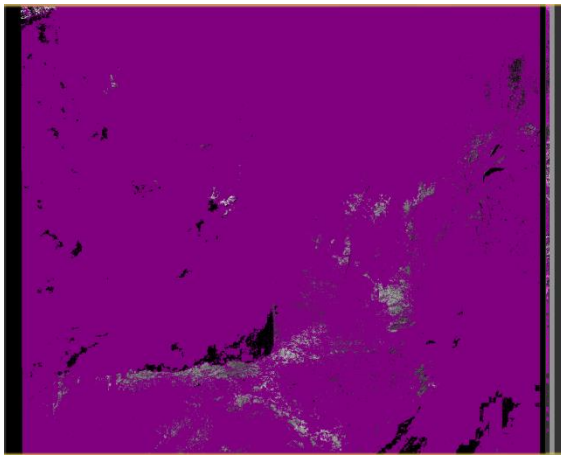


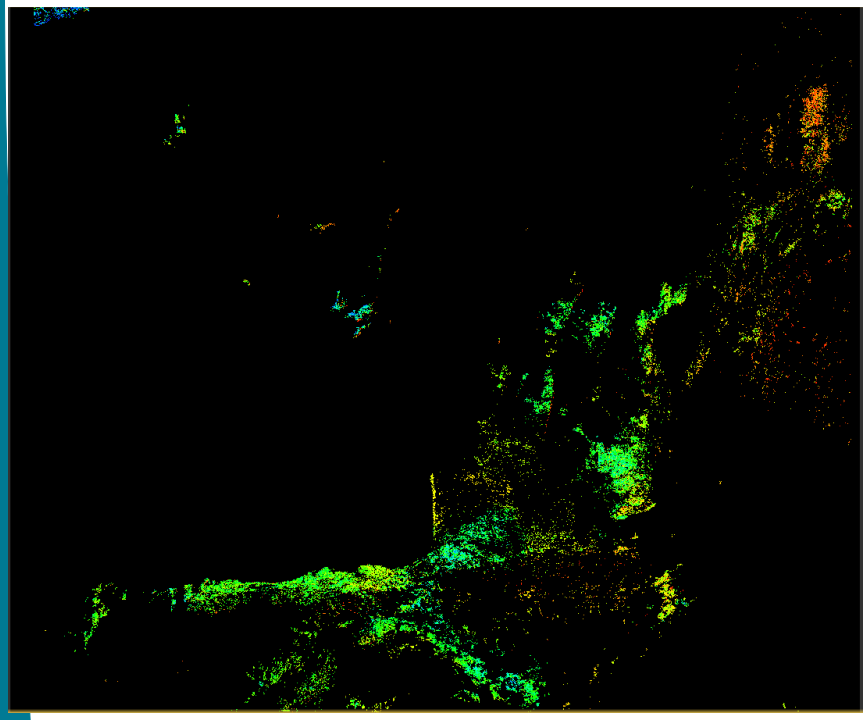


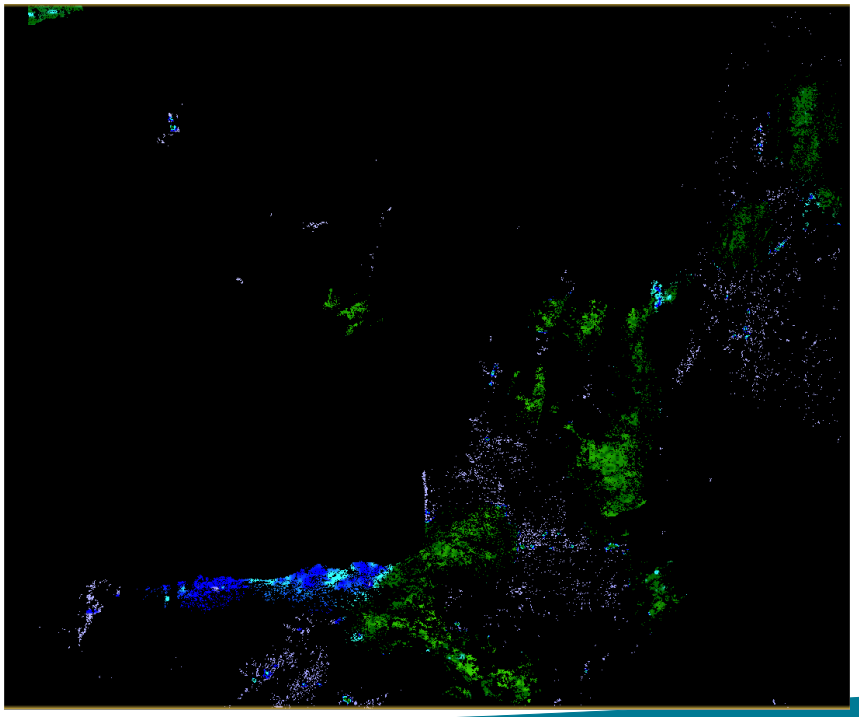
SYN L2 IPF PB 2.14 - Europe

Only clear-sky pixels filled in SYN L2 products

PB 2.14 product – SDR@865 nm and AOT@550
Syn_cloud flag in Purple







Summary of all corrections /evolutions included

4. Improvement and Correction of the aerosol interpolation

- **Correction of the aerosol interpolation** by discarding invalid parameters
  - _FillValue and outliers were taken into account in aerosol interpolation
  - Correction of the filling near coastline

- Flags associated with 300 m pixel are only set to SYN_success if the 4 macro-pixels used during “Aerosol interpolation” are set to SYN_Success

- Disabling the outputting of aerosol parameters over cloudy pixels – **Only clear-sky pixels will be filled in SYN products**

5. Inland waters are now discarded from processing

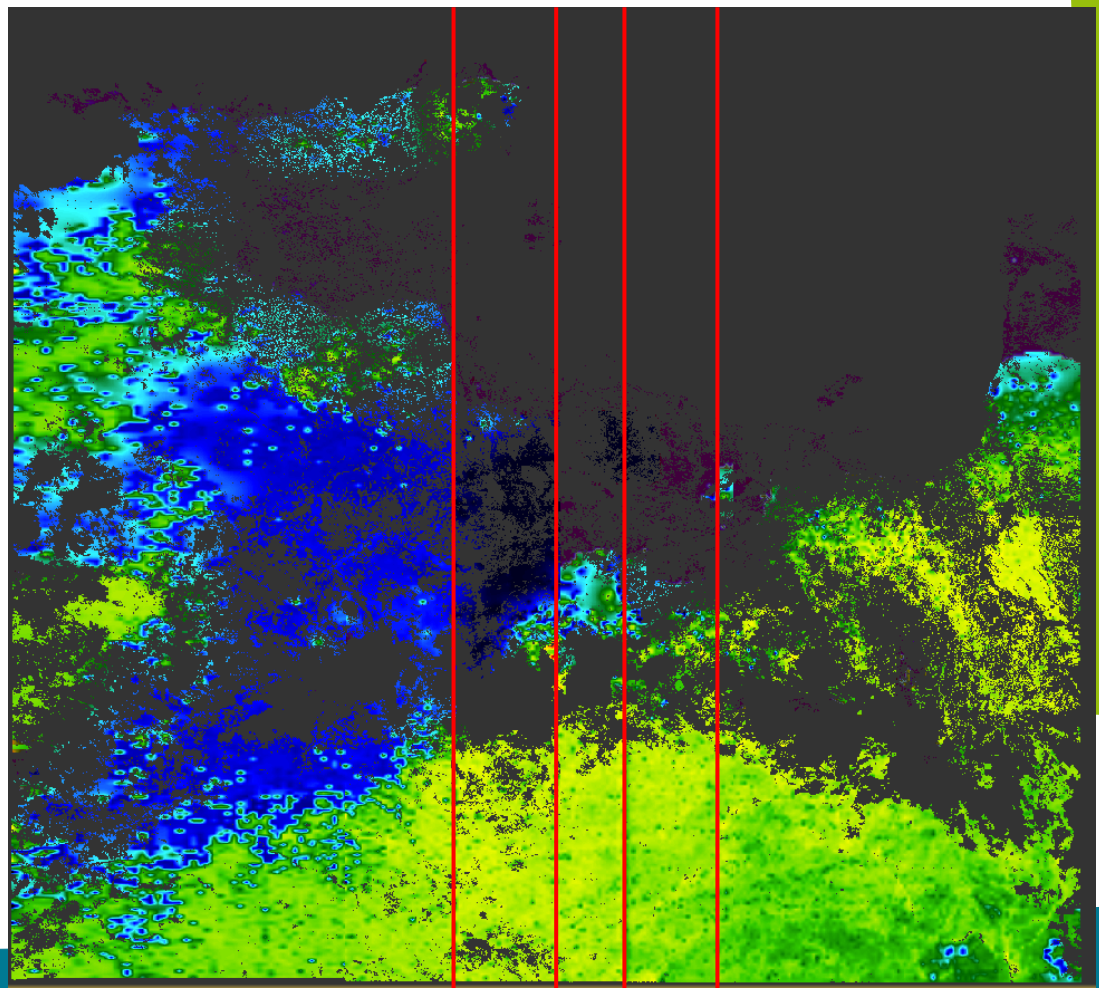
6. Surface reflectance out of range (not included in [0,1]) are set to _FillValue

- Definition of a new SDR_OOR flag (Replacement of SYN_shadow_risk)
- Raised if the SDR is out of range for at least one channel

Remaining issues

1. Discontinuities observed on several images.

- Transition in SLSTR azimuth and between single and dual view
- OLCI camera interfaces
  - Cosmetic filling /aerosol interpolation performed with a fixed camera module,
  - Possibility to take into account full continuous grid but need investigation and testing in collaboration with OLCI ESLs

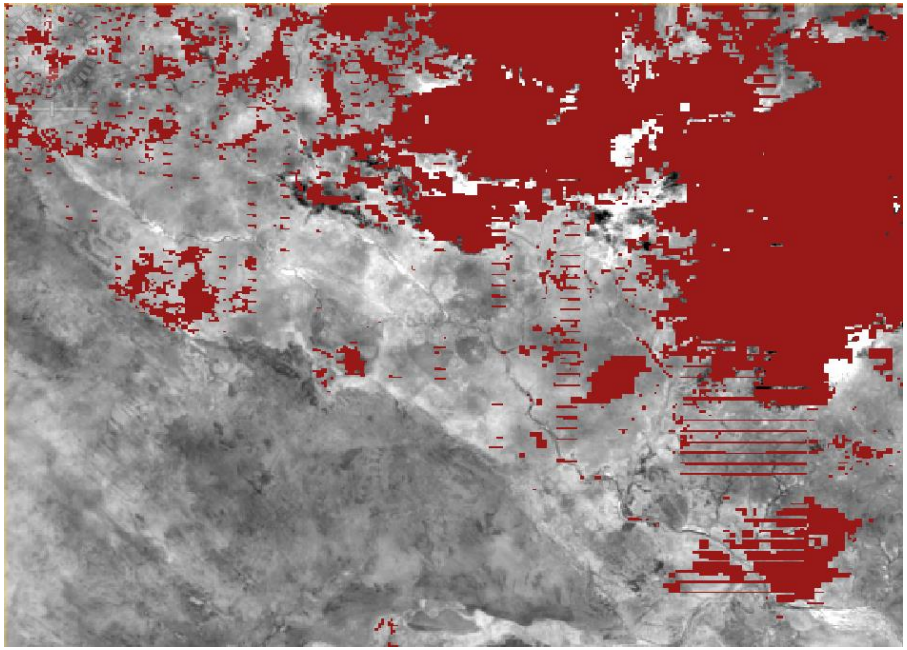


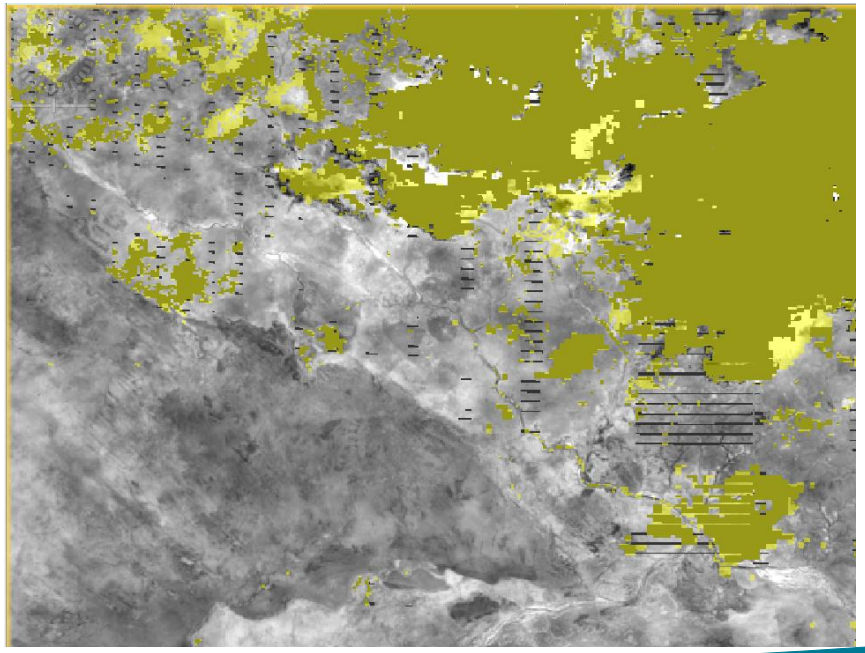
Remaining issues

2. Investigation on going on SYN cloud flags wrongly transposed from SYN L1, creating rectangular empty area,

In red : SYN_cloud transferred from Syn L1

In yellow = original SLSTR Summary cloud





Remaining Issues

3. SYNERGY only in descending part of the orbit / issue around poles

4. Scientific Validation

5. Same verification and debugging work on SYN-VGT like on-going

Evolutions :

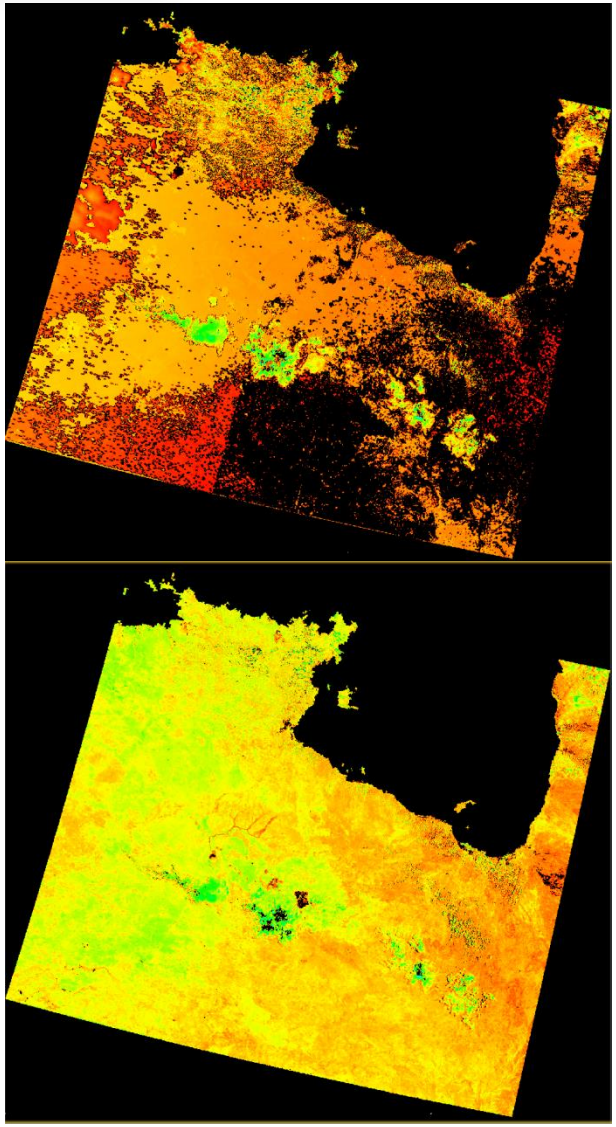
- Specific SYN Cloud flagging using Idepix

- *Status of the L1 input data*
- *SYNERGY processing @PDGS and data availability*
- *Verification and evolution of the SYN L2 processing*
  - *Updated SYN L2 IPF*
  - *Official Release of SYN L2 product*
  - *Remaining Issues*

- **Status of SYN VGT-like**

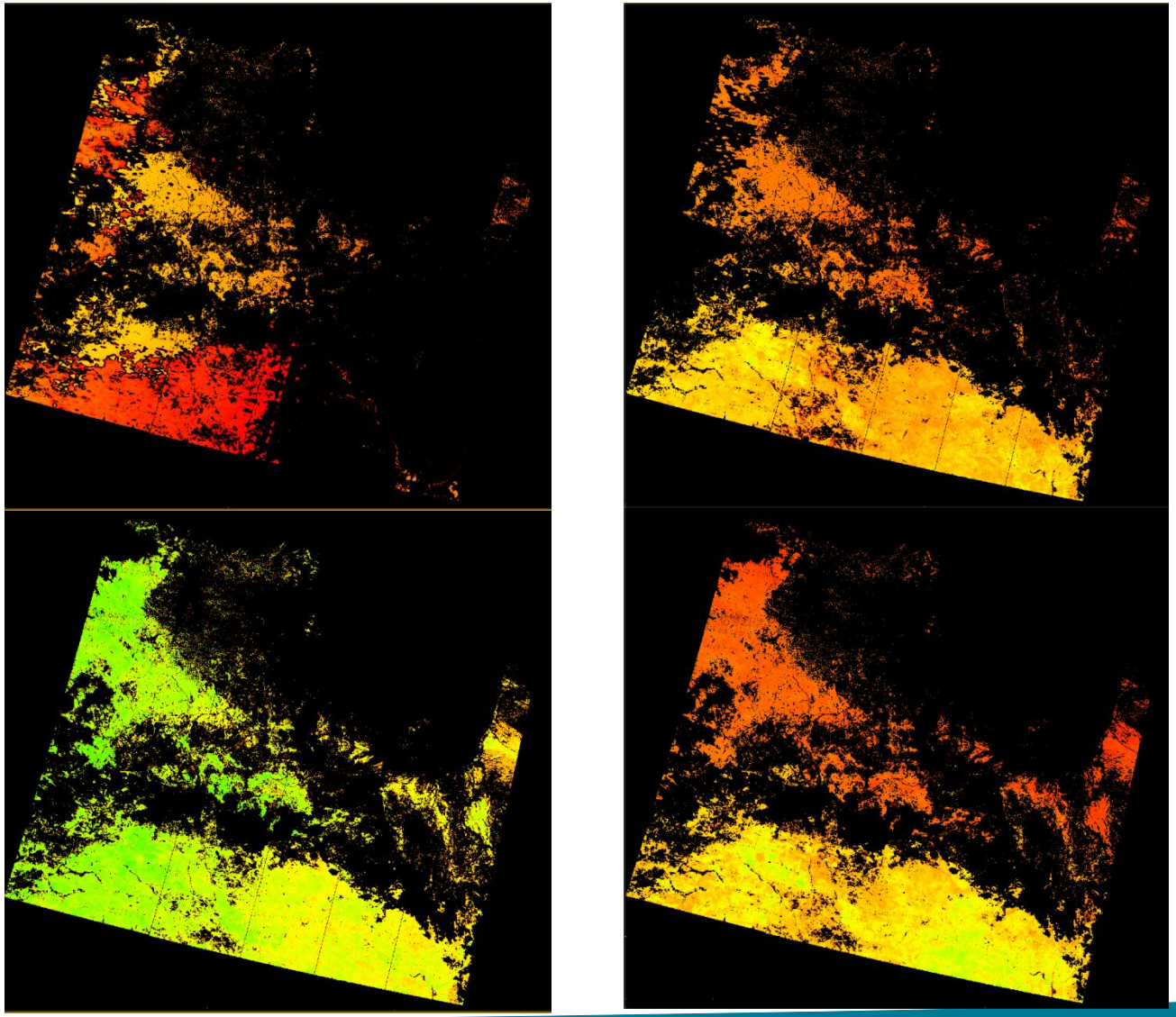
Over Australia – IPF PB 2.13

B0, B2, B3, MIR



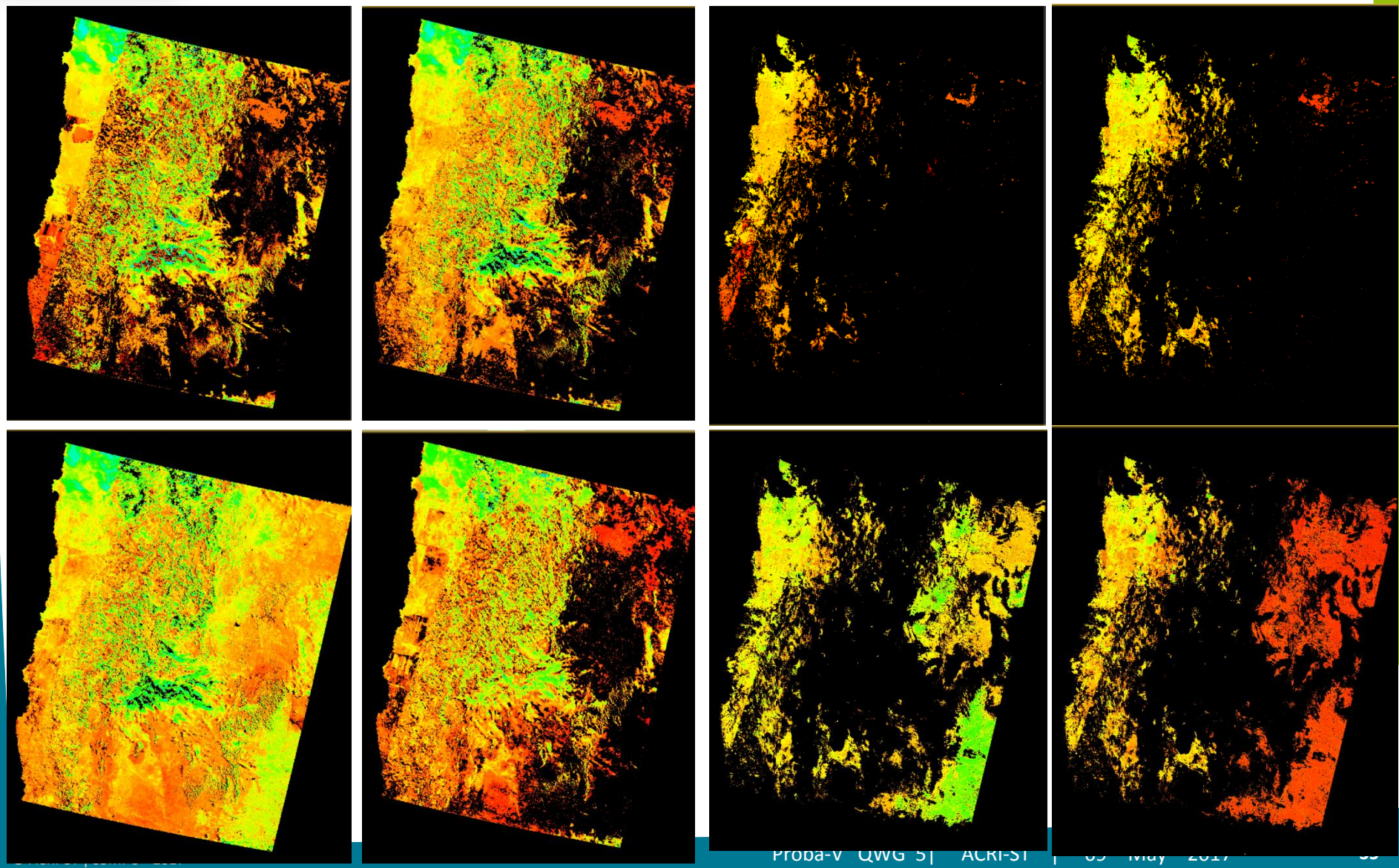
Over Australia – IPF PB 2.14

B0, B2, B3, MIR



South America – IPF PB 2.13 / IPF PB 2.14

B0, B2, B3, MIR



New Product –Global Aerosol

NRT product from SLSTR L1 products

NTC product from « SYNERGY L1 » products

1. **4,5 km * 4,5 km resolution**
2. **Global Ocean/Land product**
3. **One file gathering**
   - {SDR, AOD, AOD_uncertainty, SSA} @ 550, 670, 865, 1600, 2250, ((440))
   - {FM_AOD, D_AOD, AAOD} @ 550
   - ANG_550_865
   - Contextual information

Thank you for your attention