

High spectral resolution synthetic radiance for geostationary imager

Phase 3 Final meeting

Wednesday 15th December 2021
Teleconference

Mathieu Compiègne (HYGEOS, Lille, France)
on behalf the HYGEOS/LOA consortium

Phase 3 overview

- Production of new synthetic TOA radiance using the framework developed during first part of the project
 - Radiance integrated into Spectral Response Function (e.g. SEVIRI, METImage, FCI)
 - Full SEVIRI disks at SEVIRI spatial resolution
 - Production of all repeat cycles over 24 hours with a 15 min resolution (Sept 20th 2017, same day as previous phase)
- Slight modifications of the scene description
 - Variable effective radius for liquid clouds
 - OCA 1 layer only product
 - Updated gas absorption modelling

Phase 3 overview (II)

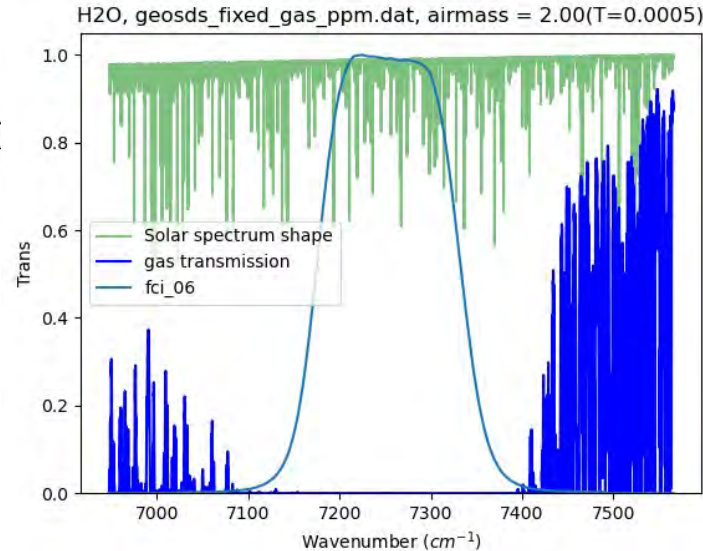
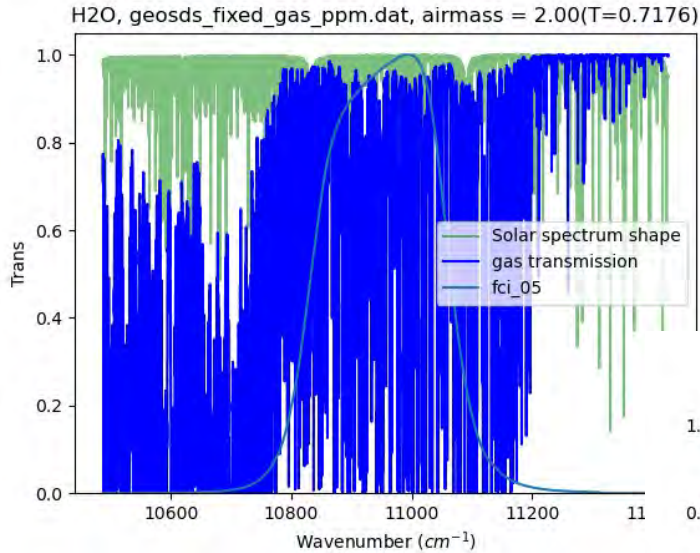
- ARTDECO used for UV to SWIR channels
 - Corresponding new K-distribution coefficients computed
 - Surface, cloud, and aerosols optical properties are averaged over the SRF
- RTTOV used for SWIR to thIR
 - use RTTOV corresponding parameters (cloud and aerosols and Altas (surface emissivity))

Channels central wavelength (μm)					
SEVIRI	FCI	LI	ABI	VII	SLSTR
	0.444		0.467	0.443	
	0.510			0.555	0.555
0.640	0.640		0.640	0.670	0.659
				0.752	
		0.7774		0.763	
0.808	0.865		0.865	0.865	0.865
	0.914			0.914	
				1.240	
	1.380		1.378	1.375	1.375
1.638	1.610		1.610	1.630	1.610
	2.250		2.250	2.250	2.250
3.893	3.800		3.900	3.740	3.740
				3.959	
				4.040	
6.248	6.300		6.180		
			6.950	6.725	
7.351	7.350		7.340	7.325	
8.706	8.700		8.500	8.540	
9.659	9.660		9.610		
10.733	10.500		10.350	10.690	10.850
			11.200		
11.955	12.300		12.300	12.020	12.000
13.302	13.300		13.300	13.345	

Ancillary data

- EUMETSAT provided
 - OCA cloud product for all repeat cycles
 - ECMWF profiles and surface (wind, pressure, skin temperature) parameters for all repeat cycles (interpolated at 15 min resolution)
- HYGEOS/LOA retrieved CAMS profiles over the 24 hours (3hrs step)
 - interpolated linearly at 15 min resolution
- Surface properties (BRDF, emissivity) are kept constant over the 24 hours

Correlated K-distribution update

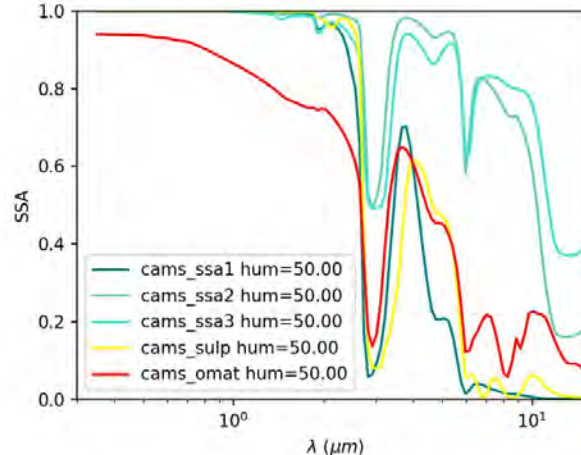
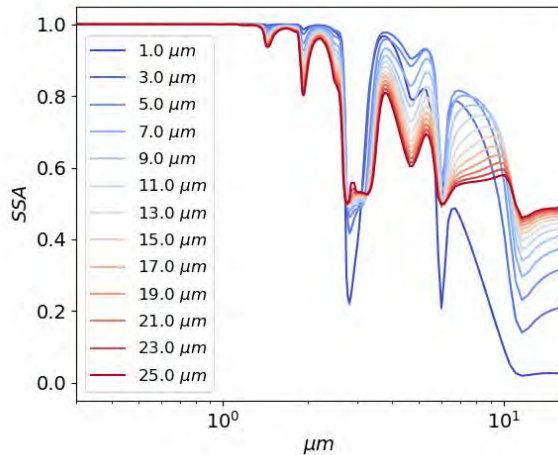
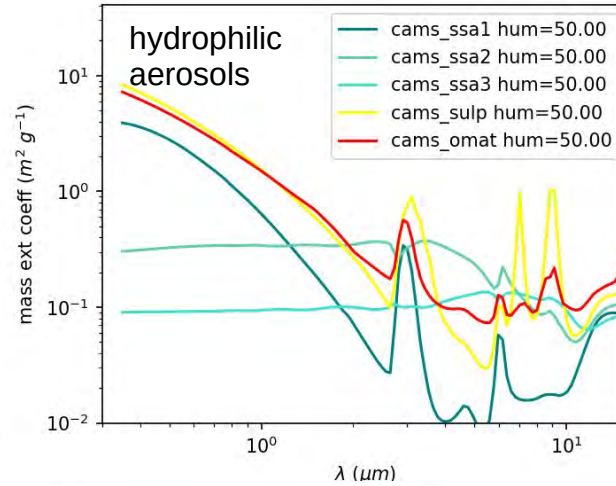
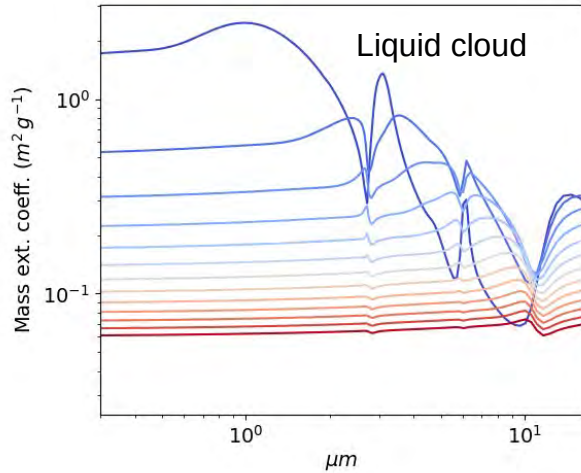


- Used SRF :
 - latest FCI version (EUMETSAT comm.)
 - METimage from SAF NWP
 - SEVIRI (MSG3) from NWP

Updated LBL

- newer MT_CKD 3.2 continuum
- line contribution updated accordingly
- still HITRAN 2012

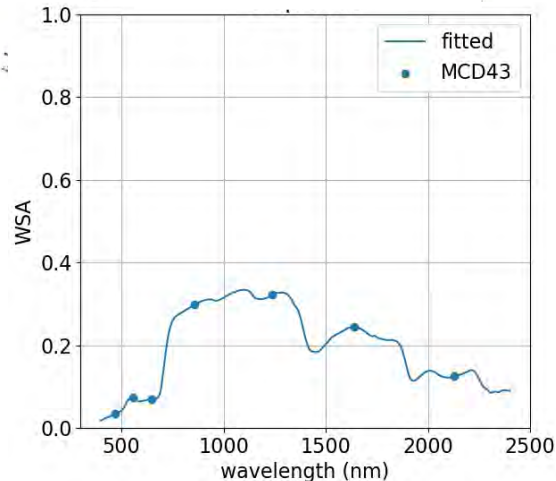
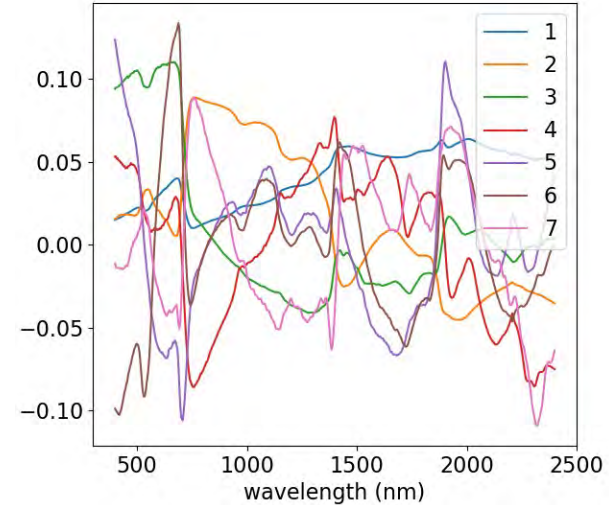
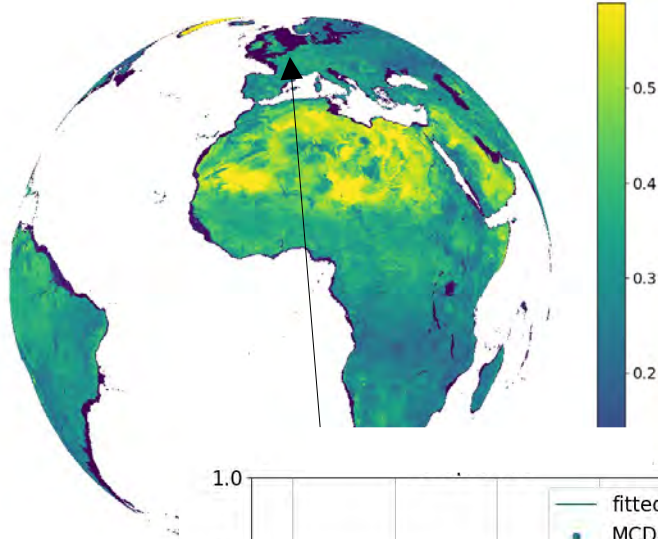
Cloud/aerosol optical properties



- In high spectral res. product:
 - Spectrally varying optical properties used
- Phase 3 ARTDECO side: Integration of all optical properties in SRFs

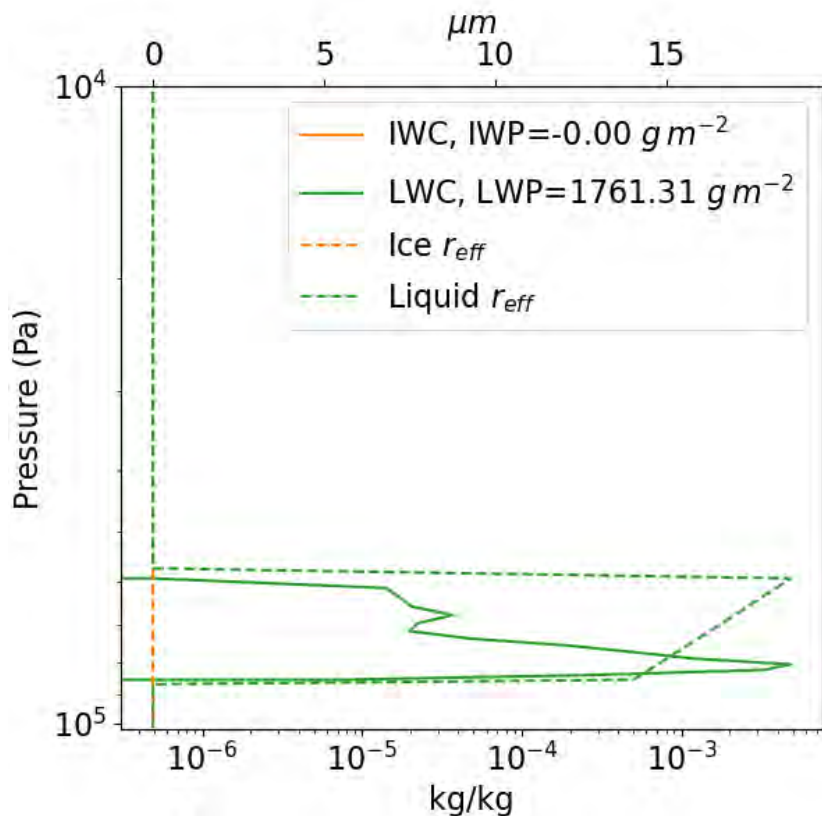
Land spectral parameters

MCD43 ISO band2



- In high spectral res. product:
 - Spectral white sky albedo WSA_{spec} is derived by fitting the 7 PCs to MODIS MCD43 product
 - MCD43 ISO, VOL, GEO are scaled to comply with WSA_{spec}
- Phase 3 ARTDECO side : Integration of PCAs in SRFs

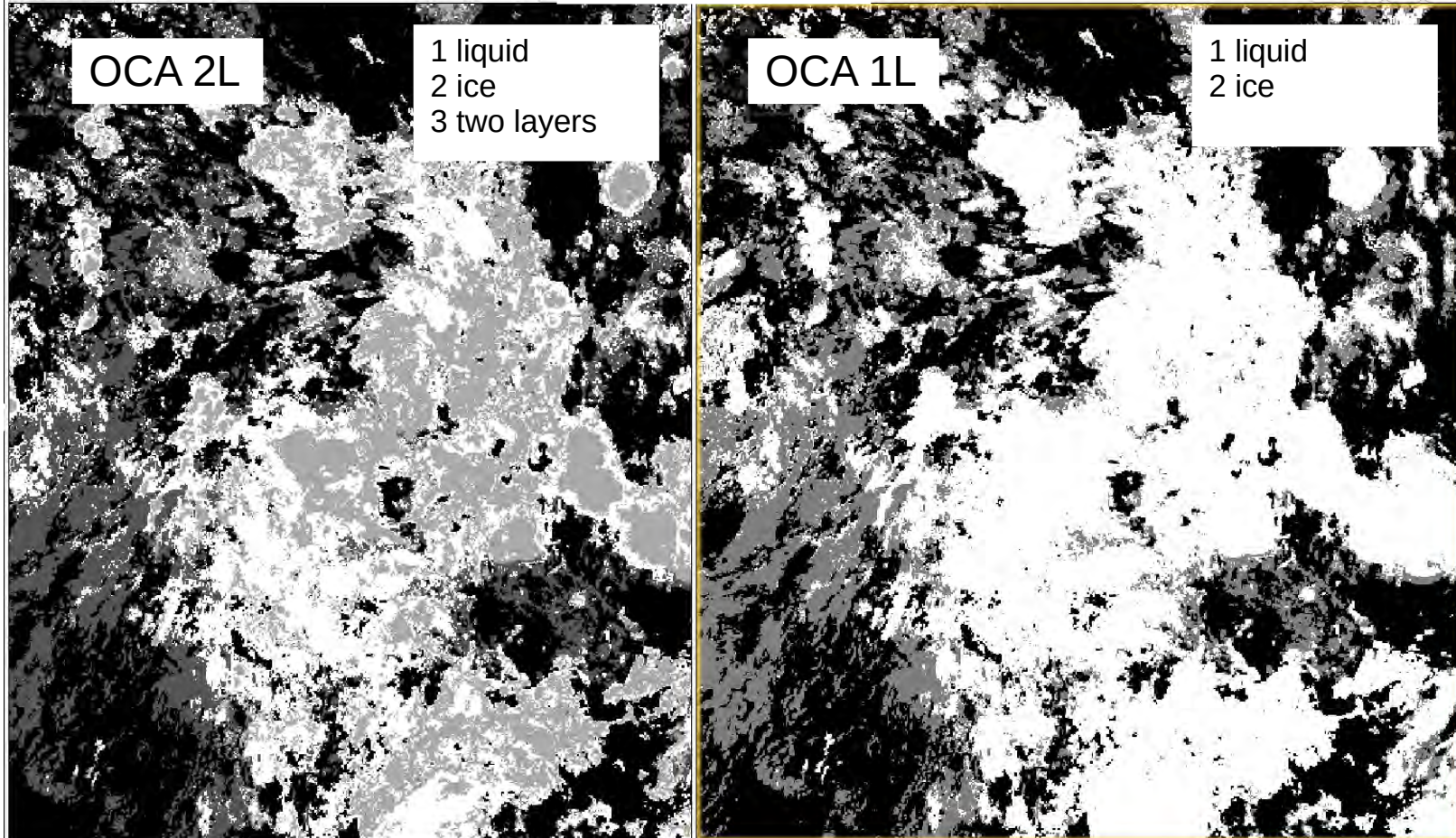
Liquid cloud effective radius



- In high spectral res. product: fixed to 14 microns
- Phase 3
 - Fixed to 14 microns if ice phase present
 - Varying if liquid phase only
 - $\frac{\Delta r_{\text{eff}}}{\Delta z} = \frac{0.7 \times r_{\text{eff,L2}}}{CGT_{\text{MAX}}}$
 - with $CGT_{\text{MAX}} = 7000\text{m}$ (from climatology)
 - $r_{\text{eff,CTOP}} = r_{\text{eff,L2}}$

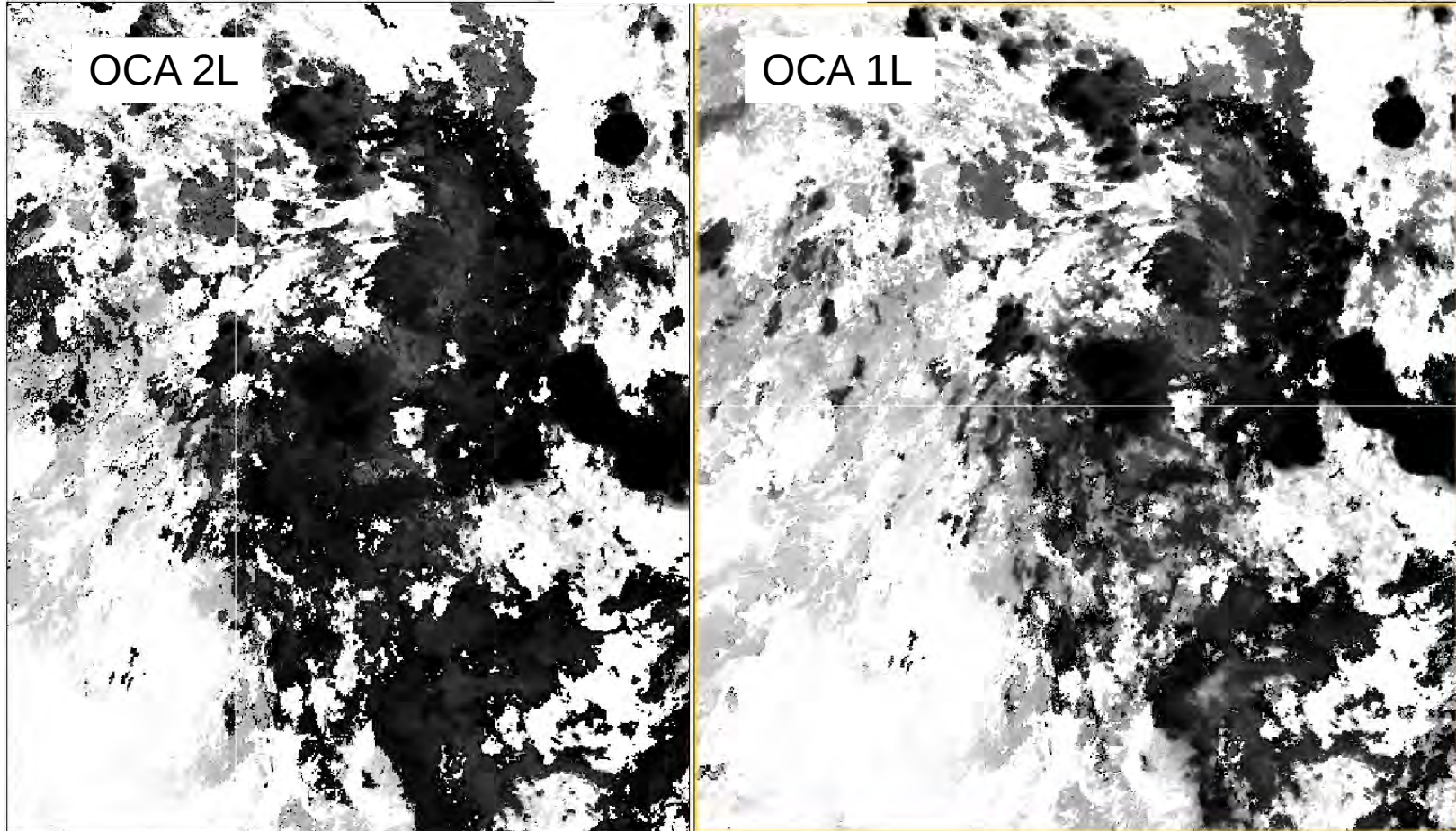
OCA 1L versus 2L

OCA Phase



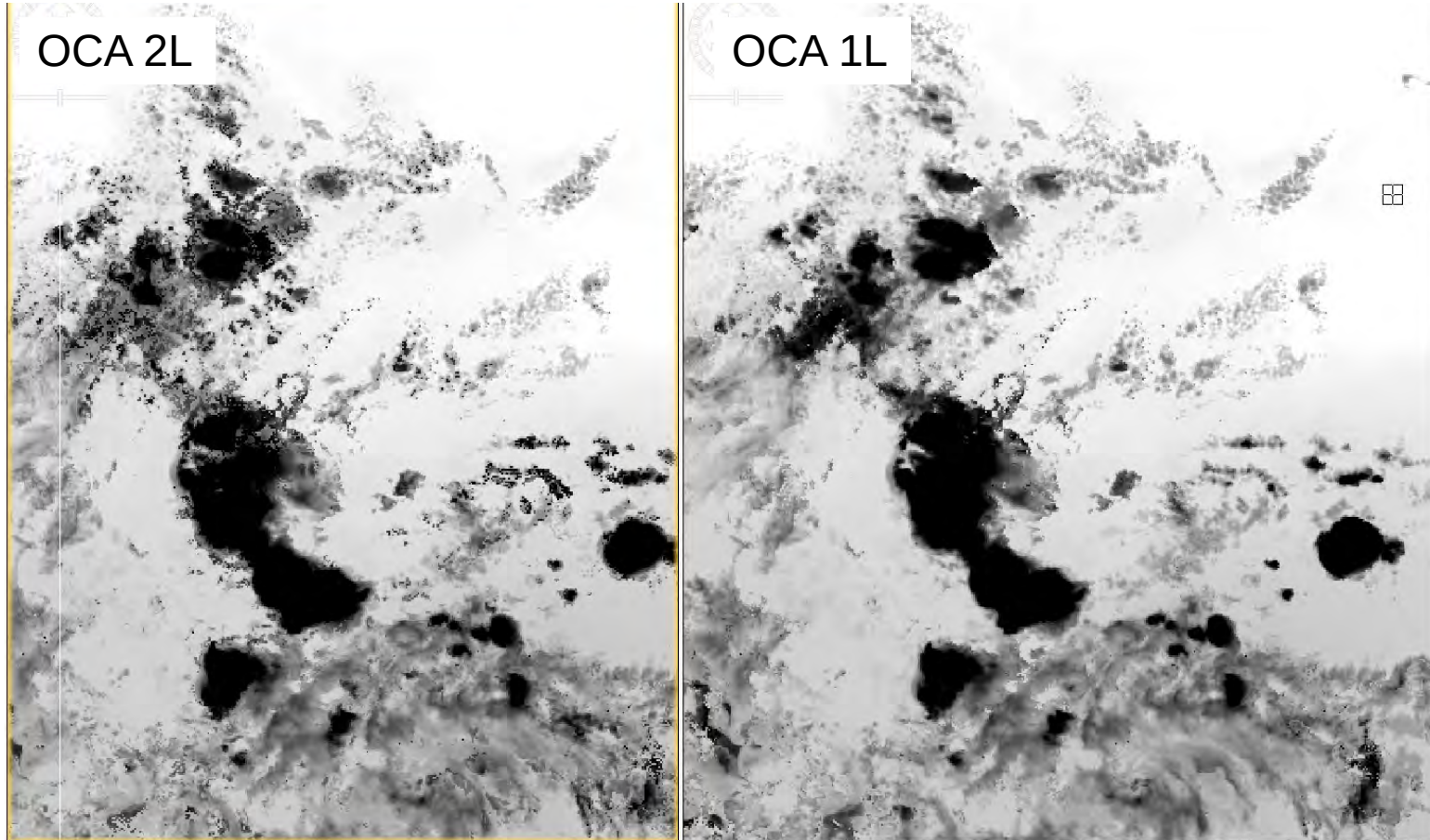
OCA 1L versus 2L

OCA CTP



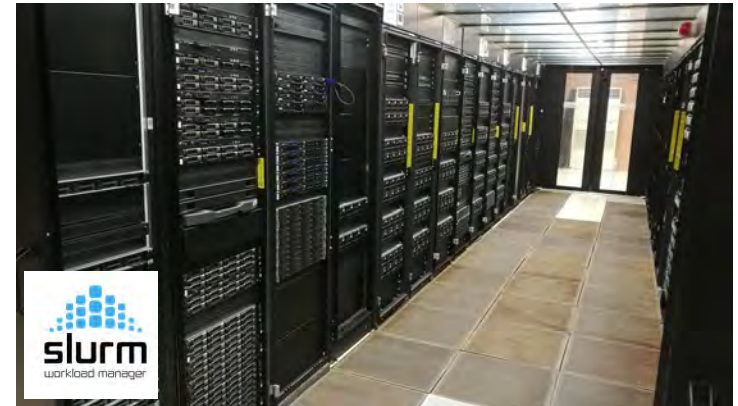
OCA 1L versus 2L

SEVIRI ch 11



CPU demand

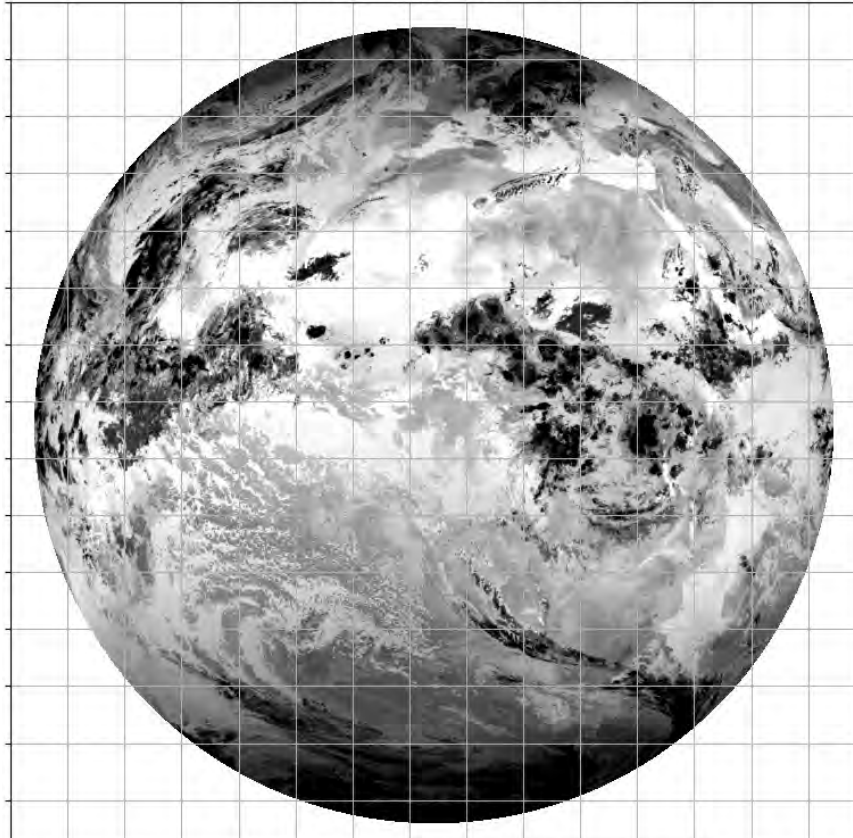
- RTTOV demand is low as compare with ARTDECO
- CPU demand for UV-SWIR part (ARTDECO part)
 - FCI channel 1 to 8 required 102 288 core-hrs
 - SEVIRI channel 1 to 3 required 53 819 core-hrs



SEVIRI ch 4 (RTTOV)

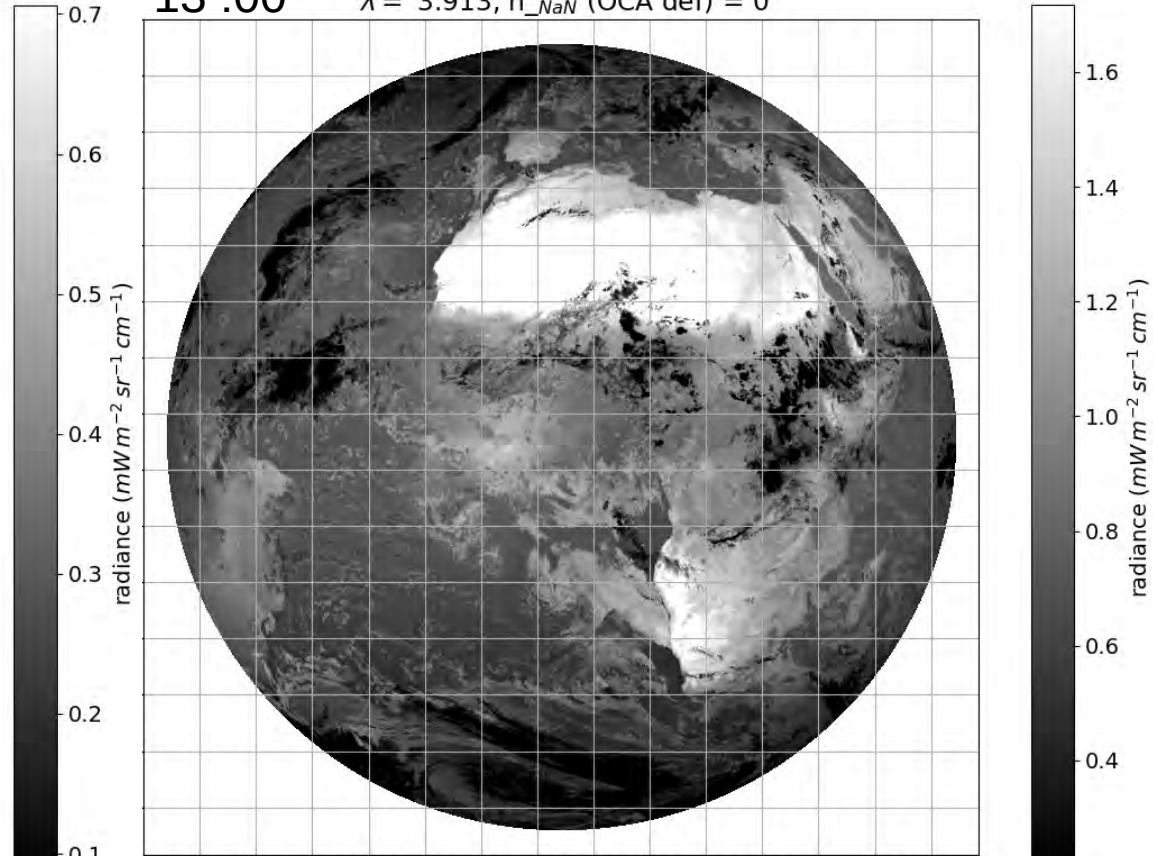
00 :00

$\lambda = 3.913, n_{NaN} \text{ (OCA def)} = 0$



13 :00

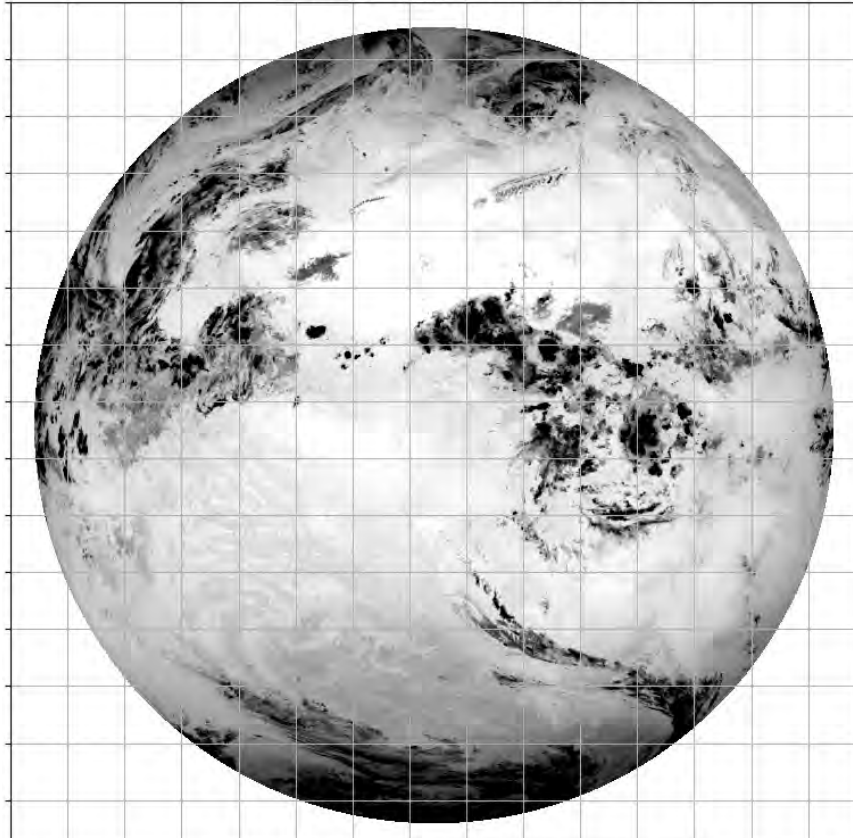
$\lambda = 3.913, n_{NaN} \text{ (OCA def)} = 0$



SEVIRI ch 11 (RTTOV)

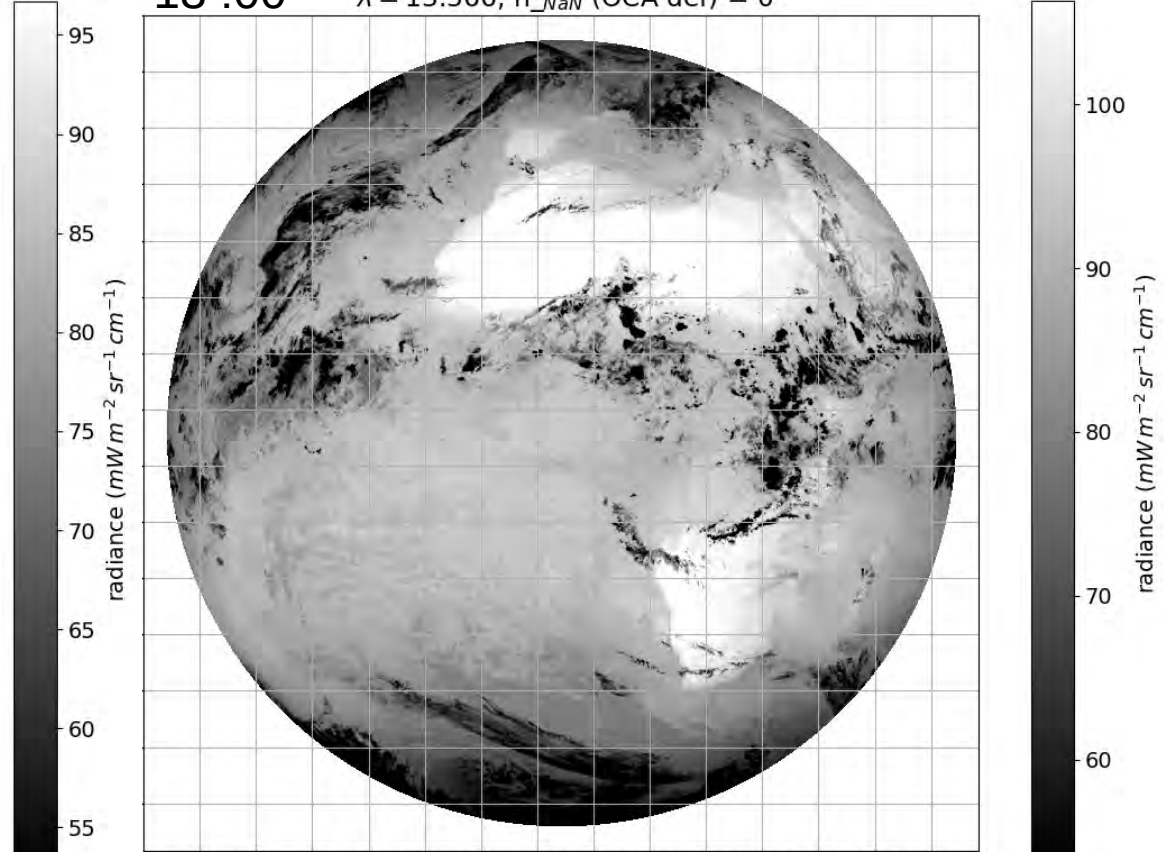
00 :00

$\lambda = 13.366$, n_{NaN} (OCA def) = 0



13 :00

$\lambda = 13.366$, n_{NaN} (OCA def) = 0



videos...

Delivery status

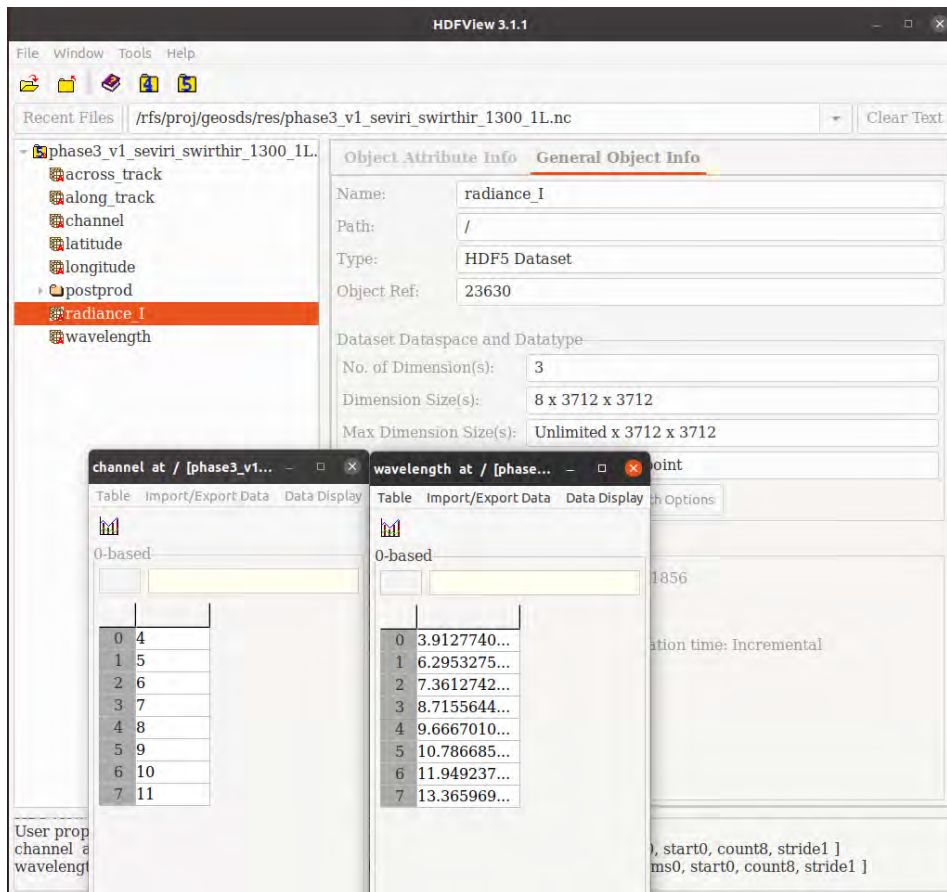
- Phase I

- Reporting
- High spectral res. SEVIRI disk radiance
 - RC 1200
 - RC 1230
- High spectral res. MODIS granules radiance
 - 1115
 - 1230
 - 1305
- Ancillary data
- Aerosols and cloud optical properties

- Phase III

- Reporting
- SEVIRI 24h
 - channel 1-3 (OCA 2L and OCA 1L)
 - channel 4-11(OCA 2L and OCA 1L)
- FCI 24h
 - channel 1-8 (OCA 1L)
 - channel 9-16 (OCA 1L)
- METimage 24h
 - channel 1-11 (OCA 1L)
 - channel 11-20 (OCA 1L)
- Ancillary data
- Aerosols and cloud optical properties

Radiance file format



The screenshot shows the HDFView 3.1.1 interface. The main window displays the 'radiance_I' dataset with the following properties:

- Name: radiance_I
- Path: /
- Type: HDF5 Dataset
- Object Ref: 23630
- Dataset Dataspace and Datatype:
 - No. of Dimension(s): 3
 - Dimension Size(s): 8 x 3712 x 3712
 - Max Dimension Size(s): Unlimited x 3712 x 3712

Two smaller windows are overlaid on the main window, showing data tables for 'channel' and 'wavelength'.

channel at / [phase3_v1...

0-based	
0	4
1	5
2	6
3	7
4	8
5	9
6	10
7	11

wavelength at / [phase...

0	3.9127740...
1	6.2953275...
2	7.3612742...
3	8.7155644...
4	9.6667010...
5	10.786685...
6	11.949237...
7	13.365969...

- For a given instrument
 - 1 file per repeat cycle including the full disk and all channels
 - Separated set of files
 - for ARTDECO production (UV – SWIR)
 - for RTTOV production

Project outreach...

- ~~Living Planet Symposium 23-27 May 2022
Bonn, Germany~~
- International Radiation Symposium, 4-8 July 2022, Thessaloniki, Greece
- Eumetsat Conference, 19-23 Sept. 2022, Brussels, Belgium