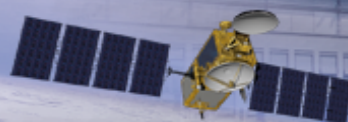


# Current Status of EUMETSAT Operational Winds



Ken Holmlund

Meteorological Operations Division

+ Régis Borde, Marie Doutriaux-Bouchard, Manuel Carranza,  
Greg Dew, Thomas Heinemann

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# Content of talk:

## **Geostationary Satellite status**

MTP/MSG Planning

Major evolutions impacting AMVs since last IWWS

Upcoming Changes

MTG Summary

## **Low earth Orbiting Systems**

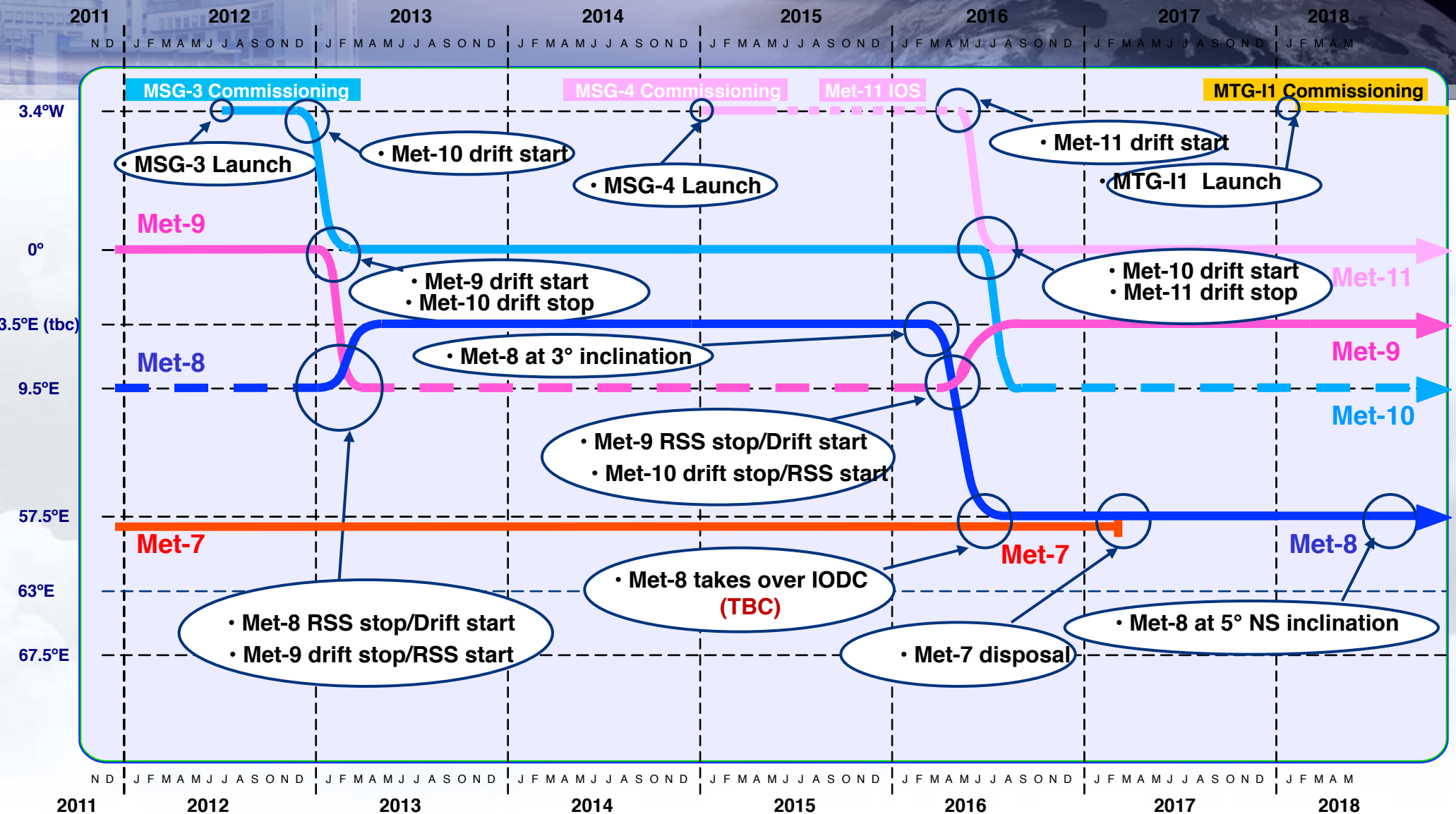
Metop planning

AVHRR Polar Winds

ASCAT Status

Oceansat-2 status

# Meteosat Long-Term Planning Perspective





# The GEO AMV Products

Product	Satellite	Region	Bulletin header	Product times
Clear Sky Water Vapour Winds	Meteosat-7	IODC	IXCN01-IXCN03 IXCS01-IXCS03	Every 1.5 h 00:00,01:30...
Expanded Low Res Winds	Meteosat-7	IODC	IXCN05-IXCN11 IXCS05-IXCS11	Every 1.5 h 00:00,01:30...
High Res Water Vapour Winds	Meteosat-7	IODC	IXCN13-IXCN22 IXCS13-IXCS22	Every 1.5 h 00:00,01:30...
High Resolution Visible Winds	Meteosat-7	IODC	IXCN24-IXCN29 IXCS24-IXCS29	Every 1.5 h 00:00,01:30...
Atmospheric Motion Vectors	Meteosat-9	Africa/Europe	IUVA01-IUVA89 IUVD01-IUVD89 IUVE01-IUVE89 IUVH01-IUVH89 IUVI01-IUVI89 IUVL01-IUVL89	Hourly 00:45,01:45...
RSS AMVs	Meteosat-8	Europe		Every 20 mins 00:20,00:40...



# Recent Changes

## New approach to releases

Before: Single changes introduced per product as 'patches' as required

Now: All changes introduced in limited number (2-3) releases per year

Critical fixes still allowed, but are the exception

Since last IWWS 2 major releases:

1.5.1 Transition to new hardware and operating system

1.5.2 Introduction of new cloud mask and surface emissivity maps

# Release 1.5.1 'SUN MPEF'

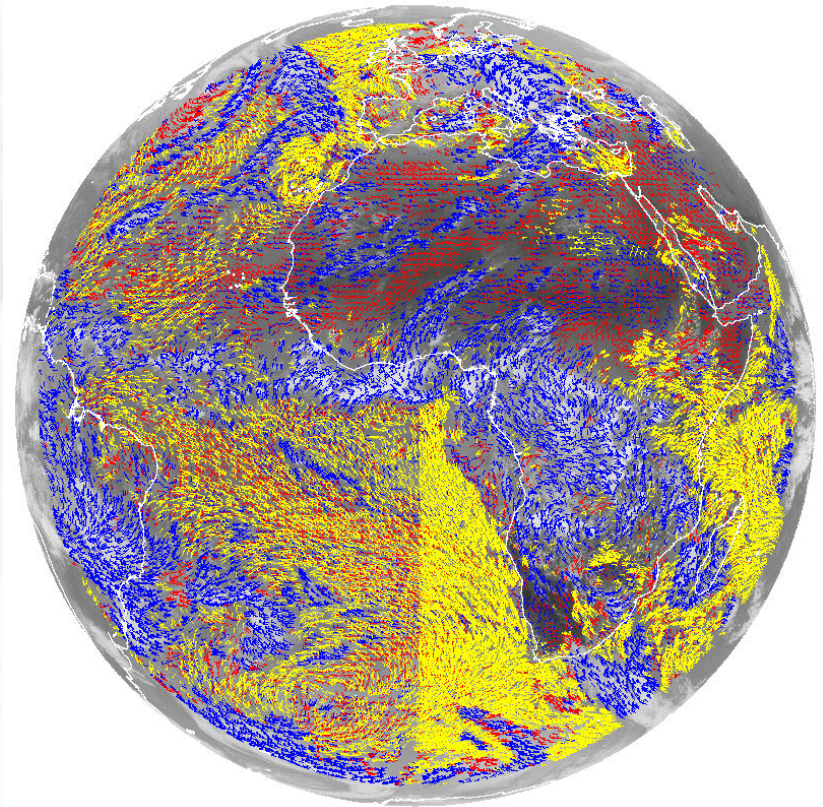
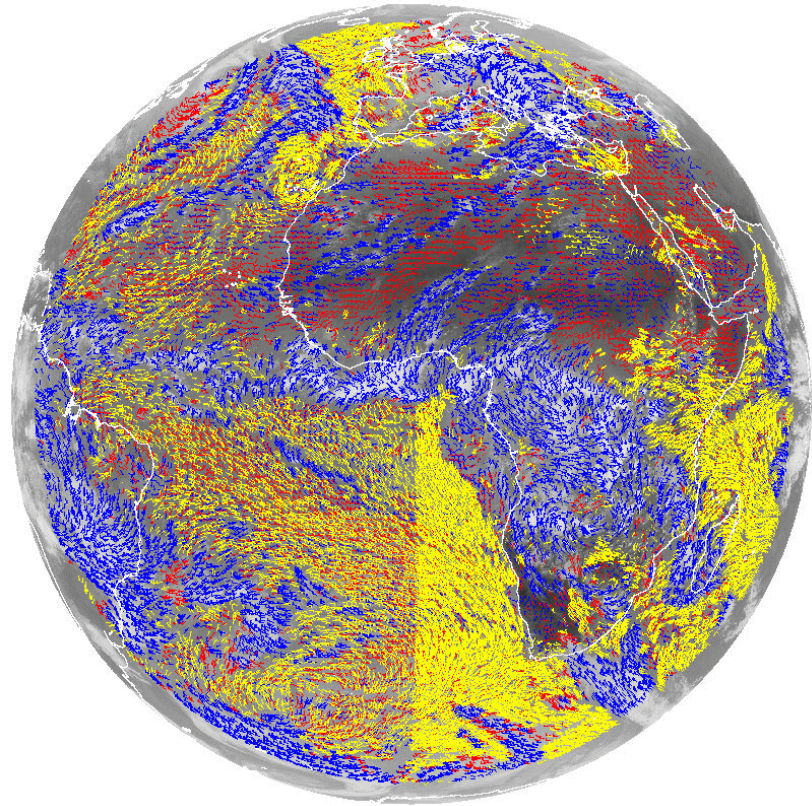
## Introduced: 17 Feb 2011

### Transition from HP-UX to SUN-Solaris - No change in algorithms foreseen

Chan.		n_winds	m_pres	m_fc	m_tvec	m_svec	m_speed	m_qi
02 VIS0.8	OPE_12:45	13853	616.4	46.09	80.14	75.79	10.17	74.75
	VAL_12:45	13876	614.8	45.67	80.32	75.62	10.2	74.7
	Diff. (%)	<b>0.17</b>	<b>-0.26</b>	<b>-0.91</b>	<b>0.22</b>	<b>-0.22</b>	<b>0.29</b>	<b>-0.07</b>
05 WV6.2	OPE_12:45	6571	281.7	51.46	77.26	74.99	19.85	76.15
	VAL_12:45	6561	281.3	51.57	77.13	75.16	19.94	76.17
	Diff. (%)	<b>-0.15</b>	<b>-0.14</b>	<b>0.21</b>	<b>-0.17</b>	<b>0.23</b>	<b>0.45</b>	<b>0.03</b>
06 WV7.3	OPE_12:45	6675	296	51.68	82.3	76.63	18.12	79.5
	VAL_12:45	6665	295.2	51.68	82.51	76.43	18.19	79.5
	Diff. (%)	<b>-0.15</b>	<b>-0.27</b>	<b>0.00</b>	<b>0.26</b>	<b>-0.26</b>	<b>0.39</b>	<b>0.00</b>
09 IR10.8	OPE_12:45	13293	598.4	49.61	69.88	68.27	14.91	66.45
	VAL_12:45	13388	597	49.27	70.41	69.13	14.33	66.99
	Diff. (%)	<b>0.71</b>	<b>-0.23</b>	<b>-0.69</b>	<b>0.76</b>	<b>1.26</b>	<b>-3.89</b>	<b>0.81</b>
12 HRV	OPE_12:45	34272	600.7	41.59	69.25	76.11	11.93	68.65
	VAL_12:45	34332	596.1	41.09	69.37	75.88	11.92	68.78
	Diff. (%)	<b>0.18</b>	<b>-0.77</b>	<b>-1.20</b>	<b>0.17</b>	<b>-0.30</b>	<b>-0.08</b>	<b>0.19</b>



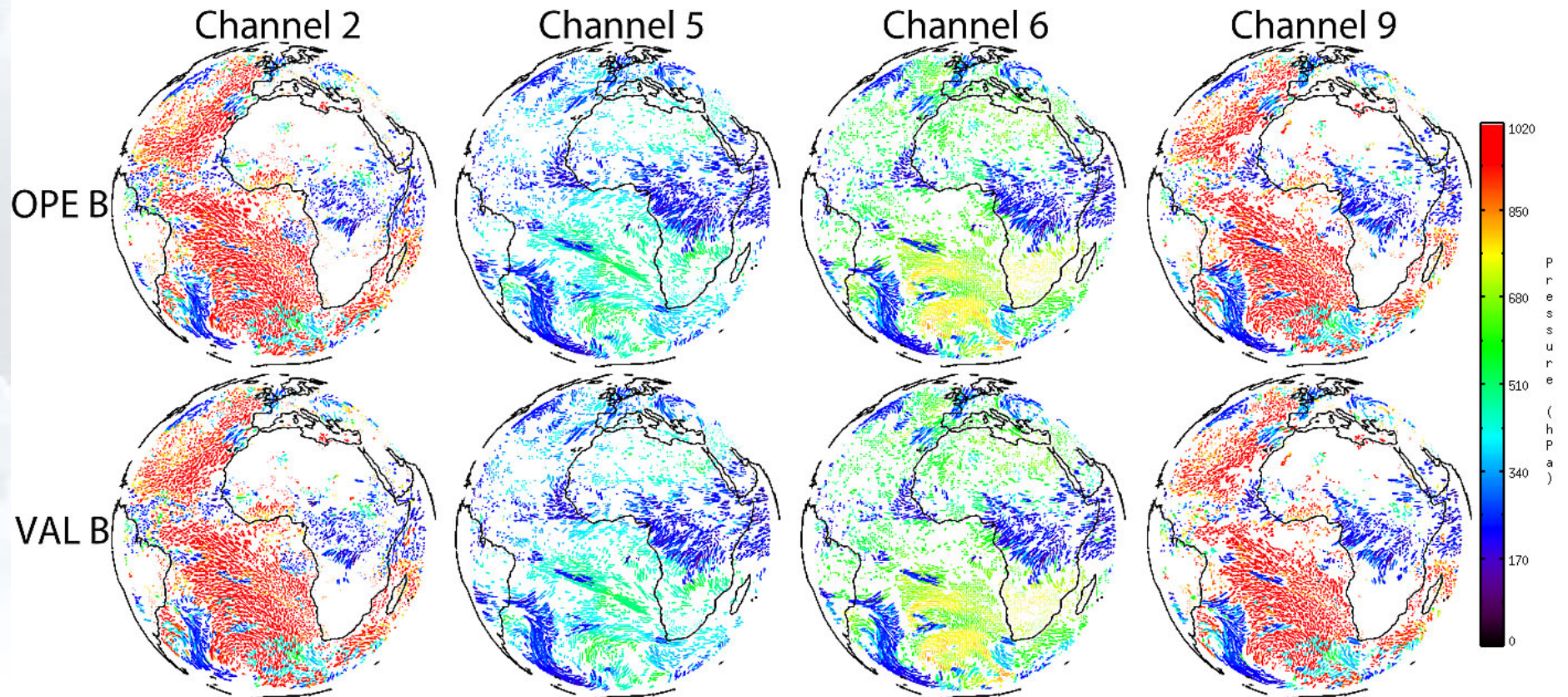
# SUN MPEF verification OPE vs VAL





# Release 1.5.2. CLM and surface emissivity maps

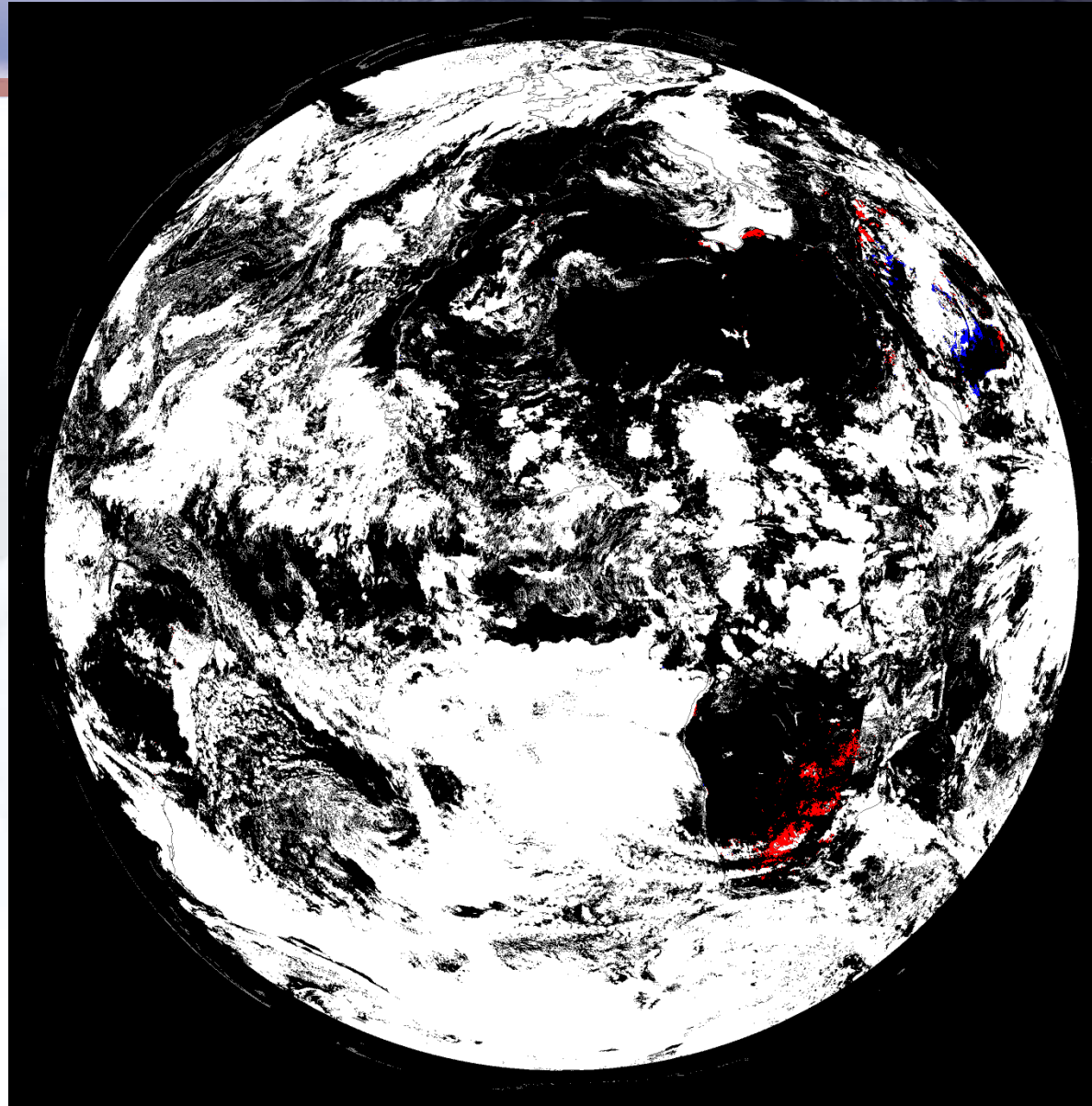
## Intrpoduced: 8 Feb 2012





**Differences between operational and validation  
chain for CLM on  
20.09.2011 15:30 UTC**

**white = clouds in both  
red = OPE only  
blue = VAL only**



# Release 1.5.2. CLM and surface emissivity maps

## 8 Feb 2012

	00:15 UTC		12:15 UTC	
	OPE	VAL	OPE	VAL
<b>Channel 5 (WV6.2)</b>				
All winds	13813	13814	14427	14433
Winds with QI>60	5459	5478	6115	5960
<b>Channel 6 (WV7.3)</b>				
All winds	13957	13933	14513	14532
Winds with QI>60	6707	6663	7413	7508
<b>Channel 9 (IR10.8)</b>				
All winds	13258	13253	13045	12980
Winds with QI>60	7435	7338	7690	7602
<b>Channel 2 (VIS0.8)</b>				
All winds	0	0	13355	13278
Winds with QI>60	0	0	8566	8647
<b>Channel 12 (HRV)</b>				
All winds	0	0	32213	31834
Winds with QI>60	0	0	19007	18911



# Upcoming changes

MSG MPEF Release 1.5.3 planned for summer 2012

- Schedule driven by MSG-3 launch and commissioning
- Initial introduction of OCA (Optimal Cloud Analysis)
- AMV Height assignment based on CCC

MSG MPEF Release 1.5.4 winter 2012/2013

- Increase in derivation frequency and coverage of OCA

MTP release 2013

- Introduction of CCC for Meteosat-7
- In the future transition to MSG s/w
- State of the art
- Consolidation of formats



# The Future: MTG

## Some Key Dates

1. Phase B2/C/D started (C/D mid July 2012)
2. Instrument Data Processing Facility Procurement initialised (L1)
3. MTG I1 launch not before end 2017
4. MTG S1 launch 18 months later
5. MTG I2 mid-2022
6. MTG I3 early-2026
7. MTG S2 early 2027
8. MTG I1 mid-2030



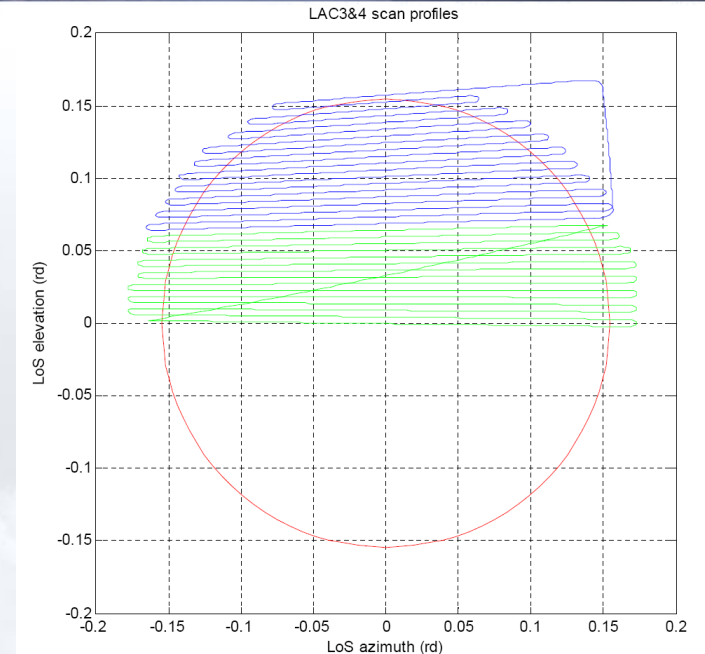
# Flexible combined Imager (FCI)

## Main characteristics:

- Coverage area: Full disc (FDC), FDC/2, FDC/3, FDC/4
- Instantaneous field of view 210 km north-south swath (with 30 km overlap).
- Scanning alternately E-W and W-E
- **Full Disc Coverage in 10 minutes.**
- Calibration: black body, MND solar filter
- Scan mirror with east-west and north-south axes.
- **Spatial Sampling Distance: 0.5, 1.0, 2.0 km**
- Spectral Channels: 4 @ HRFI, 12 @ FDHSI spatial resolutions, 1 fire channel
- Data rate ~65 Mbps, mass ~290 kg, power ~510 W.
- Heritage Europe: SEVIRI.

HRFI = High Resolution Fast Imagery mission

FDHSI = Full Disc High Spectral resolution Imagery mission





# Flexible combined Imager Channels

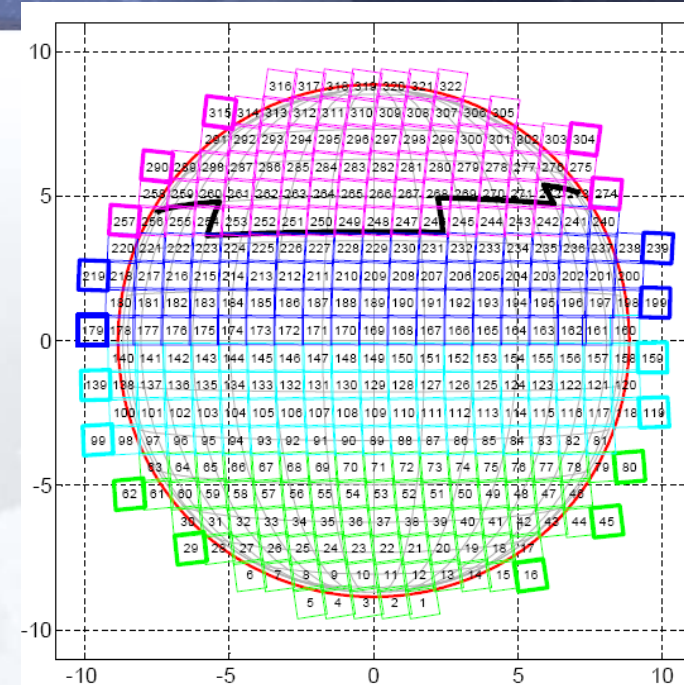
Spectral Channel	Central Wavelength, $\lambda_0$	Spectral Width, $\Delta\lambda_0$	Spatial Sampling Distance (SSD)
VIS 0.4	0.444 $\mu\text{m}$	0.060 $\mu\text{m}$	1.0 km
VIS 0.5	0.510 $\mu\text{m}$	0.040 $\mu\text{m}$	1.0 km
VIS 0.6	0.640 $\mu\text{m}$	0.050 $\mu\text{m}$	1.0 km 0.5 km #1
VIS 0.8	0.865 $\mu\text{m}$	0.050 $\mu\text{m}$	1.0 km
VIS 0.9	0.914 $\mu\text{m}$	0.020 $\mu\text{m}$	1.0 km
NIR 1.3	1.380 $\mu\text{m}$	0.030 $\mu\text{m}$	1.0 km
NIR 1.6	1.610 $\mu\text{m}$	0.050 $\mu\text{m}$	1.0 km
NIR 2.2	2.250 $\mu\text{m}$	0.050 $\mu\text{m}$	1.0 km 0.5 km #1
IR 3.8 (TIR)	3.800 $\mu\text{m}$	0.400 $\mu\text{m}$	2.0 km #2 1.0 km #1
WV 6.3	6.300 $\mu\text{m}$	1.000 $\mu\text{m}$	2.0 km
WV 7.3	7.350 $\mu\text{m}$	0.500 $\mu\text{m}$	2.0 km
IR 8.7 (TIR)	8.700 $\mu\text{m}$	0.400 $\mu\text{m}$	2.0 km
IR 9.7 (O <sub>3</sub> )	9.660 $\mu\text{m}$	0.300 $\mu\text{m}$	2.0 km
IR 10.5 (TIR)	10.500 $\mu\text{m}$	0.700 $\mu\text{m}$	2.0 km 1.0 km #1
IR 12.3 (TIR)	12.300 $\mu\text{m}$	0.500 $\mu\text{m}$	2.0 km
IR 13.3 (CO <sub>2</sub> )	13.300 $\mu\text{m}$	0.600 $\mu\text{m}$	2.0 km



# Infrared Sounder (IRS)

## Main characteristics

- Coverage area: Full disc scanned, but using LAC=FDC/4 zones in a sequence repeated according to a programmed pattern (default for sequence repetition = 6 hours)
- Instantaneous field of view over dwell 640x640km.
- Dwell time: ~10s
- Calibration: black body
- Resampled interferogram transmission to the ground.
- Spatial Sampling Distance:
  - 4 km (sub-sampled by 3x3 on-board)
- In-built Imager = 1km
- Spectral characteristics: 0.625 cm<sup>-1</sup> spectral resolution
  - LWIR: 680 to 1210 cm<sup>-1</sup> (including extended range 680 to 700 cm<sup>-1</sup>)
  - MWIR: 1600 to 2250 cm<sup>-1</sup> (including extended range 2175 to 2250 cm<sup>-1</sup>)
  - Radiometric accuracy < 0.5 K
- Data rate ~150 Mbps, mass ~350 kg, power ~600 W.
- Heritage: IASI (Europe), GIFTS (USA, not flying).





# Metop-A Status

- DHSA: I/O Board back on Nominal side following successful test during PLSOL of 22 Oct. 11
- HRPT:B unit in restricted operation. Complete longitudinal coverage zone active since 18th January 11 (No transmission at higher latitudes in both hemispheres)
- AMSU A1: Channel 7 is declared failed
- MHS Local oscillator swap made 6/12/11 – noise back to original levels – monitoring continues
- A-DCS: frequency complaints - no requests to stop operations.
- GOME throughput loss regarded as instrument "feature".

<b>SVM</b>	AOCS	→	POWER	→	DHSA	→
	COMMS	→	Housekeeping	→		
	Thermal	→	PMCIF	→		
<b>PLM</b>	PMC	→	TCU	→	PCU	→
	PDU	→	RTU	→	FMU	→
	SSR	→	XBS	→		
	A-HRPT	→	LRPT	Off		
<b>INST</b>	ASCAT	→	MHS	→	ADCS	→
	AMSUA1	→	GRAS	→	SARR	→
	AMSUA2	→	GOME	↘	SARP	→
	HIRS	→	IASI	→		
	AVHRR	→	SEM	→		





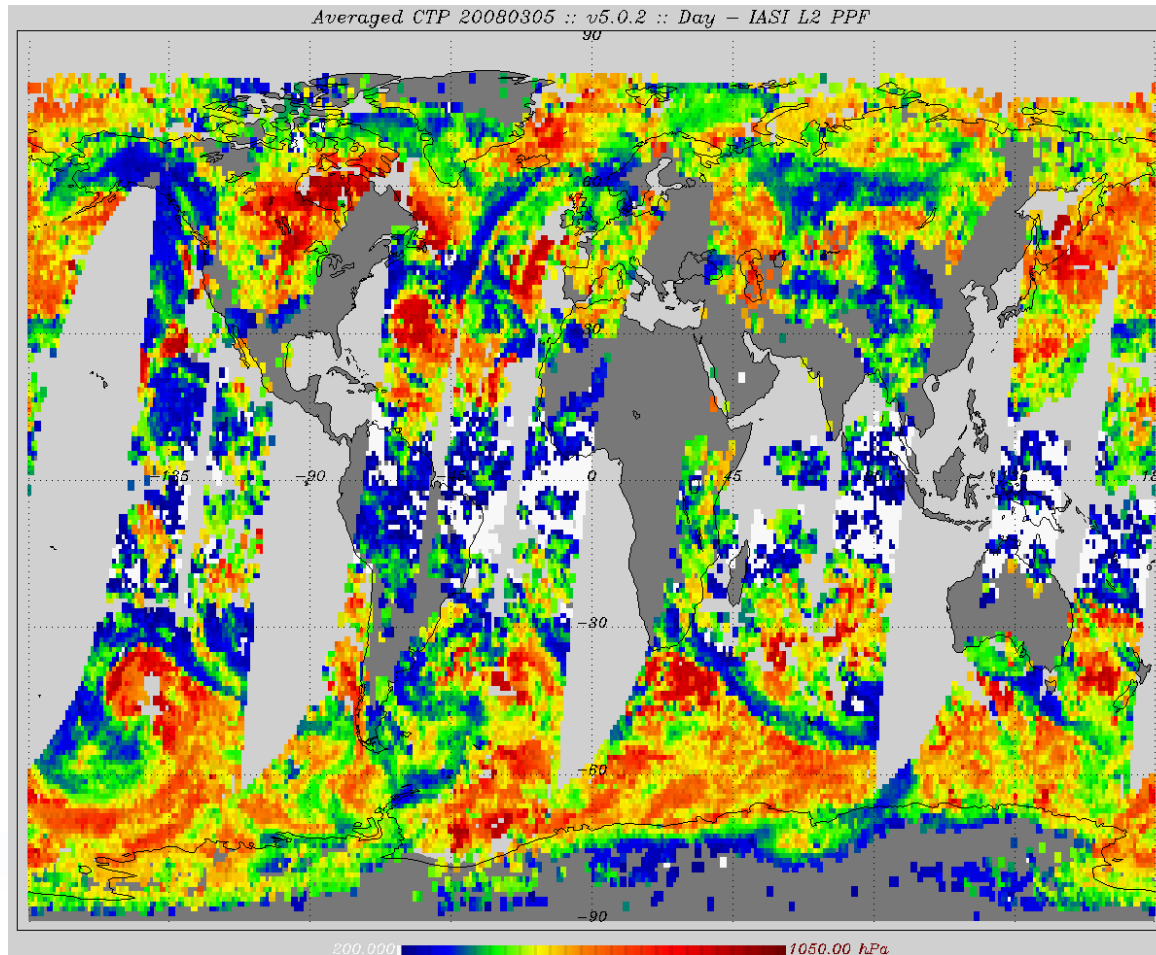
# LEO Operations Near-Term Planning

- 2012:
  - **New EARS Services: IASI, EARS Nowcasting, EARS NPP for ATMS, CrIS and VIIRS**
    - Requires upgrade of EARS Product Processing Nodes
  - **DRAPSO operational dissemination before end of Q1 2012 (more later)**
  - **SARAL Launch May 2012 (TBC)**
  - **Reception and distribution of NPP Global Data**
  - **23rd May 2011 (Baseline): Metop-B launch**
    - **commissioning**
    - **dual Metop operations**
  - **20 September 2012: Metop-B Handover from PRD to OPS and Cal/Val Phase 2 start**
- 2013/2014
  - **Q1 2013: Metop-B to become primary operational satellite (ADA timeliness)**
  - **Parallel Metop-A/B operations anticipated until end of commissioning of Metop-C**
    - **Initially until mid 2013**
    - **Continuation depending on overall health**
    - **Demonstrated positive impact**
  - **Sentinel-3A Launch (baseline Oct. 2013)**
  - **ADA Operational Service Start Q1/2 2014 (all orbits, one satellite).**
  - **Jason-3 Launch (April 2014)**



# Polar winds status

**Polar Winds operational 25/01/2011 (11/08/2010 demo)**



# Metop Polar Wind Change 13/12/2011

=> For detailed analysis see Greg's talk

Use collocated cloud top heights derived from the Metop-A IASI instrument, when available.

Use cross-correlation (Fourier) method instead of Euclidean Distance for tracking

Use cross-correlation contribution (CCC) method to relate the pixels selected for height assignment more closely to the tracking

Introduce parallax correction

Apply a low-level height correction to allow for temperature inversions

Use "full-level", instead of "half-level", ECMWF forecast coefficients to apply to ECMWF forecast data

Amend Earth radius to a more realistic one applicable to polar regions

Amend latitude and longitude output values to represent a mean position (either spatial or CCC method derived) associated with the wind instead of the target centre

Use dynamic repeat cycle time instead of fixed orbit value

Amend height QI test to only compare adjacent heights if the same height method is used, else set to 0 if there is an IASI height assignment fail, or set to 1 if no IASI collocation is found in one of the orbits

Filter out any targets if any part of the search area lies outside the PDU processing area.



# Scatterometer winds

## Metop ASCAT winds

Two services: Global and EARS/Fast extraction service

EUMETSAT derives sigma 0's

OSI SAF derives winds

Changes:

Antarctic Data Acquisition (ADA) McMurdo started 10/06/2011

ASCAT Coastal Product (OSI SAF 02/11/2011)

For further details see Ad's talk

## Oceansat-2

See following slides



# Oceansat-2 Service Update



Slide: 21

- The EUMETSAT contribution the Oceansat-2 NRT System
- A cooperation with ISRO coordinated with NOAA

# User requirements for ISRO OSCAT data products (target/threshold)

## Data on EUMETCast:

L2a (  $\rho_0$ @50km grid)

L2b ( wind @50km grid)

## Data to NOAA:

L1b (  $\rho_0$ @original resolution)

L2a (  $\rho_0$ @50km grid)

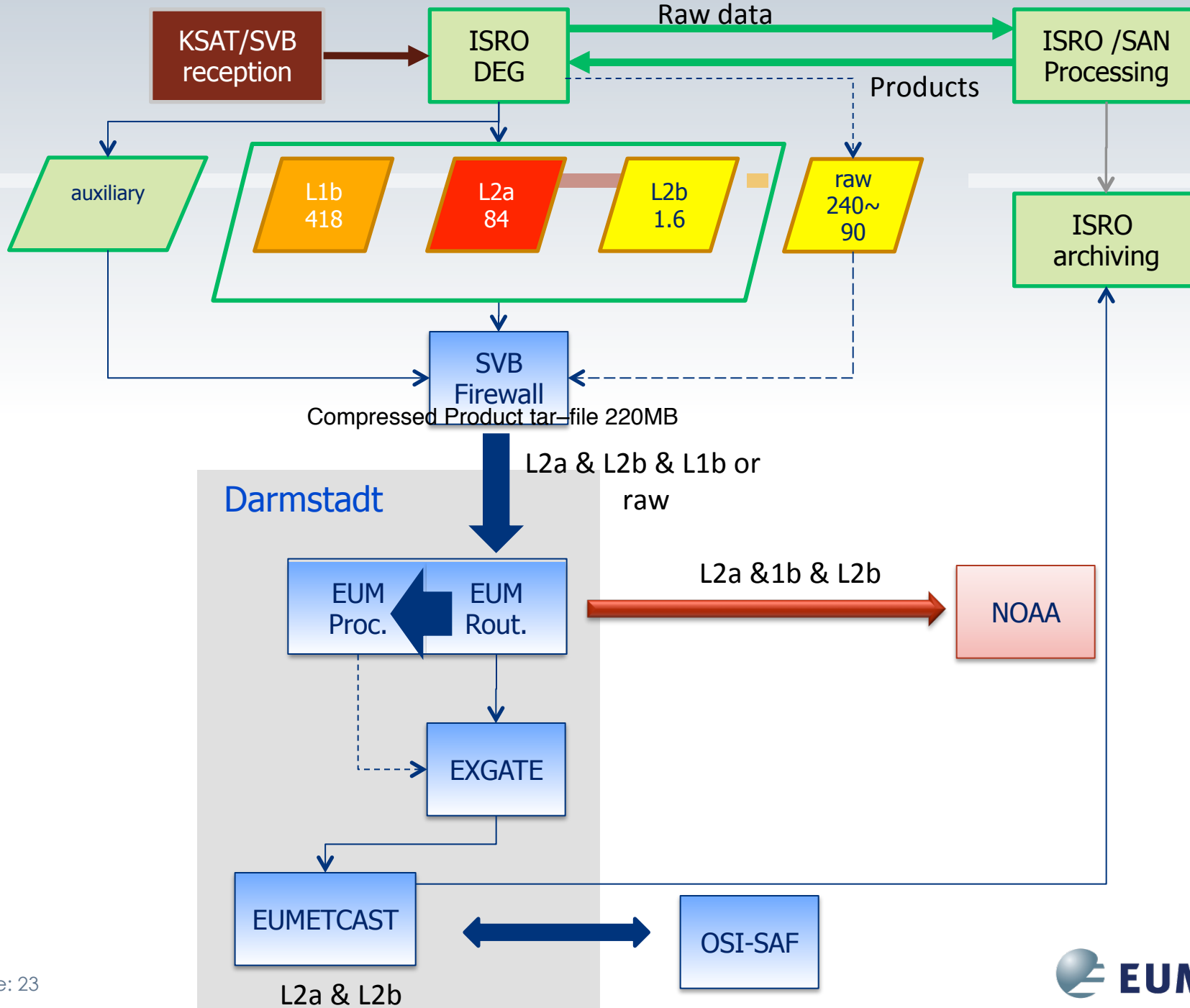
L2b ( wind @50km grid)

## Timeliness :

Overall: 180min / 240 min (150min desirable)

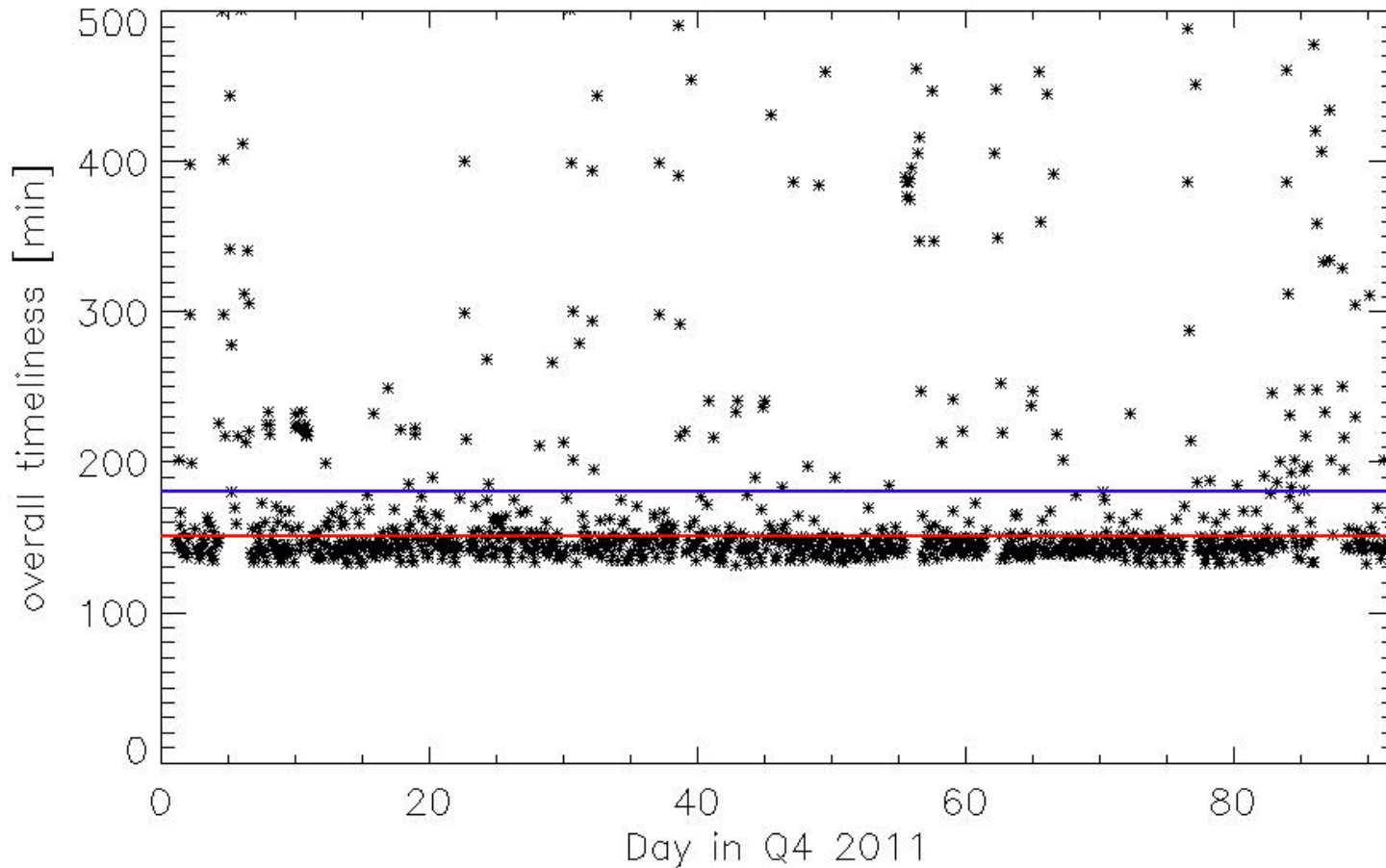
EUMETSAT part: 60min / 120min

Availability : 98% / 85%



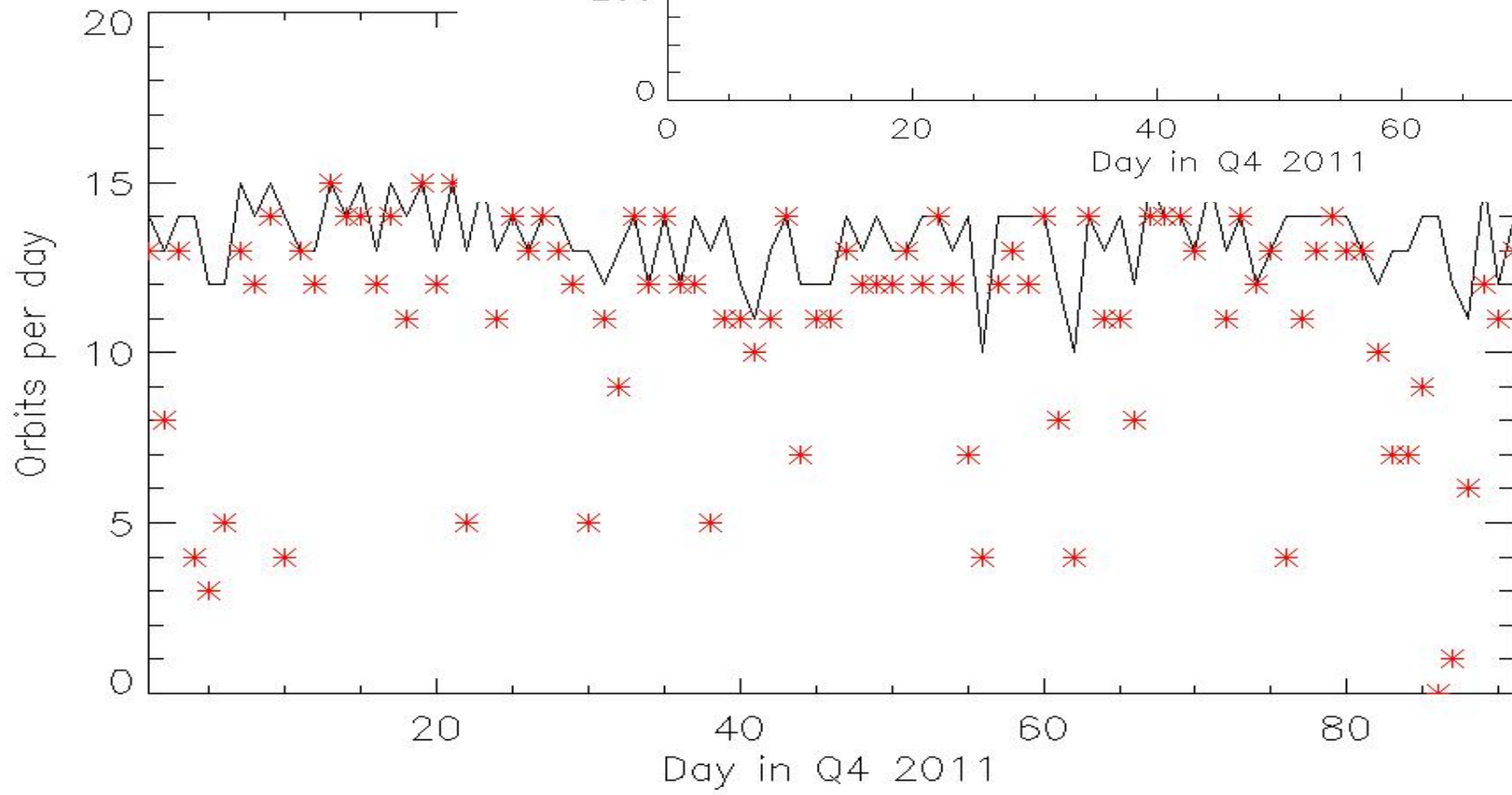
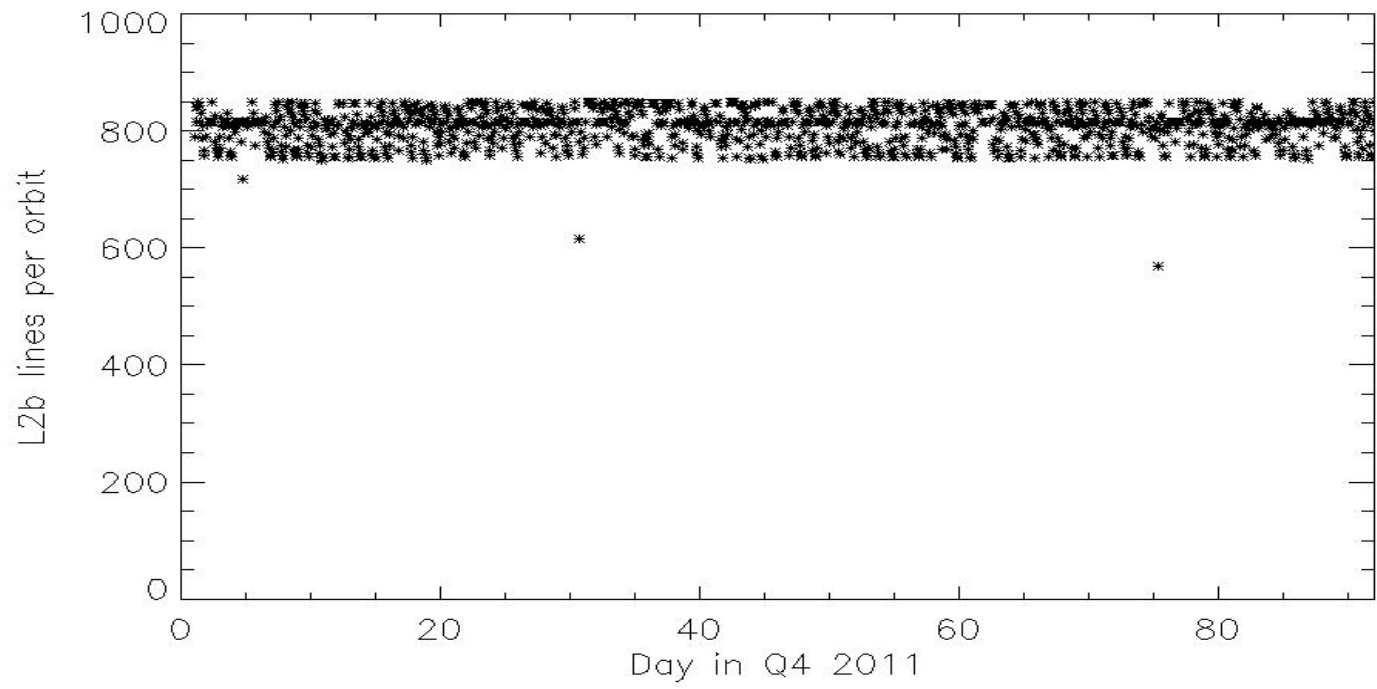


# Data timeliness (Trial dissemination started 7 April 2011)



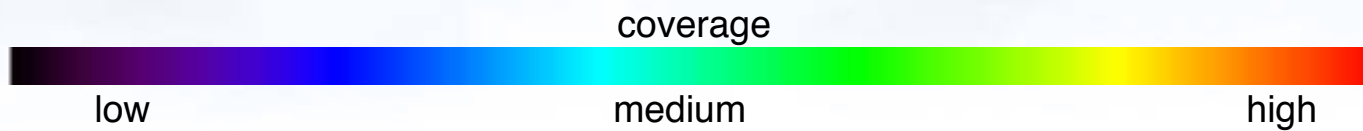
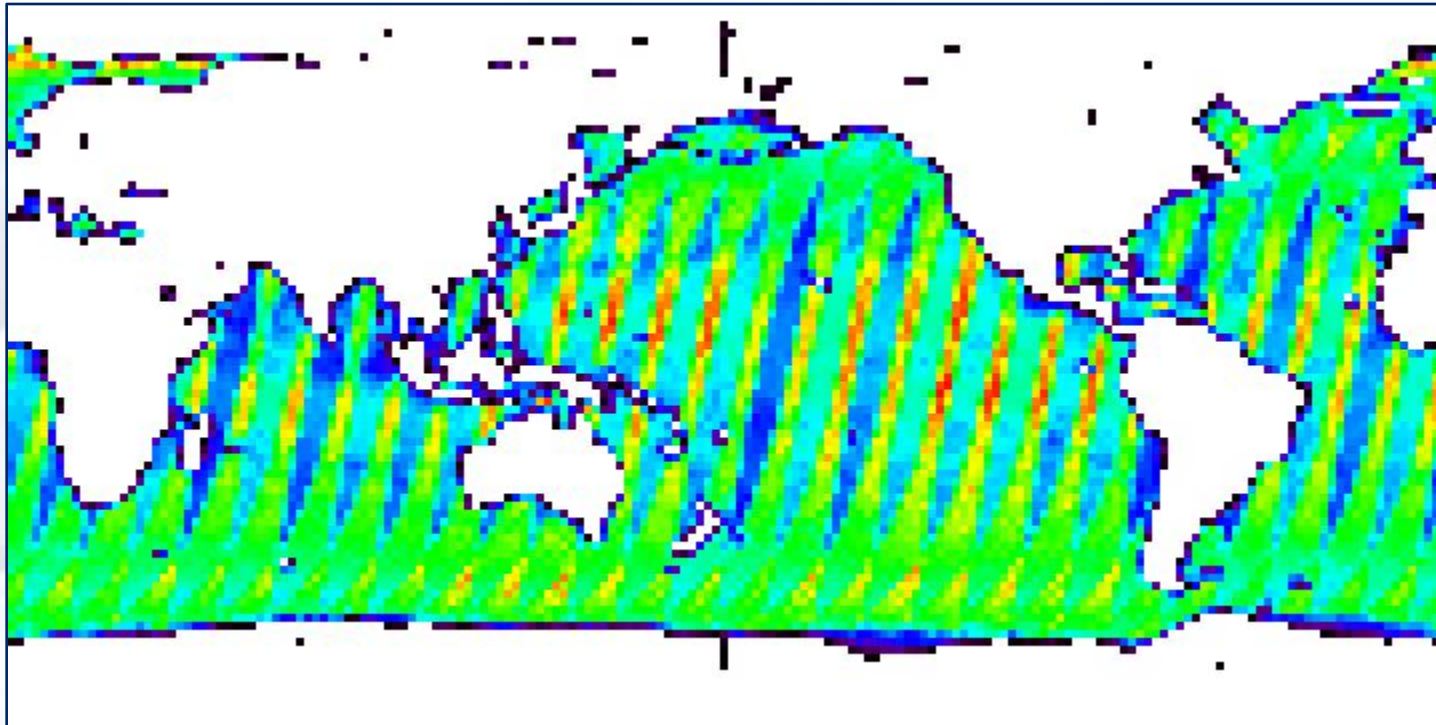


# Data completeness



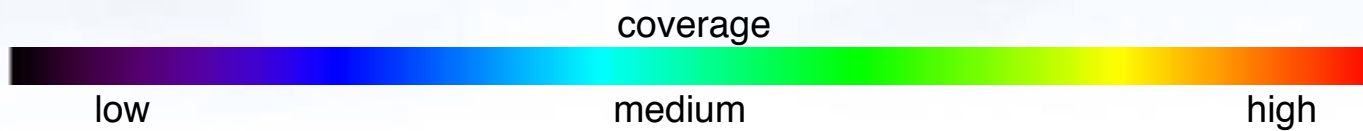
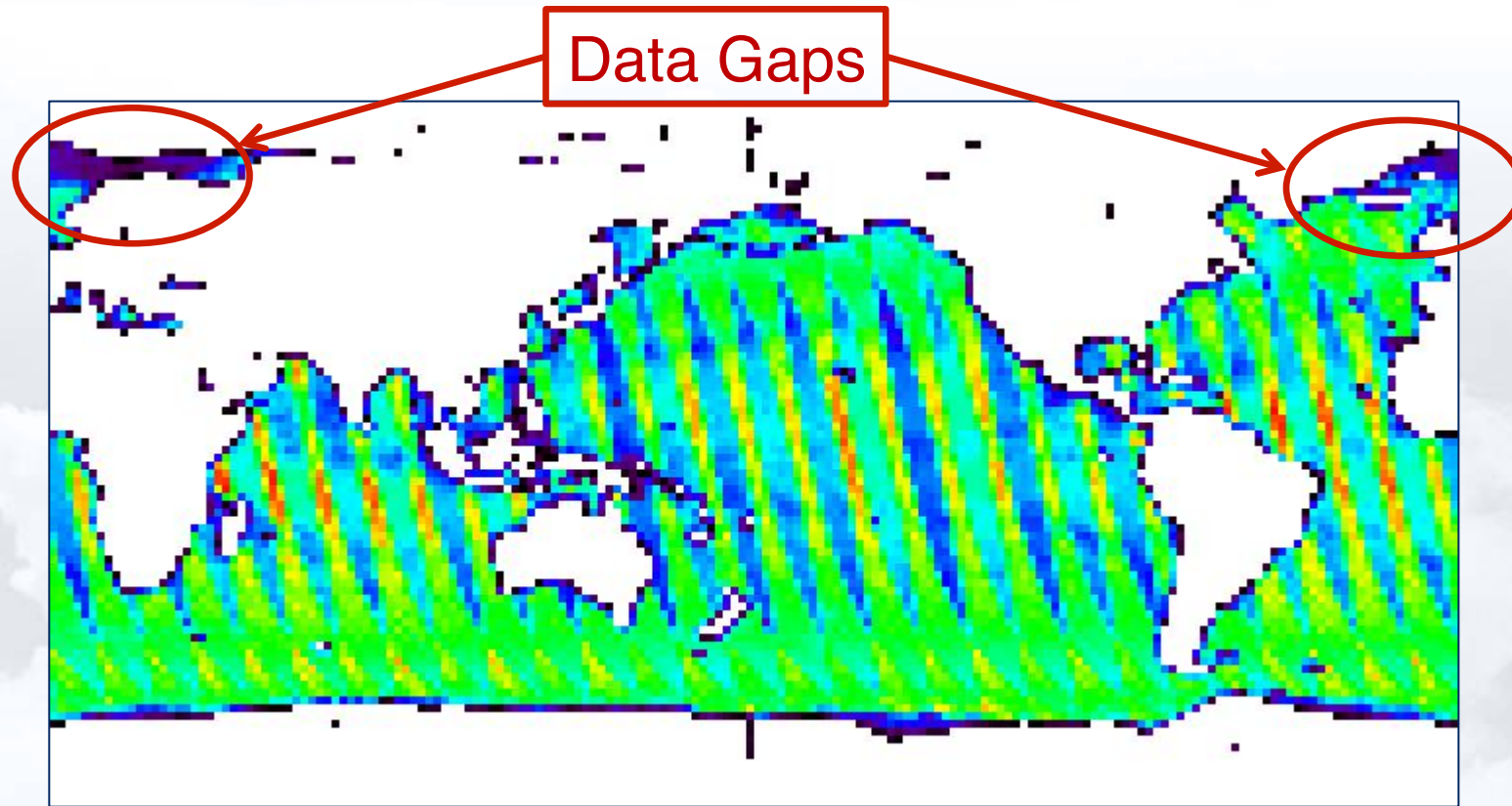


# Orbit completeness, May, descending part of orbits





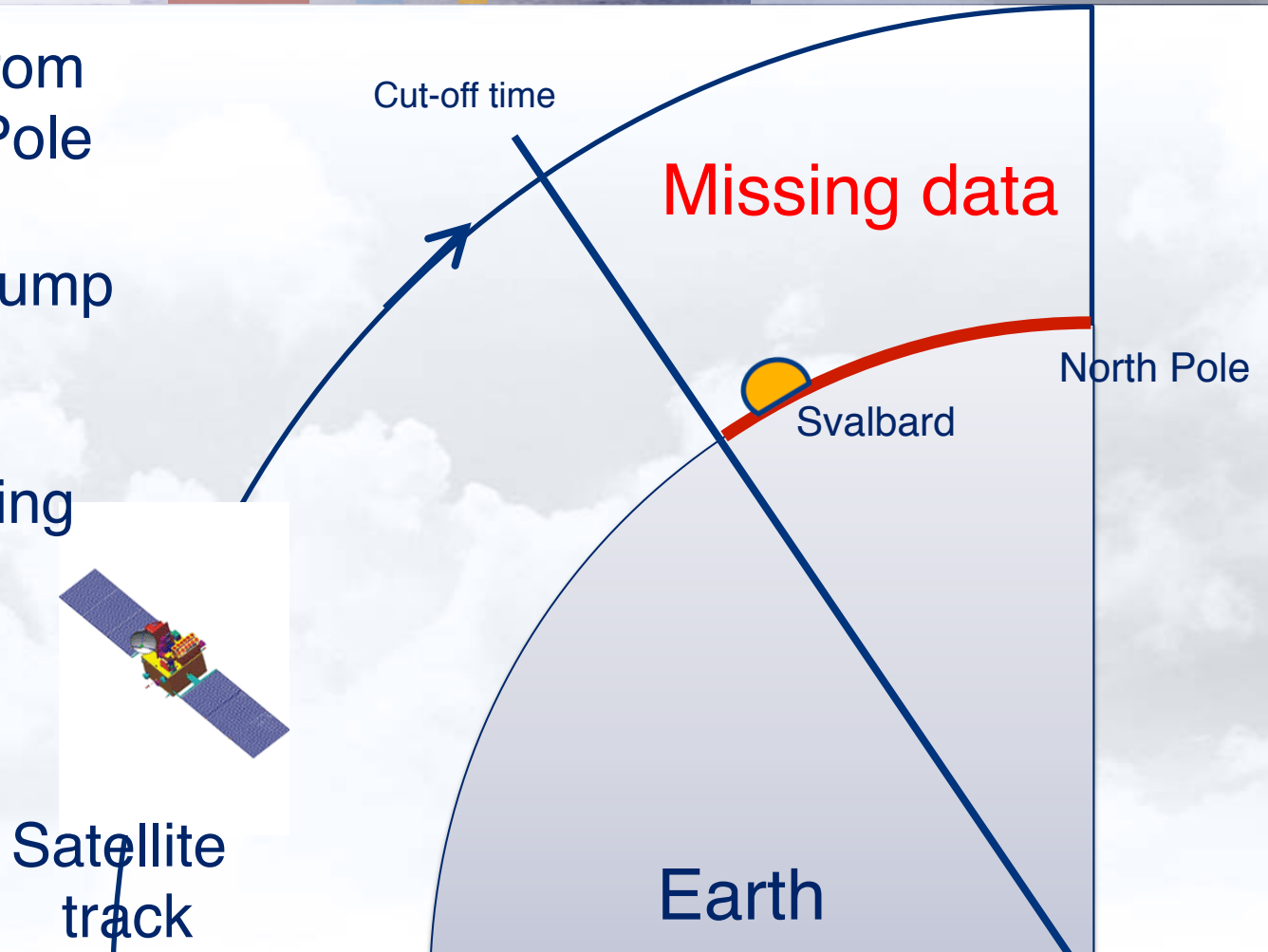
# Orbit completeness, May, ascending part of orbits





# North Atlantic Data Gap (NADAG) problem on ascending node

- Orbits are defined from North Pole to North Pole
- Data cut-off before dump is mandatory
- Dump before reaching North Pole





# L2 products from OSI-SAF (more by Ad)

OSI-SAF developed an independent OSCAT wind processor in order to:

- Perform OSCAT L1 quality monitoring
- Generate winds which show a lower RMSE compared to buoys
- Provide an overall service for users of scatterometer winds in consistent data formats (ASCAT, QuikSCAT, OSCAT), according to EUMETSAT standards

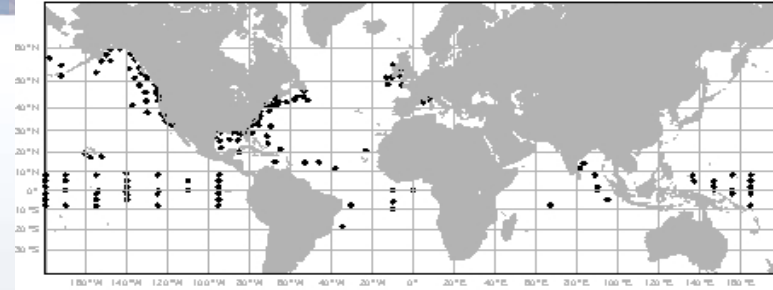
The planned activities of the OSI-SAF are defined in the OSI-SAF CDOP Service Specification Document (to be presented to next SAF-SG).

Requirements of the OSI-SAF OSCAT wind product in BUFR are taken from the original requirements for SeaWinds product (50km resolution, 2m/s wind speed RMSE ...).

OSI-SAF is providing the OSCAT wind products already to several European institutions and received useful feedback (a.o. from ECMWF, UK Met Office, Meteo France and DWD).

Users expressed interest also in a 25km-resolution product. Discussion in OSI-SAF SG and with users is ongoing.

# OSI-SAF/KNMI buoy validation, Oct. 2010 version



OSCAT 50–km product SDs	SD Speed m/s	Direction degree	SD $u$ m/s	SD $v$ m/s
<b>L2B, 130 buoys, collocated OWDP</b>	1.38	22.17	2.29	2.18
<b>OWDP, 130 buoys, collocated L2B</b>	1.25	22.82	2.11	2.06
<b>L2B, collocated OWDP, <math>\geq 6</math> m/s</b>	1.34	19.40	2.41	2.30
<b>OWDP, collocated L2B, <math>\geq 6</math> m/s</b>	1.33	16.67	2.02	2.12

- OWDP winds verify better with buoys than L2B does (in vector RMS)
- Low OWDP winds are relatively poor due to the backscatter PDF biases (this results in a bad  $u$  component, but a very reasonable  $v$  component)



# Open issues

1. Agreement on Joint Operations Procedures and Operations ICD with ISRO
2. Establish operational monitoring and reporting
3. Finalisation of full redundancy
4. Agreement on mitigation of NADAG
5. Solution for problem with automated triggering of ADP software at EUMETSAT
6. Full stabilisation of data processing by ISRO



**Thank you for your attention!!**

**BTW**

**Interested in history?**

**Check the IWWS home page**

**All proceedings from the past workshops online**

**The last proceedings (1 & 2) will be available soon!**