MTG EURD update: Presentation to IRS-MAG

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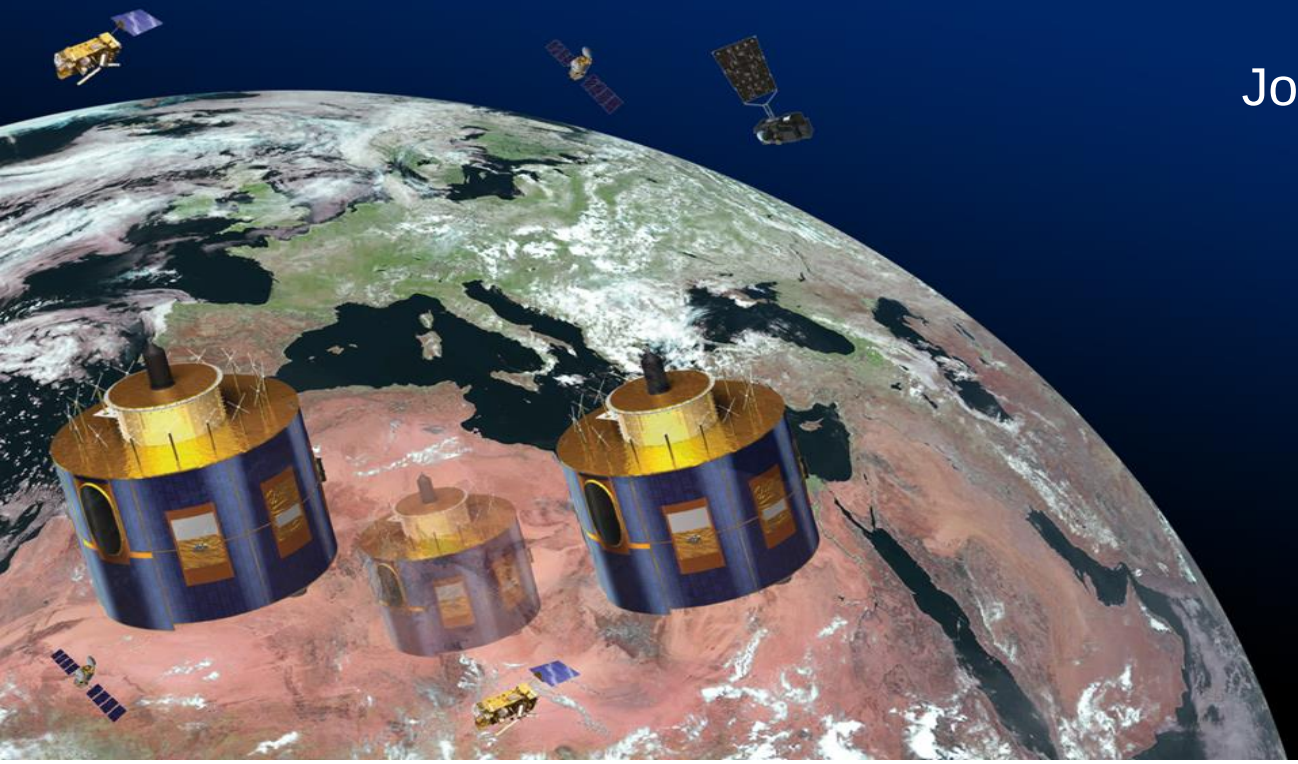
November 2018

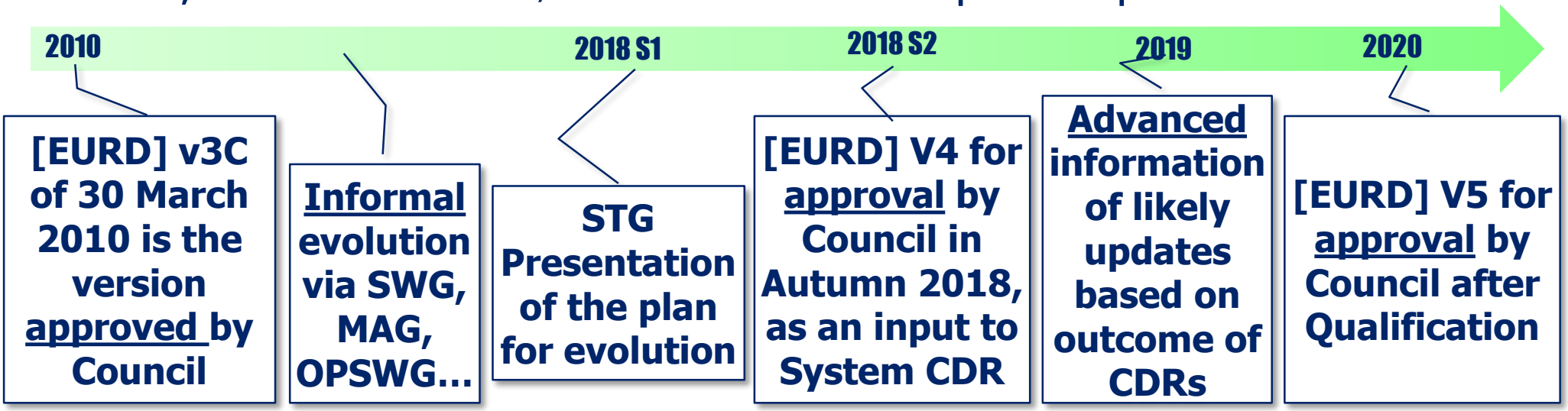


Topics

- Status and roadmap of the EURD updates
- Major changes affecting the IRS
    - Clarifications
    - Additions
    - Improvements
- Operations aspects for IRS
- Conclusions

1. [EURD] evolution : Status and roadmap

- The [EURD] defines the End-User Requirements applicable to the MTG Programme. It is complemented with the definition of the MTG disseminated products in its annex [MTGDIS].
- Main changes have been announced to the DB, up to STG, during Spring 2018:
  - V4, now, as an input to the system CDR: removal of TBD/TBC, harmonisation with evolution, unify the dissemination baseline. Focusing on MTG-I.
  - V5, after the CDRs, with instrument expected performances.



IRS requirements clarified (1/5)

- IRS clarification related to spectral channel interval (IRS-04020)

<table>
<tr><th>ID</th><th>[EURD v3C requirement</th><th>[EURD] v4 requirement</th><th>Category/Justificatio</th></tr>
<tr><td>IRS-04020</td><td>The IRS shall cover the spectral domain from 680 - 2250 cm^{-1} in two spectral bands; a long wave infrared (LWIR) and a medium wave infrared (MWIR) spectral band with the characteristics provided in Table 7.
<table>
<tr><th>Spectral Band</th><th>Status</th><th>Wavenumber range</th><th>Spectral Channel Interval</th><th>Spatial Sampling Distance (SSD)</th></tr>
<tr><td>LWIR</td><td>Extended</td><td>680-700 cm^{-1}</td><td>0.625 cm^{-1}</td><td>4.0 km</td></tr>
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<tr><td>MWIR</td><td>Specified</td><td>1600-2175 cm^{-1}</td><td>0.625 cm^{-1}</td><td>4.0 km</td></tr>
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Table 7: Infra-Red Sounder (IRS) Spectral Bands
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<tr><th>Spectral Band</th><th>Status</th><th>Wavenumber range</th><th>Spectral Channel Interval</th><th>Spatial Sampling Distance (SSD)</th></tr>
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</table>

IRS requirements clarified (2/5)

- To provide further information on the parameter calculation method (IRS-04135)

ID	[EURD v3C requirement	[EURD] v4 requirement	Category/Justificatio
IRS-04135	The IRS spectral sample spectral response function difference between the actual spectral response function and that characterised during spectral calibration averaged over the spectral calibration period shall not exceed a value corresponding to a radiometric error of 50 mK (NEdT@280K) when considering a spatially homogeneous scene and the spectra given by Figure 8. Note: The requirement applies at a 68.26% confidence level calculated over all spectral samples within a spectral band, considering the LWIR and MWIR spectral bands separately.	The IRS *spectral sample spectral response function difference* between the actual spectral response function averaged over one day, and that given by the SRF Estimation model shall not exceed a value corresponding to a radiometric error of 50 mK (NEdT@280K) when considering a spatially homogeneous scene and the spectra given by Figure 10. Note: The requirement applies at a 68.26% confidence level calculated over all *spectral samples* within a spectral band, considering the LWIR and MWIR *spectral bands* separately. This means that, for every *spectral band*, at least 68.26% of the spectral channels of every spatial sample) meet the requirement.	Mission performance clarifi To provide further informati the parameter calculation m

IRS requirements clarified (3/5)

- Radiometric performance (**old** table 9)

LWIR Wavenumber *(cm^{-1})*	*Ref. Signal, Tref*	Radiometric Noise *(NEdT)*	Medium Term Radiometric Stability	Long Term Radiometric Stability	Radiometric Accuracy
700	280K	<0.5K	<0.1K	<0.3K	<0.5K
714	280K	<0.5K	<0.1K	<0.3K	<0.5K
715	280K	<0.4K	<0.1K	<0.3K	<0.5K
729	280K	<0.4K	<0.1K	<0.3K	<0.5K
730	280K	<0.3K	<0.1K	<0.3K	<0.5K
769	280K	<0.3K	<0.1K	<0.3K	<0.5K
770	280K	<0.2K	<0.1K	<0.3K	<0.5K
1100	280K	<0.2K	<0.1K	<0.3K	<0.5K
1210	280K	<0.35K	<0.1K	<0.3K	<0.5K
MWIR *Wavenumber* (cm^{-1})	Ref. Signal, Tref	*Radiometric Noise*(NEdT)	*Medium Term Radiometric Stability*	*Long Term Radiometric Stability*	*Radiometric Accuracy*
1600	280K	**<0.2K**	<0.1K	<0.3K	<0.5K
1810	280K	**<0.2K**	<0.1K	<0.3K	<0.5K
1980	280K	<0.4K	<0.1K	<0.3K	<0.5K
2175	280K	**<0.85K**	<0.1K	<0.3K	<0.5K

IRS requirements clarified (4/5)

- Radiometric performance (**new** table 9)

LWIR **Wavenumber** *(cm^{-1})*	*Ref. Signal, Tref*	**Radiometric Noise** *(NEdT)*	**Medium Term Radiometric Stability**	**Long Term Radiometric Stability**	**Radiometric Accuracy**
700	280K	<0.5K	<0.1K	<0.3K	<0.5K
714	280K	<0.5K	<0.1K	<0.3K	<0.5K
715	280K	<0.4K	<0.1K	<0.3K	<0.5K
729	280K	<0.4K	<0.1K	<0.3K	<0.5K
730	280K	<0.3K	<0.1K	<0.3K	<0.5K
769	280K	<0.3K	<0.1K	<0.3K	<0.5K
770	280K	<0.2K	<0.1K	<0.3K	<0.5K
1040	280K	<0.2K	<0.1K	<0.3K	<0.5K
1118	**280K**	**<0.224K**	**<0.1K**	**<0.3K**	**<0.5K**
1210	280K	<0.35K	<0.1K	<0.3K	<0.5K
MWIR *Wavenumber* **(cm^{-1})**	**Ref. Signal**, **Tref**	*Radiometric Noise***(NEdT)**	*Medium Term Radiometric Stability*	*Long Term Radiometric Stability*	*Radiometric Accuracy*
1600	280K	**<0.224K**	<0.1K	<0.3K	<0.5K
1630	**280K**	**<0.2K**	**<0.1K**	**<0.3K**	**<0.5K**
1750	**280K**	**<0.2K**	**<0.1K**	**<0.3K**	**<0.5K**
1871	280K	**<0.269K**	<0.1K	<0.3K	<0.5K
1980	280K	<0.4K	<0.1K	<0.3K	<0.5K
2134	**280K**	**<0.757K**	**<0.1K**	**<0.3K**	**<0.5K**
2175	280K	**<0.906K**	<0.1K	<0.3K	<0.5K

IRS requirements clarified (5/5)

- IRS level 2 algorithms are now based on IASI algorithmic baseline
  - No change in requirements…
  - …but mentioned in Section 4.2, “IRS Data Acquisition and Generation Services”:

  - “*The development of the IRS Level 2 (L2) product processing chain will capitalise on this very valuable heritage and in particular on IASI operational experience within EUMETSAT*.”

IRS requirements added (1/2)

- Spectral channel interval (IRS-04122) [**see also IRS-04020**]

ID	[EURD v3C requirement	[EURD] v4 requirement	Category/Justification
IRS-04122	• none	• The spectral channel interval (Δν) for both IRS spectral bands LWIR and MWIR shall not exceed the value given in Table 7. Note: The spectral channel interval is given for the resampled spectral channel spacing. The actual spectral sampling of the interferogram will be variable across a dwell coverage dependent on the maximum optical path difference for a spatial sample.	Mission performance clarification related to spectral channel interval

- FWHM: Full Width Half Maximum (IRS-04124)

ID	[EURD v3C requirement	[EURD] v4 requirement	Category/Justificatio
IRS-04124	none	The full width half maximum (FWHM) of the IRS spectral sample spectral response function (SRF) shall be less than or equal to 0.754 cm-1.	Mission performance clarifi Related to spectral FWHM.

IRS requirements added (2/2)

- Integrated energy (IRS-04230)

ID	[EURD v3C requirement	[EURD] v4 requirement	Category/Justificatio
IRS-04230	none	For all IRS spatial samples of the spectral channels in the wavenumber range from 900 cm-1 to 2175 cm-1 the integrated energy (IE) shall be: over a square 4x4 km2 shall be equal to or larger than 67%. • over a square 4x4 km2 equal to or larger than 67%, • over a square 12x12 km2 equal to or larger than 92%.	Mission performance clarifi related to integrated energy

- ASPKE (LAC): absolute sample position knowledge error (IRS-04250)
- ASPKE (dwell): absolute sample position knowledge error (IRS-04255)

ID	[EURD v3C requirement	[EURD] v4 requirement	Category/Justificatio
IRS-04250	none	The absolute value of the IRS *absolute sample position knowledge error* (ASPKE) shall be as given in Table 11 when evaluated over any *LAC zone*.	Mission performance clarifi related to ASPKE (LAC)
IRS-04255	none	The absolute value of the IRS *absolute sample position knowledge error* (ASPKE) when evaluated over a single *dwell* shall be as given in Table 11.	Mission performance clarifi related to ASPKE (dwell)

IRS requirement improvements (1/2)

- Data completeness with a clearer wording and adding the case of contiguous missing soundings (IRS-04080)

ID	[EURD v3C requirement	[EURD] v4 requirement	Category/Justificatio
IRS-04080	An IRS LAC dataset shall be considered complete if all of the conditions below are met: a) The IRS dataset acquisition requirements are met, b) **Less than** 5% of the MWIR spectral soundings in the LAC are declared missing soundings, c) **Less than** 15% of the LWIR spectral soundings in the LAC are declared missing soundings.	The IRS shall provide complete *datasets*. An IRS LAC *dataset* is considered incomplete if any of the conditions below occur: a) The IRS dataset acquisition requirements are not met, b) **More than** 5% of the MWIR spectral soundings in the LAC are declared missing soundings, c) **More than** 15% of the LWIR spectral soundings in the LAC are declared missing soundings. **d) Three or more contiguous *spectral soundings* (in either direction) are declared *missing soundings* and have been declared *missing soundings* for the previous 20 LAC *images*.** **where** **N=3 and M=0.01 in the definition of *missing sounding*** **Note 1: For contiguous *missing sounding* assessment the *spectral soundings* are referenced by *dwell*, *column* and *row*> (s,i,j) between LAC *images*.** **Note 2: The bullet d) intends to cover satellite detector ("permanent") *failure*. Thus for assessing the satellite performance, the whole requirement applies. For the assessment of the *completeness* of the data delivered to the End-Users, the last bullet d) has to be ignored, if it is due to a transient loss of *dataset* during the transmission.**	Mission performance clarifi With a clearer wording and the case of contiguous missi soundings.

IRS requirement improvements (2/2)

- IRS Level 1 timeliness improved from 30mn to 15mn:
  - The goal is to have a timeliness better than 15mn but this remains to be confirmed after system CDR and test by EUMETSAT on the operational configuration
  - Improvement requested in the MTG-IRS MAG Topical Meeting on Level 1 Processing in February 2016 [IRSMAG.L1.Rec.12]
- IRS L2 timeliness improved from 60mn to 30mn:
  - The goal is to have a timeliness better than 30mn but this remains to be confirmed after system CDR and test by EUMETSAT on the operational configuration
  - It was not specified in previous [EURD] release
  - Improvement requested in the MTG-IRS MAG Topical Meeting on Level 1 Processing in February 2016 [IRSMAG.L1.Rec.12]

Other major changes

- SAF products:
  - End to end products timeliness have been added (consistent with [L2SAF]), such that End Users have a clear reference without digging into [L2SAF] (MET-08090).
- Timeliness definitions:
  - The updated table 17 in [EURD] summarises all the timeliness aspects and indicate to what it applies (e.g. repeat cycle, chunk, dwell, flash, message…)

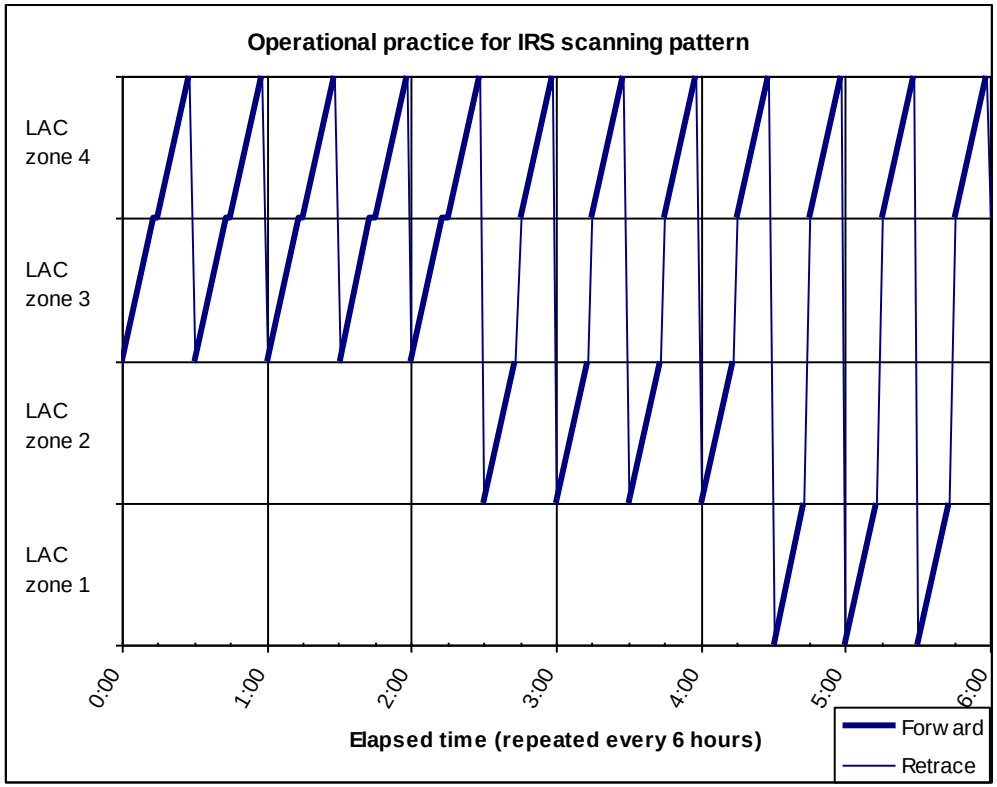
New Table 17 summarising all the timeliness aspects

disseminated dataset	operational availability *(1)*	*End to end* timeliness ***per product are defined in [MTGDIS] within the following constraints (3)***	***Timeliness applies to:***
FCI Rectified *images*	95% with a goal of 98%		**Repeat Cycle**
Full Disc Scanning Service (FCI-FDSS)		15 mn **with a goal of 10 mn**	
Rapid Scanning Service (FCI-RSS)		**5mn with a goal of 2.5mn**	
FCI Level 2 Products	95% with a goal of 98%		**Chunk level when existing otherwise to *Level 2 Product***
>=Daily products (e.g. CRM)		**Half a day**	
>=3-hourly products		60mn	
>=Hourly products		30mn	
< hourly		20mn	
DCP messages and DCP bulletins	95% with a goal of 98%		
Alert messages		3mn with a goal of 2mn	**Message**
Bulletins		10mn with a goal of 5mn	**Last contributing message**
IR Sounder ***Level 1*** *dataset* ***(principal components)***	95% with a goal of 98%	**15 mn (see open issue in Section 1.5)**	**Dwell**
IRS Level 2 Products	**95% with a goal of 98%**	**30mn (see open issue in Section 1.5)**	**Chunk level when existing otherwise to *Level 2 Product***
S4/UVN sounder ***Level 1*** *dataset*	95% with a goal of 98%	**60mn**	**5 mn *data chunk***
S4/UVN sounder *Level 2 Product*	**95% with a goal of 98%**	**60mn (120mn for day 2 *Level 2 Products***	**5 mn *data chunk***
Lightning **Group and Flash product (5)**	95% with a goal of 98%	2mn **with a goal of 30s**	**Flash**
SAF Products	**95% with a goal of 98%**	**See Section 4.5.2**	**Product**
Service Messages	95% with a goal of 98%	60mn	**Message**

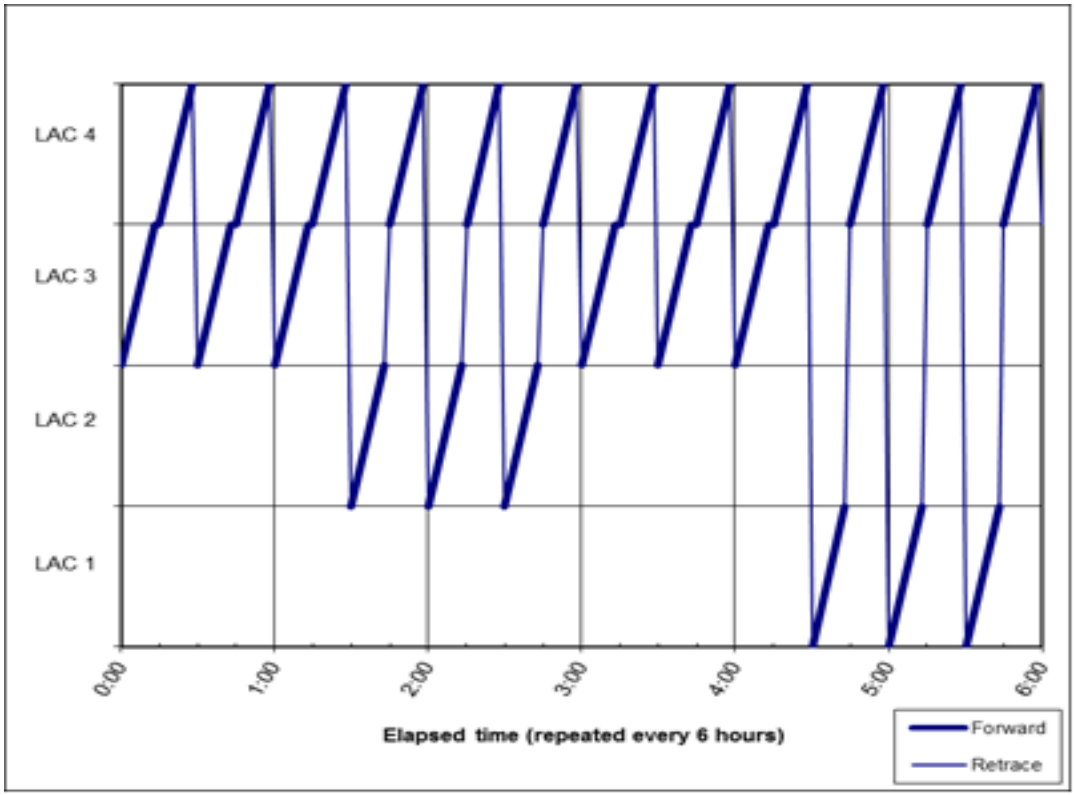
Operations aspects

- Scanning pattern for IRS instrument modified (IRS-04040) as suggested during IRS-MAG of October 2017
- Sequences of quarter of disc scanning repeated every 6 hours:
  - 3 times (LAC3 + LAC4) followed by 3 times (LAC2 + LAC4) followed by 3 times again (LAC3 + LAC4) and ultimately 3 times (LAC1 + LAC4).

BEFORE



AFTER



L1 dissemination baseline

		Previous Level 1 "baselines" existing in parallel		New unified baseline [MTGDIS]
Milestone		Council approved	STG, MAG...	Council Autumn 2018
FCI FDSS	Sat.	LR (jpeg, 30mn)	16 channels NR	**16 channels NR**
	Ter.	16 channels NR	none	none
FCI RSS	Sat	LR (jpeg, 30mn)	4 channels HR	**16 channels NR**
	Ter	4 channels HR	none	4 channels HR (TBC)
LI	Sat	L1b events	none	None (only L2)
	Ter	none	none	none
IRS	Sat	none	300 PCS per pixel	300 PCS per pixel
	Ter	300 PC per pixel	full radiance spectra	full radiance spectra (to global NWP centre, if needed)
UVN	Sat	TBD low resolution	TBD	None (only L2)
	Ter	TBD low resolution	TBD	6+1 products

- As presented in Spring

Table explanation:

- *"Council approved" means as approved by Council at its 69th Council (EUM/C/69/10/DOC/02).*
- *"STG, MAG" means has recommended in various meetings as described in the text above.*
- *"New unified baseline" reflects the outcome of the various recommendation and the presentation made to STG in May 2018.*
- *Sat: EUMETCast satellite, Ter: EUMETCast terrestrial*
- *LR: Low resolution, NR: Normal Resolution, HR: High Resolution*
- *PC Principal Component Scores*

L2 dissemination baseline

		Previous Level 2 "baselines" existing in parallel		New unified baseline [MTGDIS]
Milestone		Council approved	STG, MAG...	Council Autumn 2018
FCI FDSS	Sat	18 products	15 products	15 products
	Ter	none	none	none
FCI RSS	Sat	none	none	none
	Ter	none	none	none
LI	Sat	5 products	5 products	5 products
	Ter	none	none	none
IRS	Sat	3 products on LAC 4	4 products on LAC 4	**4 new products for all LAC/sky**
	Ter	none	1 product	none
UVN	Sat	TBD	TBD	14 products
	Ter	TBD	TBD	1 product

- As presented in Spring

- *"Council approved" means as approved by Council at its 78th Council (EUM/C/78/13/DOC/12).*
- *"STG, MAG" means has recommended in various meetings as described in the text above.*
- *"New unified baseline" reflects the outcome of the various recommendation and the presentation made to STG in May 2018.*
- *Sat: EUMETCast satellite, Ter: EUMETCast terrestrial*
- *LR: Low resolution, NR: Normal Resolution, HR: High Resolution*
- *LAC. Local Area Coverage (the earth disc is split south to north in 4 LAC)*

Conclusion

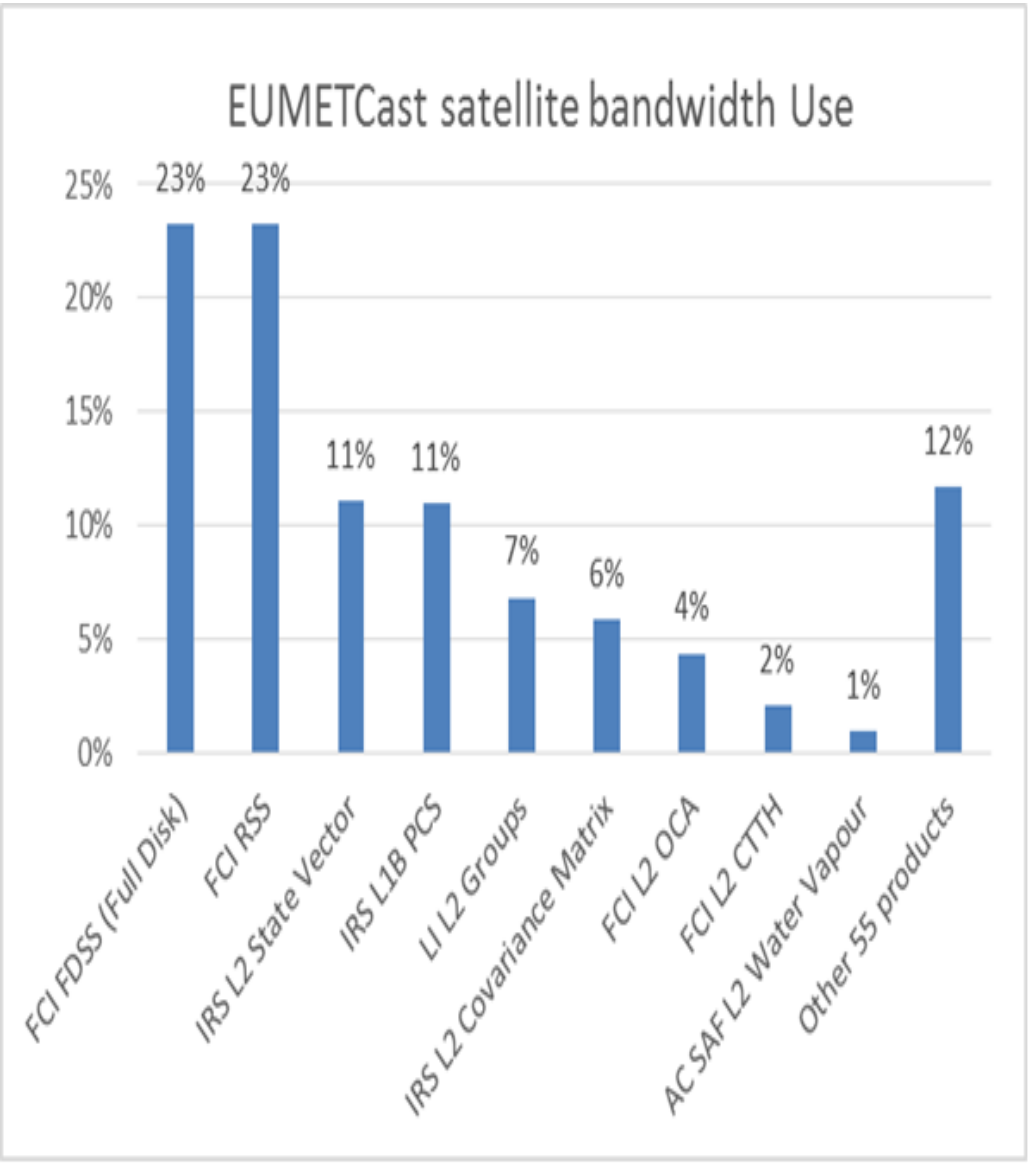
- The updated EURD has been presented to SWG/OPSWG and STG in September and October 2018, respectively

- It will seek a final approval by Council in December 2018

- Next update is V5, to be generated after the CDRs, with instrument expected performances available.

Backup

5. EUMETCast satellite Europe: Dissemination drivers



- FCI level 1 represents almost half of the bandwidth
- The 9 biggest products are shown by decrease bandwidth usage,
- The 55 smallest products represents less than 12% of the bandwidth
- The overall bandwidth is around 100Mbps,
- The 4 High Resolution channels (HR) represent the same data rate as the 16 Normal Resolution (NR) channels, consequently they are available for RSS on EUMETCast terrestrial.
- Adding the HR channels to EUMETCast satellite for RSS would add 23% to the bandwidth (also valid for FDSS).

2. [EURD] requirements evolutions

- All the changes are identified in the change record of the [EURD].
- Each modified requirement has the version 4 indicated after the Requirement ID.
- ➢ **The details of all the changes to the requirement are provided in the new Annex F of the [EURD] with:**
  - a comparison of the old requirement text vs new text
  - an explanation of the change and its rationale
- The changes concerning the [EURD] requirements can be classified as :
  - major when affecting the scope of the requirement, a mission performance or a missing instrument performances. See next slides
  - Other changes relating to the introduction of [MTGDIS], the reuse of corporate multi-mission functionalities (e.g. internet), rewording for various reasons without change of scope
- An overview of the major changes is presented in the next slides.

2. [EURD] structure and evolution overview

1. Introduction, updated:
   - To describe the way to identify the requirements which have changed
   - To provide a list of the residual open issue and assumptions
2. Mission overview, updated to reflect the latest information
3. System wide requirements: no requirement evolution
4. Data acquisition, generation and archiving services: updated/completed with:
   - Latest knowledge on the instrument performances from the Intermediate Design Checkpoints (IDCP).
   - With the latest information available from ESA for UVN.
   - SAF performances allocation have been added.
   - Refers now to [MTGDIS] for all level 1, level 2, and SAF products.
5. Near real time data dissemination and relay service, updated:
   - To reflect the new goal for timeliness (LI, IRS).
   - The requirements for data retrieval of data via internet being a re-use of the Multi Mission corporate functionalities are deleted being a duplication of the data retrieval services addressed in the next chapter.
   - Refers now to [MTGDIS] for all level 1, level 2, and SAF products.

2. [EURD] structure and evolution overview

6. Data retrieval services: No requirement evolution
7. User support service: No evolution except for editorials
8. The former chapter 8 was providing the definition of the user groups and their privileges. It is now replaced by a pointer to the EUMETSAT data policy and the Copernicus data policy.

A. In Annex A, the Service Message Baseline.
B. The former Annex was defining the dissemination baseline of the Level 1 datasets. It is now replaced by a pointer to the new document [MTGDIS].
C. Definition of conventions and terms: updated
D. Glossary: Updated
E. List of TBD/TBC: reflects that all but one (related to yaw flip outage) have been solved.
F. The new Annex track with full details the requirement evolution between the successively approved versions. It provides also statistics per category of changes and justification.