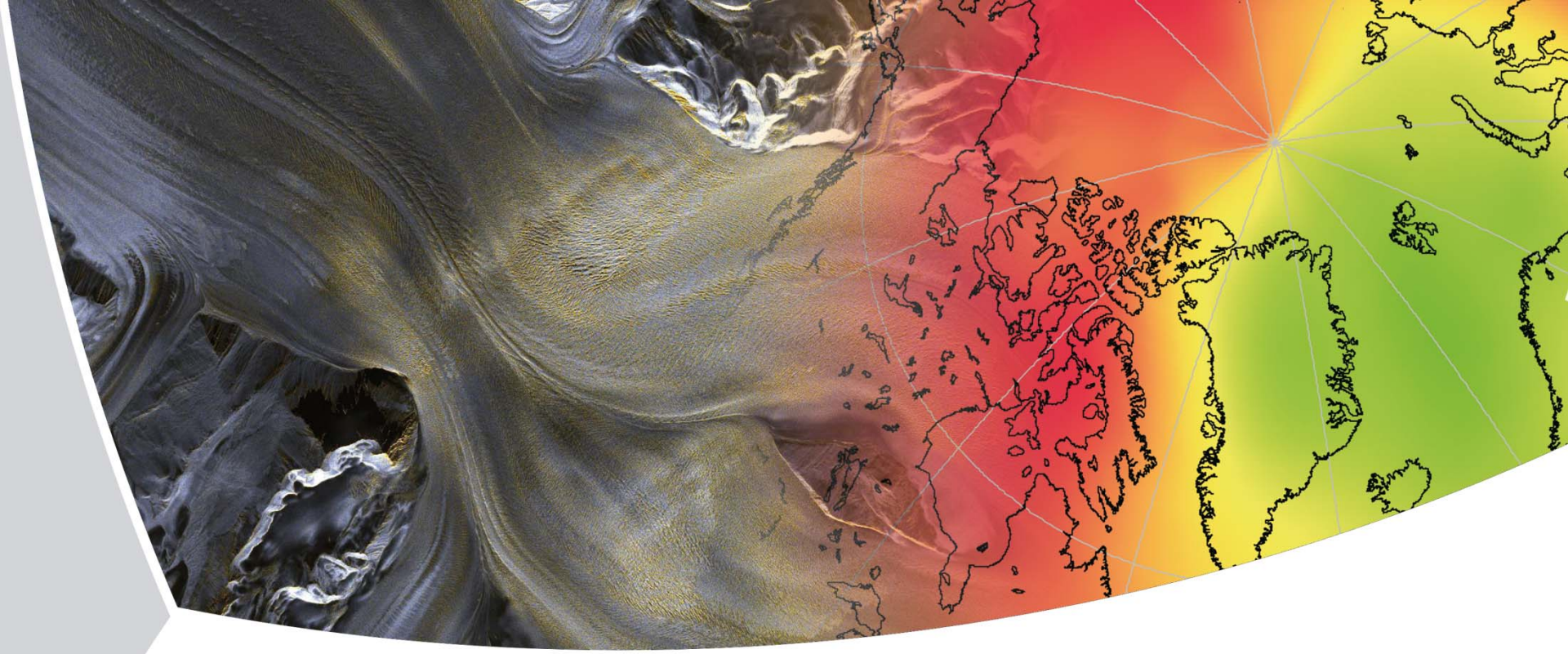


The Impact of the ENVISAT Loss

M. Gottwald – DLR-IMF

Polar Space Task Group, Geneva, 12-14 June 2012

ENVISAT Summary

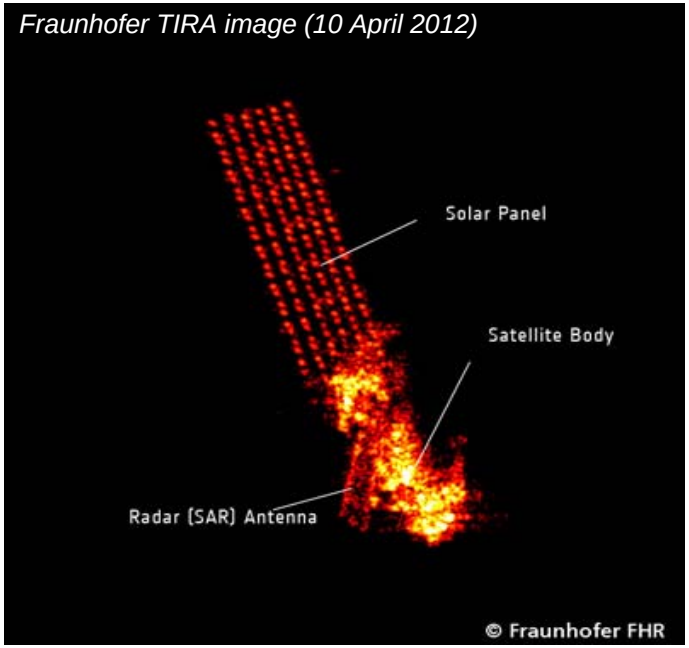
- launch March 1, 2002
- successful operation of platform and instruments
  - ASAR: C-band radar
  - RA-2: radar altimeter
  - MWR: microwave radiometer
  - DORIS: microwave tracking system
  - MERIS: imaging spectrometer
  - AATSR: scanning radiometer
  - MIPAS: Michelson interferometer
  - GOMOS: spectrometer
  - SCIAMACHY: imaging spectrometer
  - LRR: laser retroreflector
- no symptoms of degradation!
- April 8, 2012 (orbit 52868): Kiruna pass failed

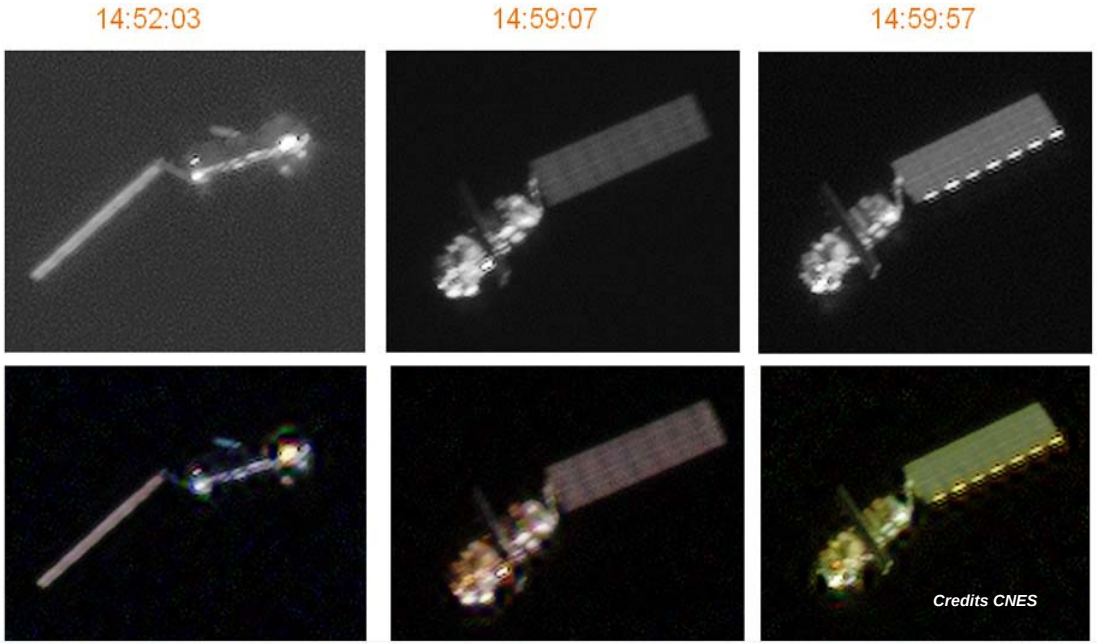
What happened on April 8?

- loss of all communication links except the S-band RF unmodulated carrier
  - ⇨ no HK telemetry, i.e. no internal visibility (S-band transponder still operational)
- immediate recovery actions at ESOC unsuccessful
- carrier received from both S-band transponders
  - ⇨ platform rotating, transponders operate, no provision of modulated signal (HK telemetry)
- carrier lost after 8-9 hours
  - ⇨ batteries depletion, solar panel not sun-oriented or inactive, unsuccessful Safe Mode
- since April 8 continuous execution of recovery procedures (CCU reconfiguration)
  - ⇨ no success (commands not received on-board)

Verification of the ENVISAT Status (1)

- ground radar imaging (Fraunhofer TIRA)
- in-orbit optical imaging using Pleiades
- ground laser ranging stations





Pleiades images (15 April 2012)

Verification of the ENVISAT Status (2)

- no damage obvious (platform, solar panel)
  - ⇨ no collision with space debris
- solar panel close to anti-canonical position
  - ⇨ Safe Mode not triggered or uncompleted
- spacecraft slowly rotating
  - ⇨ attitude control not operational

ENVISAT Status

- confirmed spacecraft status
  - correct orbit and orbital position
  - not in Safe Mode
  - rotating around roll and pitch axis, small tumbling around yaw axis
  - solar panel could receive solar flux (produce electrical power)
  - thermal system is OFF, i.e. batteries and propulsion lines thermally not maintained (e.g. fuel could be frozen)
- presently unconfirmed status (however likely)
  - are batteries depleted & are they still connected?
  - are heaters still connected?
  - would power regulation still be possible?

ENVISAT Failure Scenarios

- scenario 1: double failure in Power Subsystem
  - ⇨ no recovery possible

- scenario 2: double failure in Central Communication Unit and Safe Mode failure
  - ⇨ very small chance for recovery (many unknows after having re-established communication with spacecraft)

⇨ May 9, 2012: ESA declared ENVISAT mission ended, however continuing recovery efforts (until end of July and at some level even beyond)

ENVISAT Mission – Quo Vadis?

ENVISAT Activity	Phase F Status
Platform and payload maintenance	Run down & completion
Flight Operation Segment	Run down & completion
Acq. Stations and NRT processing	Run down & completion
Processing and Archiving Centres	Re-planning & transition
User services and mission planning	Re-planning & transition
Data dissemination incl. network	Re-planning & transition
Sensor performance, products and algorithms	Re-planning & transition
Monitoring and exploitation project support	Data-gap filling activities

ENVISAT Mission – Data Exploitation

- algorithms and processor upgrades required for data reprocessing
  - particularly for atmospheric science instruments (MIPAS, GOMOS, SCIAMACHY)
  - CCI feedback on ENVISAT algorithms expected
- increased availability of processed ASAR datasets, particularly for
  - Geohazard Supersites and Natural Laboratories
  - polar studies
- bulk processing of MERIS full resolution dataset (currently only available on demand)
- increased importance of Third Party Missions

ENVISAT – Partial Data Gap Filling (2012-2014)

ENVISAT Instrument	Potential TPM
Atmosphere (SCIAMACHY, MIPAS, GOMOS)	ODIN Osiris, SCISAT-1, GOSAT, GOME-2/IASI on MetOp-*A/-B*, sensors on Aura (incl. OMI), 3 sensors on NPP, *OCO-2*
Altimetry (RA-2, MWR, DORIS)	Jason-1/-2, *SARAL Altika*, CryoSat (Oceanographic products), HY-2A
Ocean and Land Colour (MERIS)	MODIS Terra & Aqua, VIIRS on NPP, Vegetation on Spot, *Proba-V*, India OCM on OceanSat-2
Ocean and Land Temperature (AATSR)	MODIS Terra & Aqua, VIIRS on NPP, AVHRR, *Japan GCOM-W1*
Imaging Radar (ASAR)	C-band: Radarsat-1/-2 (3-months contingency agreement with CSA/MDA is activated) X-band: Cosmo-Skymed constellation, TerraSAR-X Also India RiSAT-1/-2; *S. Korean KompSat-5*

missions in italics: to be launched

ENVISAT and the Sentinels

ENVISAT Instrument	Sentinel	Launch
Atmosphere (SCIAMACHY, MIPAS, GOMOS)	Sentinel-5P, Sentinel-4, Sentinel-5	2015 (S5P), 2019 (S4), 2020 (S5)
Altimetry (RA-2, MWR, DORIS)	Sentinel-3	2013/2014
Ocean and Land Colour (MERIS)	Sentinel-2, Sentinel-3	2013/2014
Ocean and Land Temperature (AATSR)	Sentinel-3	2013/2014
Imaging Radar (ASAR)	Sentinel-1	2013

ENVISAT – The Success

- having doubled its specified in-orbit lifetime
- provided smooth and continuous operations (platform and instruments)
- excellent Europe-wide mission execution (flight operations, payload data operations)
- about 2500 publications based on ENVISAT data

and finally

- the last news on ESA‘s EO portal just before the anomaly (April 5, 2012): *Satellite observes rapid ice shelf disintegration in Antarctic*