ASCAT mission overview and current developments

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Outline

Metop-B launch, SIOV and Cal/Val
Metop-A/B dual operations concept
ASCAT-A/B processor developments
ASCAT-A reprocessing plans
EPS-SG status
Revision of NWP assimilation of ASCAT winds
The Soyuz/Fregat flight and trajectory were 100% nominal
Metop-B was separated at 17:37:45z
ASCAT-B switch-on and start of processing

23.09.12 - 5 min telemetry check
25.09.12 - 100 min measurement mode check
25.09.12 - ... - continuous measurement operations

Processing and calibration:
23.10.12 - Dissemination of Level 1 backscatter to cal/val partners, based on preliminary calibration (ASCAT-A)
04.12.12 - Dissemination to all users
External calibration with transponders 11.10.12 – 03.02.13
Final calibration tuning planned for 28.05.13
First ASCAT-A/B winds received from KNMI

ASCAT-A and ASCAT-B come together

ASCAT-A (red)
ASCAT-B (blue)

Measurements separated 50 min
Metop-A/B dual operations concept

Originally 14 years of 3 Metop’s, 5 years in-orbit and 6 month overlap. Baseline lifetime extended to 6 years (delayed Metop-B launch to 2012 and Metop-C to 2018)

In 2012, Metop-A end-of-life strategy was approved:
  Targets dual-Metop A/B services to end of Metop-C commissioning
  Lifetime review (A+B) will assess feasibility each year

After the Commissioning phase, Metop-B satellite has primary role, Metop-A remains in operations as the secondary mission (24.04.2013)

In May-June 2013, this operations concept is expected to be approved by delegations, including a user survey planned in early 2014, in order to ascertain more precisely the user benefits of this strategy
Metop-A/B dual operations orbit formation

Same orbital plane, with Metop-B over ascending node ~49 min ahead of Metop-A

Both in morning orbit

Same 29 day repeat cycle track
Metop-A/B dual operations – data services

Data acquisition:
- Svalbard: 14 orbits per satellite on same data acquisition station
- McMurdo: currently 9 half-orbits for primary mission, early 2014 14 orbits

Timeliness:
- ASCAT-B ~ 80 min
- ASCAT-A ~ 120 min

Direct readout mission:
- Metop-A continues zone base operation
- Metop-B AHRPT reengineered – operated permanently
ASCAT A/B orbit phasing – One ASCAT
ASCAT A/B orbit phasing – 50 min
Trade-off between 29 / 50 min phasing scenarios. Maximizing sounder observations available to NWP assimilation windows (short term)

For ASCAT: significant gaps in short term and daily coverage over the tropics and mid latitudes, affecting:

- **Nowcasting** of severe weather (hurricanes and extra-tropical storms)
- Regional and local applications in near real time (**coastal**)
- **Oceanography** and **climate** (non-geostrophic component of ocean currents) – incomplete daily coverage
- **Soil moisture assimilation** (sampling and modelling of soil moisture anomalies)
- ... ????

As part of the VC work, need to review quantitatively and to document the ASCAT situation
ASCAT A/B orbit phasing – 29 min
Coming L1b processor upgrades - May 16th

✓ Line of backscatter triplet nodes generation on a fixed time-based grid
✓ Format optimisation of the full resolution geolocated sigma0 product for near real time use: size (60%) and addition of a high resolution (6.25 km) swath grid for resampling

Coming version of L1b processor (16.05.13) is 9.0 and product format version is 12.0

December 2012: Availability of spatially averaged sigma0 products in netCDF (CF compliant, netCDF4, classical model)
ASCAT-A reprocessing

ERA-CLIM is a new EU-FP7 project that prepares for the next major reanalysis at ECMWF

EUMETSAT is expected to contribute by carrying out first reprocessing of all Metop-A data including ASCAT (soil moisture, surface ocean wind)

ASCAT reprocessing is currently starting, 2 months of data (Oct-Nov) per year, in order to assess calibration, planned to finish within 2013

Peer review process – request for involvement
ASCAT L1b reprocessing product specifications

Record type: **ASCAT-A NRCS FCDR**, input to ERA-CLIM reanalysis

Format: EPS Native (v12.0), BUFR and **netCDF4** (Classic model)

Spatial coverage: Global (ocean and land), sampling:
- ASCA_SZR on 12.5km, ASCA_SZO on 25 km spacing swath grid
- ASCAT_SZF on measurement sampling pattern (i.e. full resolution)

Temporal: Continuous, **full ASCAT-A mission**: 01.2007– 06.2013, full data dumps

Target Accuracy:
- Absolute and inter-beam: 0.1 dB
- Relative (w.r.t inc angle): p2p variations of antenna patterns within 0.1 dB

Target Precision: radiometric resolution 4%

Target Stability: 0.1 dB over 5 years

Absolute calibration based on the transponders, validation over natural targets
ASCAT-A backscatter record and calibration model

<table>
<thead>
<tr>
<th>Year</th>
<th>Backscatter calibration available in the ASCAT-A data record</th>
<th>Instrument calibration changes in backscatter measured independently by the transponders</th>
<th>Transponder-based instrument absolute calibration models</th>
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<td>2008</td>
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<td></td>
</tr>
<tr>
<td>2009</td>
<td>0.1 dB</td>
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<tr>
<td>2010</td>
<td>Mid Left Beam only</td>
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<tr>
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EPS – SG status

EPS-SG Preparatory Program was approved by our Council in 2012, covering the Phase B work (until end 2014). Full Program Proposal is being prepared for 2013.

For SCAT, competitive industrial studies ongoing, strong heritage from ASCAT.

Coming activities for the ASCAT/SCAT team:
• Support System Requirements Review 2nd part in October
• Drafting ATBD, processor and product content specification

ASCAT science advisory group extended mandate to SCAT.
Important NWP model evolutions and addition of new observations need to revise how scatterometer winds are being assimilated and if necessary tune the assimilation scheme to optimize impact.

ECMWF 2-year study, several Observing System Experiments

- Focus on aspects where scatterometer wind observations are expected to provide unique and essential information:
  - Forecasting of severe weather (position and intensity)
  - Additional diagnostics/metrics: wave and wind verification

- Impact of ASCAT in the context of the current GOS
Summary and conclusions

• Metop-B launch and commissioning success, primary satellite in Metop A/B dual operations
  – We encourage feedback from ASCAT oceanography and climate users on Metop-A/B orbit phasing
• ASCAT-A and -B are of similar quality
• ASCAT new L1B near-real time full resolution products
• ASCAT-A reprocessing starting
  – advise on instrument calibration model welcomed
  – get involved in reprocessing results analysis

Come to GMES-PURE poster and get involved in shaping the long term marine services requirements
Back-up slides
Both ASCAT-A and –B maintain full redundancy, no instrument anomalies open at the moment.

Due to high solar activity, In Plane manoeuvres are needed now for both Metop missions every 3-4 months and will get even more frequent in the next year. One Out Of Plane manoeuvre per year is still the baseline.

The ASCAT instrument is left on during manoeuvres, but dissemination of data has been discontinued in the case of OOP.
Routine product generation and dissemination started on February 2007 with provisional calibration ASCAT L1b products declared operational 03/04/08, including

- First full 3-transponders absolute calibration,
- Format change (header and auxiliary data records)

Tuning of the calibration on 09/12/08 as a reference to start adapting the existing ERS-based geophysical parameter retrieval models to ASCAT data, and used for first re-processing of the mission

Implementation of dynamic (orbit-based) Power-to-s0 normalisation on 10/09/09 and start of non-frozen eccentricity orbit phase on 17/09/09

Correction of Hamming window for SZR product, updated Kp algorithm and tuning of calibration to 2010 external calibration transponder campaign on 18/08/11

Clean-up of the L1a processing and flag handling in order to facilitate code maintenance, as well as real time monitoring of instrument and platform telemetry during the processing on 20/03/2012

- Line of backscatter triplet nodes generation on a fixed time-based grid
- Format optimisation of the full resolution geolocated sigma0 product for near real time use: size (60%) and addition of a high resolution (6,125 km) swath grid for resampling
- User-requested format improvements for the L1B averaged products
- Level 1b processing performance improvements through multi-threading, processing in ground segment down to half

Coming version of L1b processing facility (16.05.13) is 9.0 and product format version is 12.0

International Ocean Vector Winds Science Team Meeting, Kona, May 2013
Other Level 1B product changes and next steps

December 2012: Availability of spatially averaged sigma0 products in netCDF (CF compliant, netCDF4, classical model)

Next steps:
• Improve handling of outlier values of Noise Power in the receive filter shape estimation and sharp PGP variations
• Fractional land flag
• Align the ASCAT BUFR template to benefit from new fields and calibration information: Q3 2013, in coordination with level 2 product experts
Full ASCAT backscatter data record to date

✓ Reprocessed data 2007 → 2008
✓ Operational data 2009 Jan → June
✓ Operational data 2009 July → August (fast NTG)
✓ Operational data 2009 Sept → now (dynamic NTG and non-frozen eccentricity orbit)
✓ Sept 2009 -> Change in Mid Left Beam calibration: increase of 0.1 dB over all incidence angles
✓ August 2011 -> EC_2010 and compensation for the MLB calibration change

Other events influencing the consistency of the data record
✓ Manoeuvre record
ASCAT L1b reprocessing product specifications

- **General**
  - **Record type:** ASCAT-A NRCS FCDR, input to ERA-CLIM reanalysis
  - **Description:** Full mission ASCAT NRCS data (dB), global coverage, latest ASCAT operational processor (PGS v8A, PFS v9A, PPF v9.1)
  - **Output data:** ASCA_SZO/R, ASCA_SZF

- **Dissemination**
  - **Format:** EPS Native (v12.0), BUFR and netCDF4 (Classic model)

- **Coverage**
  - **Spatial:** Global (ocean and land), sampling:
    - ASCA_SZR on 12.5km, ASCA_SZO on 25 km spacing swath grid
    - ASCAT_SZF on measurement sampling pattern (i.e. full resolution)
  - **Temporal:** Continuous, **full ASCAT-A mission:** Jan 2007 – June 2013, full data dumps
**ASCAT L1b reprocessing product specifications**

- **Uncertainty (target)**
  - **Accuracy:**
    - Absolute and inter-beam: 0.1 dB
    - Relative (w.r.t inc angle): p2p variations of antenna patterns within 0.1 dB
  - **Precision:** radiometric resolution 4%
  - **Stability:** 0.1 dB over 5 years

- **Validation method**
  - **Accuracy:**
    - Absolute: ensured by transponder calibration and validated over global ocean and rainforest (as far as possible)
    - Relative: global ocean, rainforest, sea ice
    - Inter-beam: global ocean measurement space
  - **Precision:** over stable sea ice
  - **Stability:** global ocean measurement space
The Copernicus/GMES Marine Service (MS) as currently implemented by MyOcean2 will become operational in 2014.

The EC has recently started the two-year project called GMES-PURE (Partnership for User Requirements Evaluation), to define and apply a structured process for the elaboration of the future MS user requirements and their translation into service specifications, service data and technical requirements (2020-...)

GMES-PURE constitutes an opportunity for users to ensure that their current and emerging requirements are captured in time and to influence the future evolution of the MS.
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<th>Mode 2</th>
<th>Date/Time</th>
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(YSM: Yaw Steering pointing mode)  
(GEO: Geocentric pointing mode)  
(IP: In Plane manoeuvre)  
(OOP: Out of Plane manoeuvre)  
(CAM: Collision Avoidance Manoeuvre)
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ASCAT A+B daily coverage map