ASCAT-A CLIMATE DATA RECORD: ASSESSMENT OF RADAR BACKSCATTER PRODUCT QUALITY

EUMETSAT

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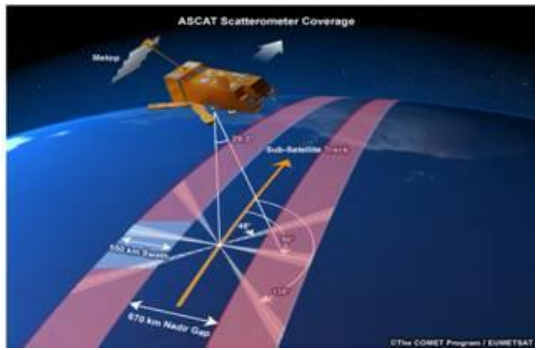
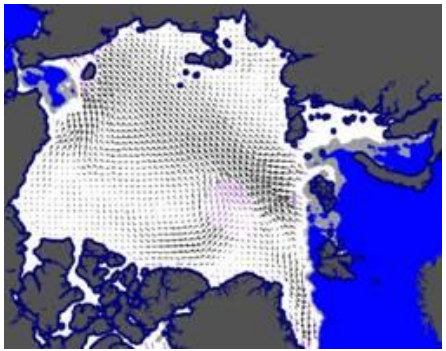
Background - Advanced Scatterometer (ASCAT)

- 6 beam scatterometer, C band, VV polarisation
- Carried on board Metop-A (operational 2007), Metop-B (operational 2013) and Metop-C
- Designed for retrieval of ocean wind fields

ASCAT **ocean winds (KNMI)** **sea ice (IFREMER)** **soil moisture (TU Wien)**





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Background – ERA-CLIM Climate Data Records

- EUMETSAT participates in the European re-analysis of global climate observations (ERA-CLIM) project
- Aims to produce consistent data records from global observation systems
- One contribution is a homogeneous and consistent ASCAT data set covering 2007-2014

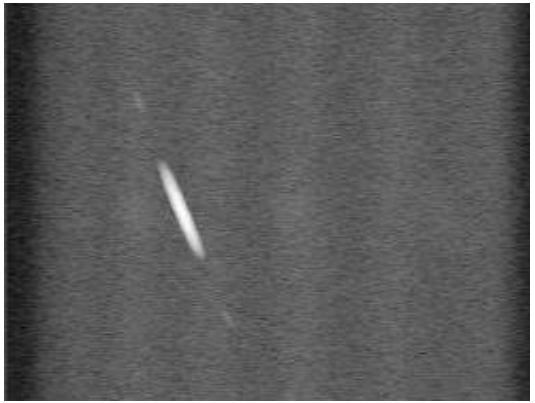
Quality Requirements

- Requirements for the quality of ASCAT CDR have been discussed by ASCAT Science Advisory Group
- Recommendations are
  - absolute and inter beam calibration accuracy better than 0.1 dB (approx 0.1 ms^{-1} wind speed)
  - relative calibration accuracy with respect to incidence angle less than 0.1 dB (peak to peak variation)
  - stability better than 0.1 dB over 5 years

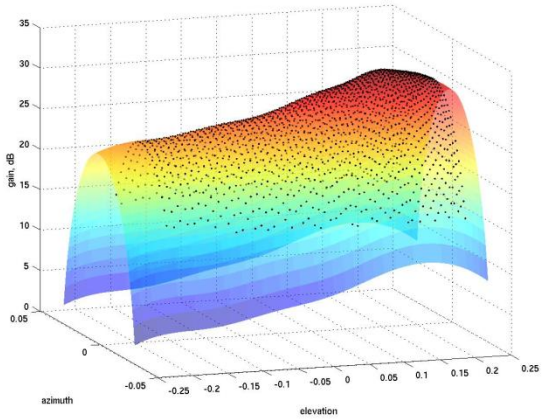
Calibration

- ASCAT calibrated using 3 transponders

Transponder



Signal seen by ASCAT

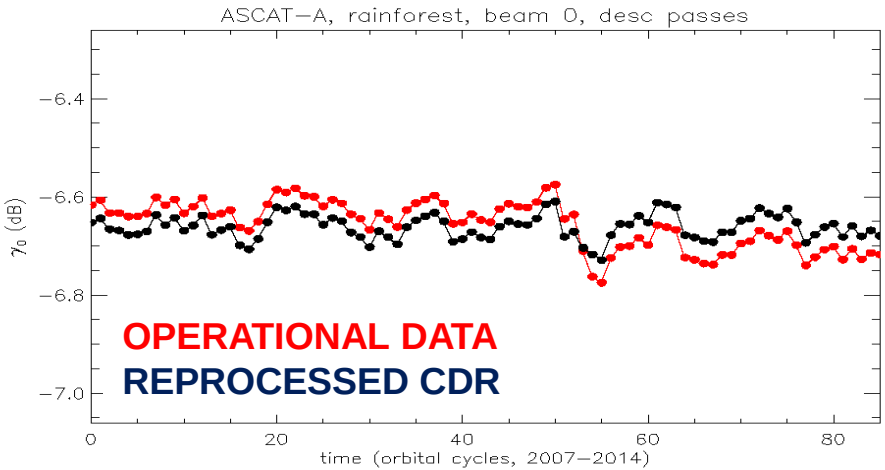


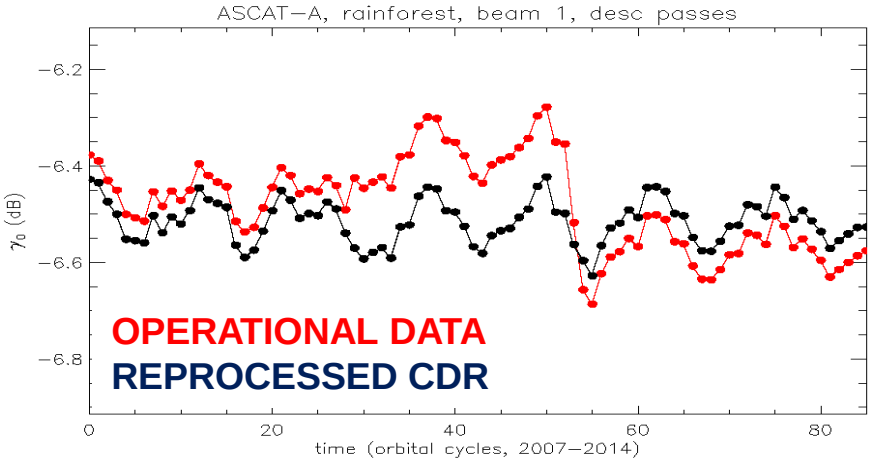
Beam pattern

- Transponder data used to estimate beam patterns from which calibration factors are calculated
- Calibration campaigns in 2007, 2010 & 2012 (also 2014)

Calibration

- Results from all 3 campaigns very similar
- ASCAT SAG recommended using an average of the three for the entire data set



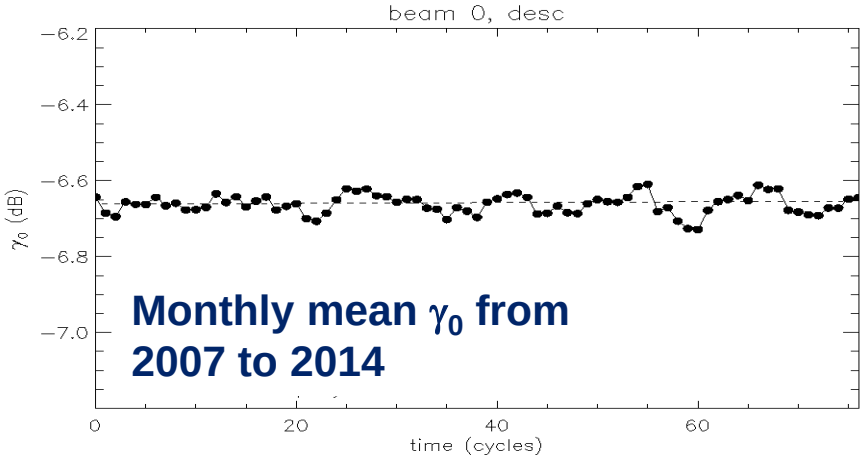


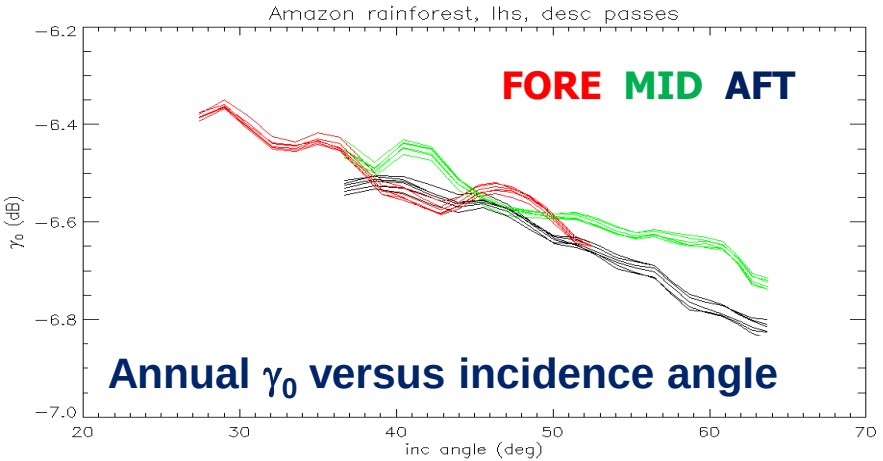
Validation of CDR quality

- The quality of the CDR needs to be verified
- To do this we take the backscatter from various natural targets and
  - compare against models
  - compare the behaviour in each beam
  - examine behaviour across the swath
  - examine the behaviour over time
- Natural targets are rainforest, ocean & sea ice

Amazon rainforest

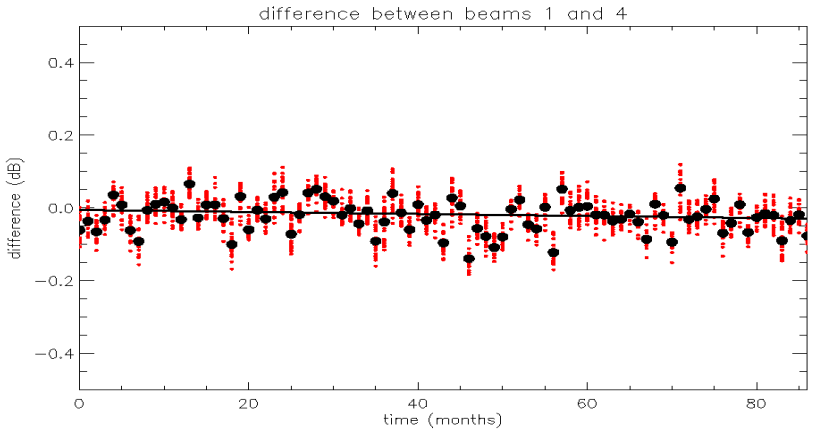
- Examine $\gamma_0 = \sigma_0/\cos\theta$
- Time series plots show a stability of 0.001 dB per year
- Comparison of γ_0 against ERS scatterometer data from 1996-2001 shows a difference of 0.08 - 0.14 dB
- Plots across swath show oscillations less than 0.1 dB





Ocean: comparison of opposing beams

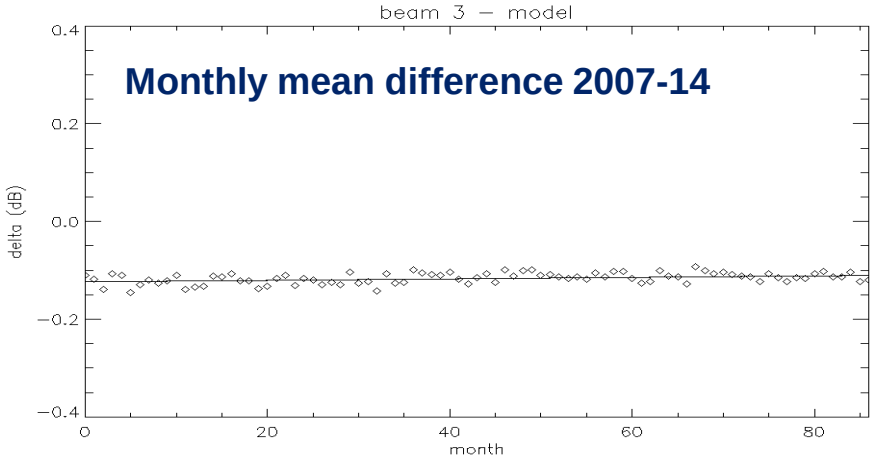
- Ocean backscatter from look angles that differ by 180° is approximately the same
- Examine the difference in backscatter between opposite beams
- Shows that relative calibration is better than 0.1 dB and stability is around 0.003 dB per year

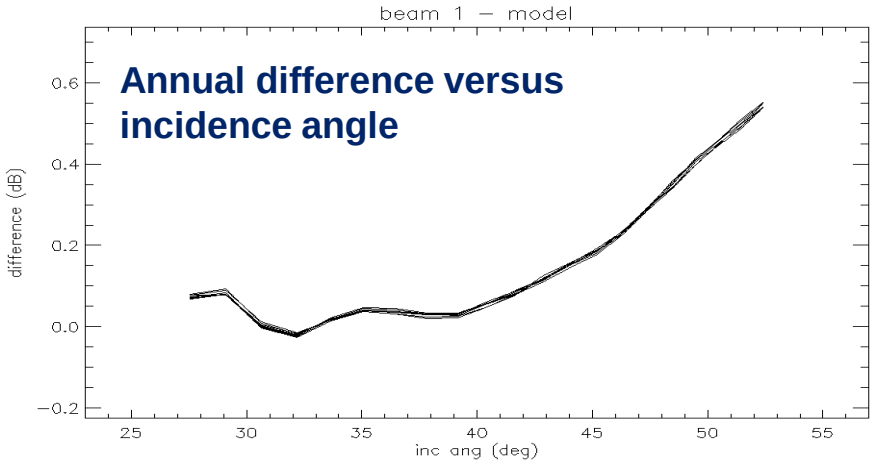


Monthly difference between mid beams 2007-2014

Ocean: comparison against CMOD5

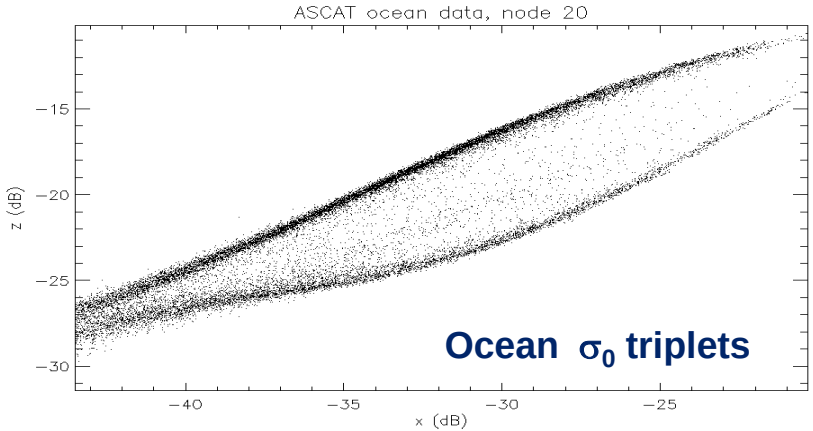
- Examine difference between data and the value from ocean backscatter model CMOD5
- Time series plots show a stability of 0.002 dB per year
- Mean difference over ERS incidence angle range is less than 0.08 dB
- Plots across swath show oscillations less than 0.1 dB

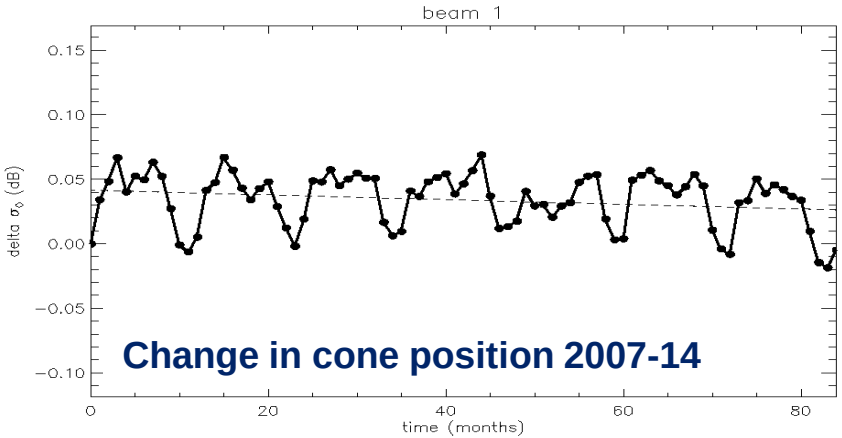




Ocean: cone position

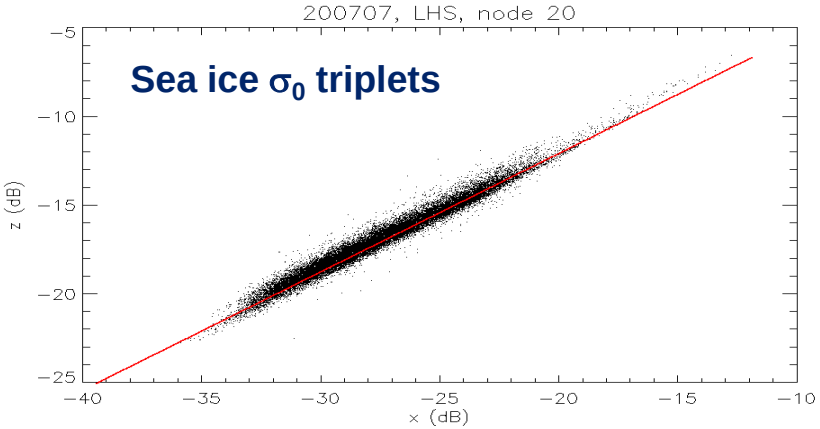
- Plots of ocean backscatter triplets show a cone shape
- Changes in ASCAT calibration move the cone
- To check stability we monitor the position over time
- Stability is better than 0.002 dB per year

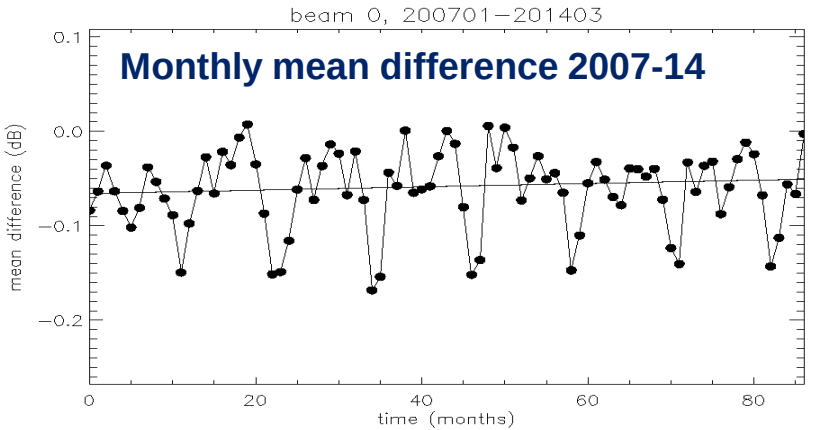




Antarctic sea ice

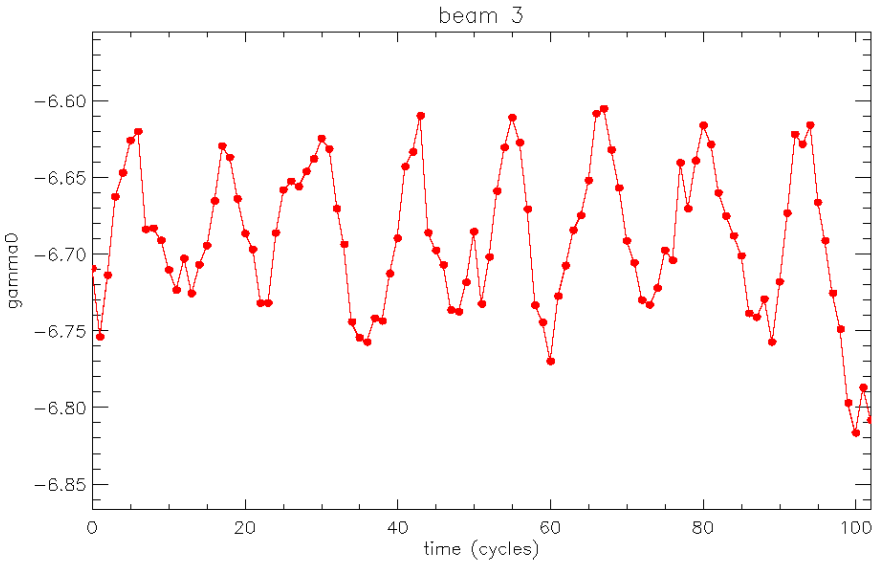
- Backscatter triplets from sea ice form a line
- Existing model (ERS data) is not accurate at large incidence angles so fit a model to a month of data
- Examine difference between model and data
- Difference is small, similar in all beams and stable





Operational Data

- The calibration used in the CDR also used in operational processing from March 2014.
- But, as reported by KNMI, two small anomalies in Sep & Oct 2014. Drop of 0.08 dB.



Rainforest γ_0 in ASCAT-A CDR and operational data 2007-15

Summary

- ASCAT-A CDR release 2 is now available
- Validation using natural targets shows that the backscatter meets the quality requirements
- Transponder calibration shows a very stable instrument which is confirmed by analysis of data (so basis of good level 2 products)
- ASCAT-A & ASCAT-B data will be reprocessed in 2016

Accessing the CDR

- General information

  www.eumetsat.int

- Product descriptions and documentation

  navigator.eumetsat.int

  search with “ascat cdr” leads to user guide

- Eumetsat data centre

  eoportal.eumetsat.int