# Status of calibration activities

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# Status of calibration activities

- Overview - Plan
- ERS-2 calibration assessment
- ERS-1 calibration assessment
- Way forward

# Overview

- Goal: review calibration of ERS-1
  - Compare ERS-1 s0 to ERS-2 s0 during tandem mission
    - Over the rainforest
      - ERS-1 is « matched » to ERS-2 assumed correctly calibrated
    - Using NWP Ocean Calibration (NOC)
      - ERS-2 is « matched » to NOC using a GMF
    - Issue revised antenna pattern (calibration coefficients)
  - Assess stability of the calibration of ERS-1 during its mission
    - Monitoring over rainforest
    - Using NOC

# Overview - Plan

Plan

- Review calibration of ERS-2 (will be used as reference)
- Derive calibration coefficients for ERS-1
  - Require to know the antenna diagram used to produce the data
    - Validation of the WSP/ASPS for ERS-1/AMI processing
  - Actually deduce calibration coefficients (new antenna pattern)
    - Validate by processing a significant dataset using new antenna pattern
      - G-POD
    - Check calibration of processed data
- Assess temporal stability of ERS-1

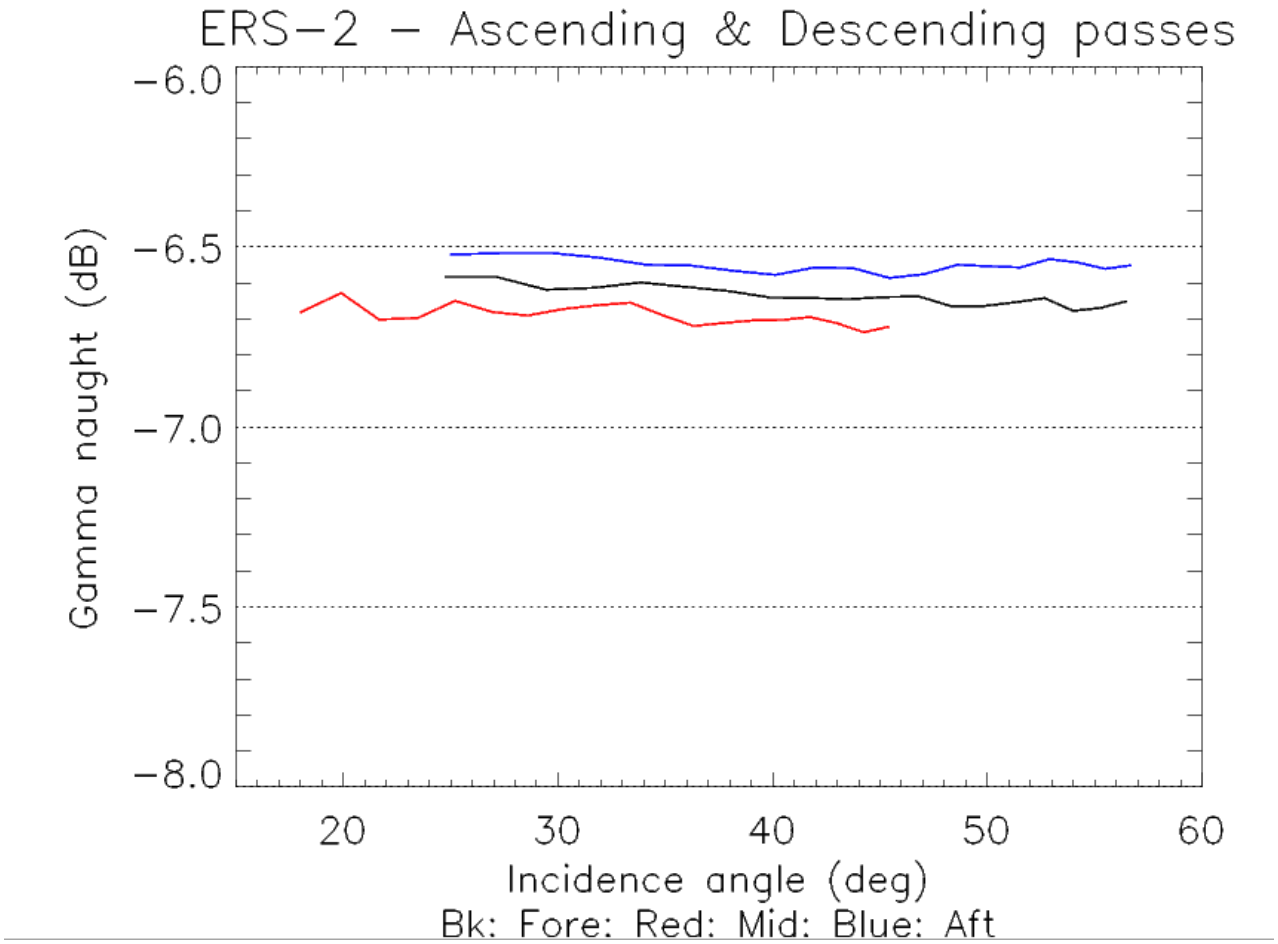
# Cross-calibration methodology

- Combine different approaches (natural targets + geophysical models)
  - Ocean
    - CMOD5n,CMOD6a/b (ECMWF ERA-interim winds used as reference)
  - Rainforest
    - Constant gamma model (no absolute reference)
- Model bias
  - Difference between the measured and simulated sigma nought
  - Model bias (incidence, beam) = measurement - model
- Cross-calibration bias
  - Bias(incidence,beam) = Model_bias_1 – Model_bias_2

# ERS-2 calibration review

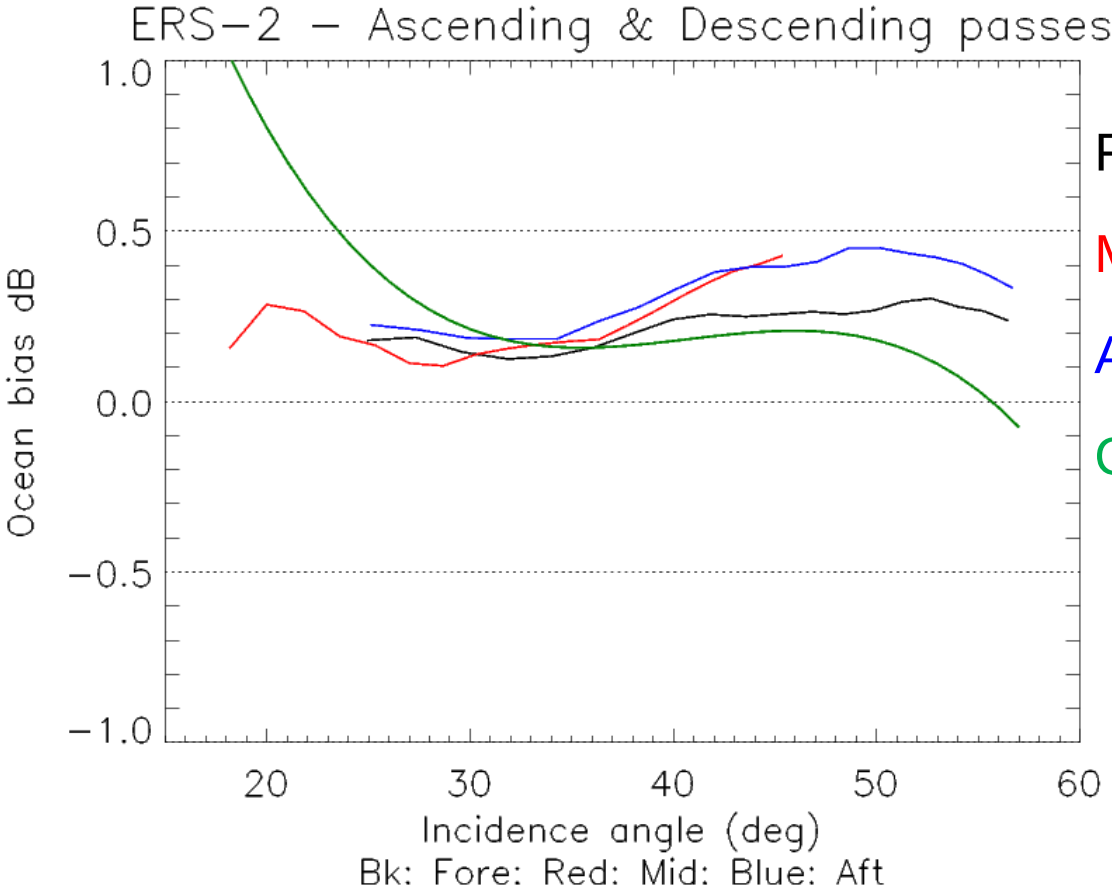
- Dataset: ERS-2
  - Format: ASPS
  - Source: ESA
  - Time: from 01/01/1997 to 14/04/1997
- Comparison
  - Over the Rainforest
  - Using NOC
    - GMF:
      - CMOD5n
      - CMOD6a (not valid at small incidence angles)
      - CMOD6b (validity extended at small incidence angles)

# ERS-2 over Rainforest: gamma0 pattern




- ERS-2 pattern very flat as expected

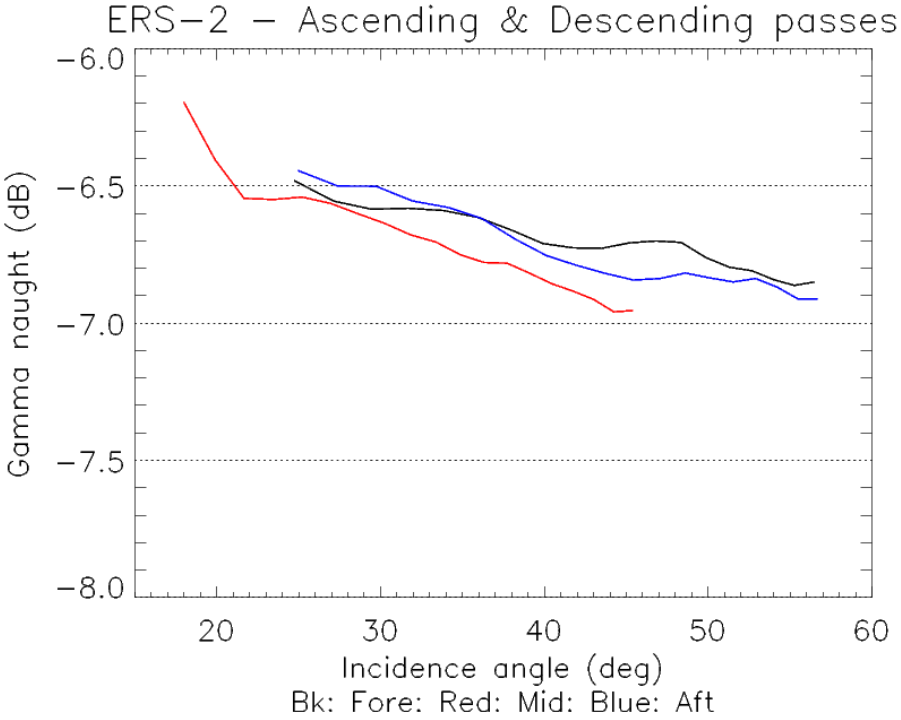
# ERS-2 NOC: bias CMOD5n




- Less good agreement
  - With CMOD5n

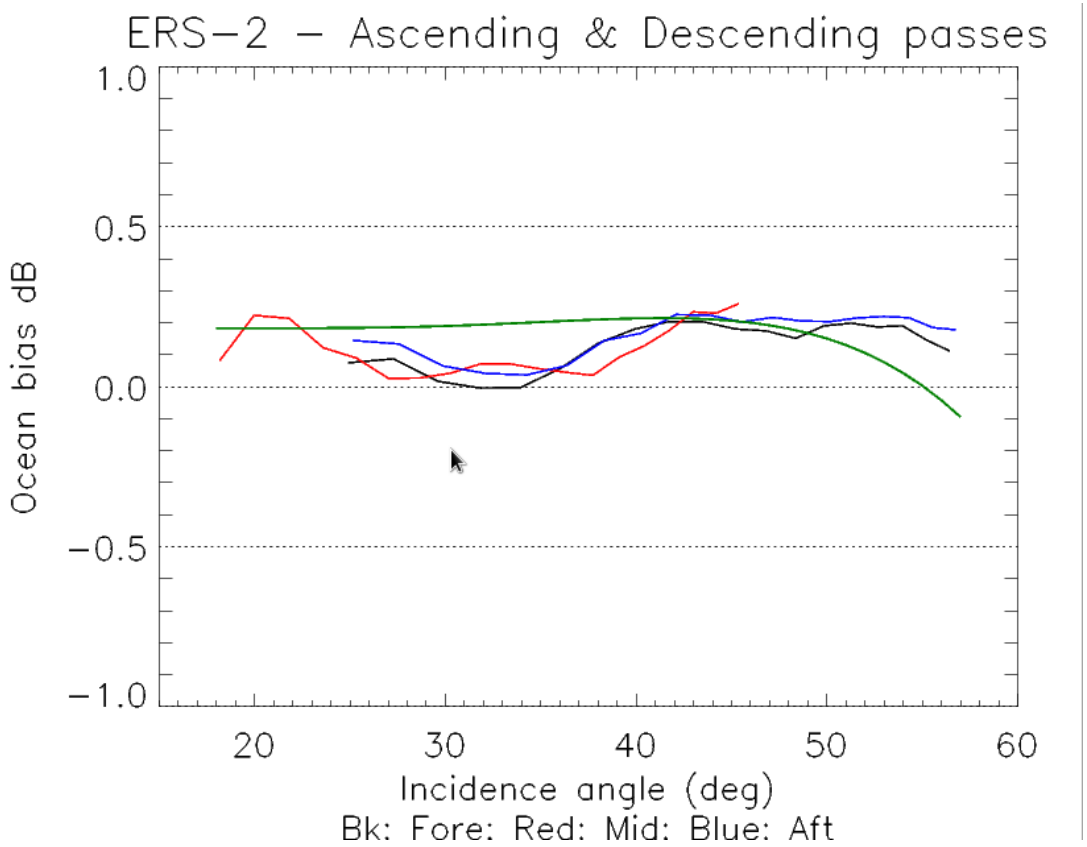
# ERS-2 NOC: Assessment over Rainforest

- The model bias wrt to **CMOD6a** is used to « correct » ERS-2 s0
  - As if it were the new calibration coefficients
- Using these « corrected » s0, compute the gamma nough
  - Gamma nought look similar to what is obtained with ASCAT data
    - Due to the use of CMOD6(a) as reference




Fore / Mid / Aft / CMOD6-CMOD5n (old version)

# ERS-2 NOC: bias CMOD6b




Fore / Mid / Aft / CMOD6-CMOD5n (new version)

- The agreement is not very bad between scatterometer and CMOD6b

# Intermediate conclusions

- ERS-2:
  - "flat" pattern when assessed over the Rainforest
    - Assuming a "constant gamma" model
  - Larger bias when assessed using NOC
    - After correction (as if using "new calibration"), the gamma nought over the rainforest is not flat anymore
      - Due to the use of the CMOD6(a) model, obtained from ASCAT data, which is calibrated using transponders.

Central question:

Limit of validity of the constant gamma rainforest model?

# Overview - Plan

Plan

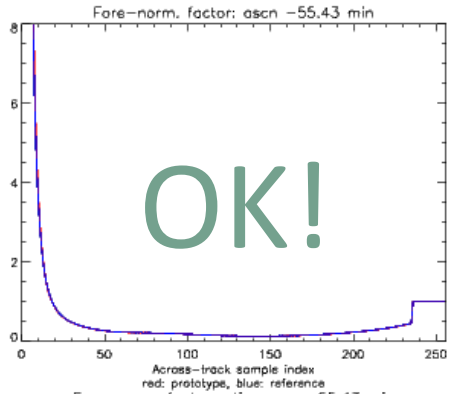
- Review calibration of ERS-2 (will be used as reference)
- Derive calibration coefficients for ERS-1
  - Require to know the antenna diagram used to produce the data
    - Validation of the WSP/ASPS for ERS-1/AMI processing
  - Actually deduce calibration coefficients (new antenna pattern)
    - Validate by processing a significant dataset using new antenna pattern
      - G-POD
    - Check calibration of processed data
- Assess temporal stability of ERS-1

# Validation of the antenna diagram of ERS-1

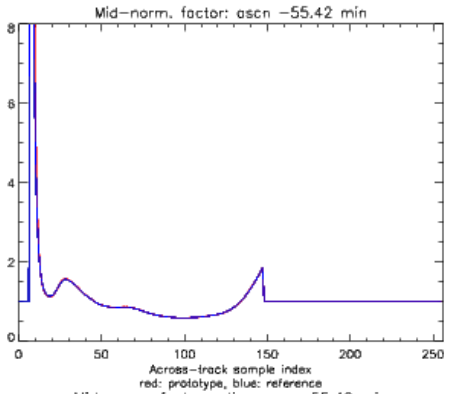
Preliminary remark: we can only provide antenna pattern corrections from a known antenna pattern

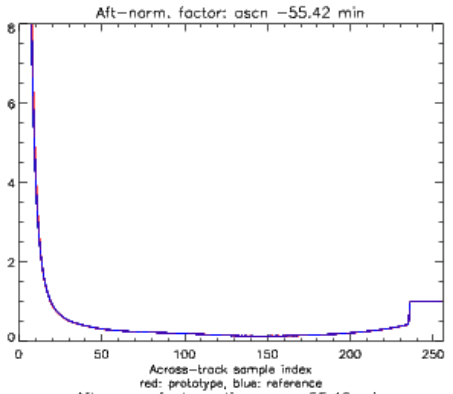
- Goal
  - Verify that the antenna pattern of ERS-1 correspond to that used to process the data from which we will deduce a new antenna pattern.
    - Sub-goal: Validate WSP/ASPS processors for ERS-1 processing
- Process:
  - Compute normalization factors and compare tot the LUT of the processor
    - Validate antenna pattern and computing procedure at the same time

Normalization factors across-track

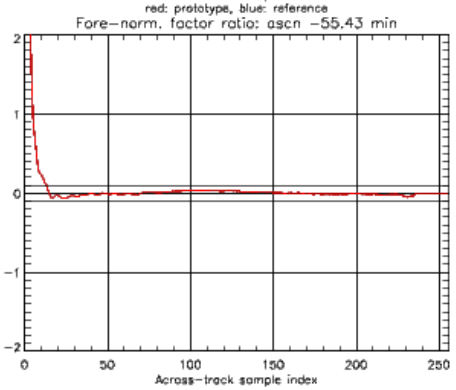


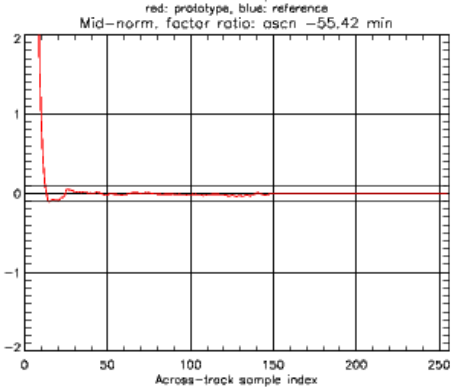

OK!

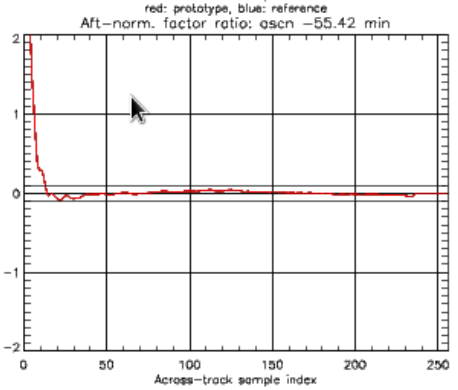


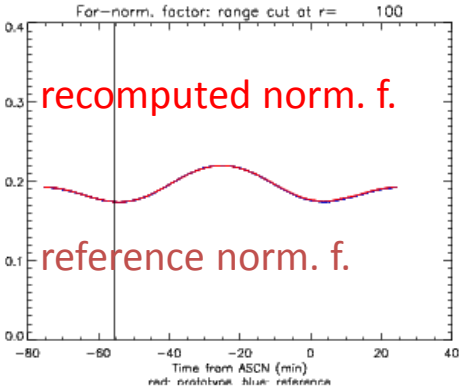

Difference across-track

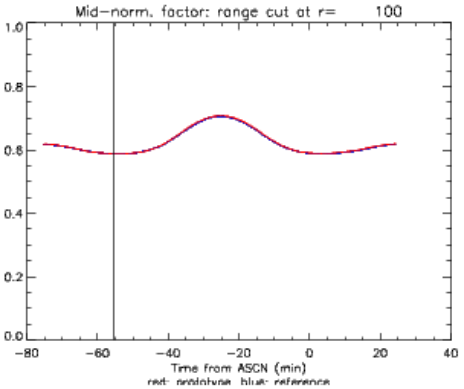


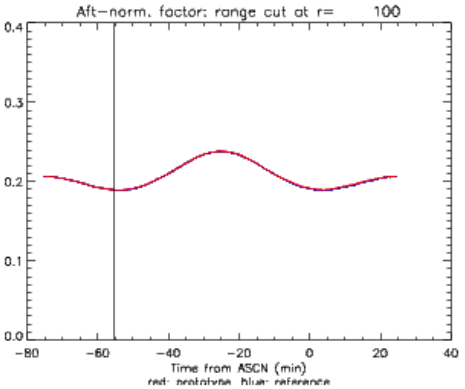



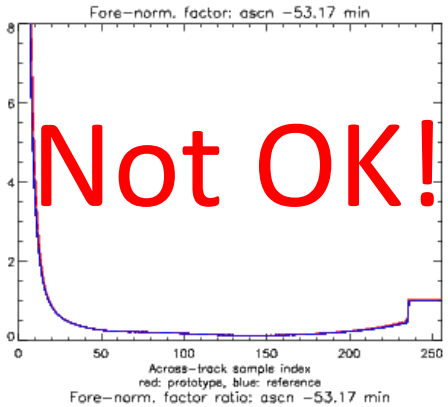

Normailization factors along-track

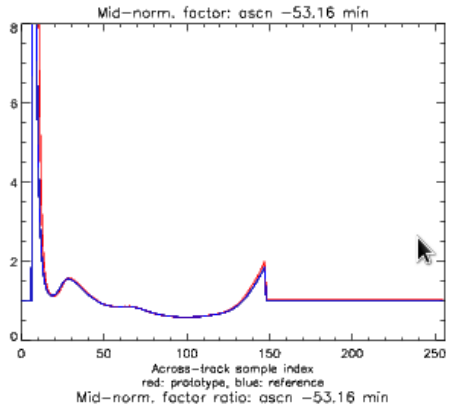


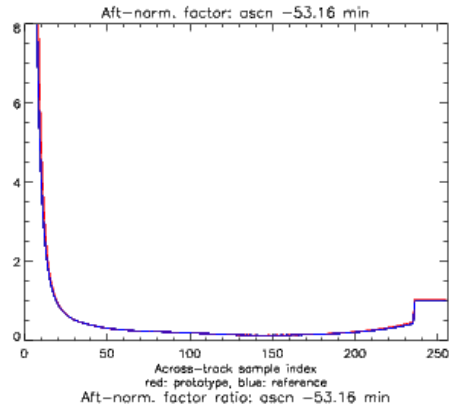



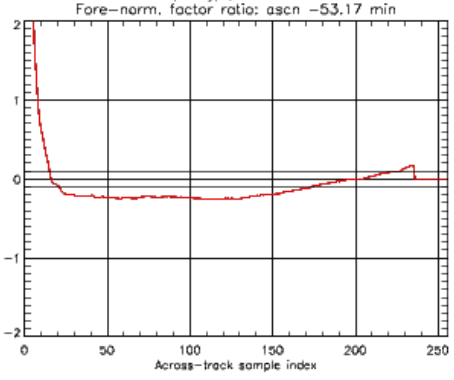
Normalization factors across-track

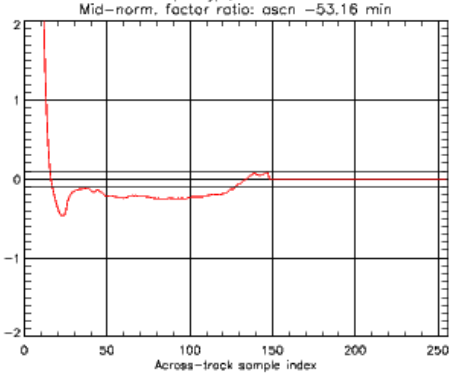


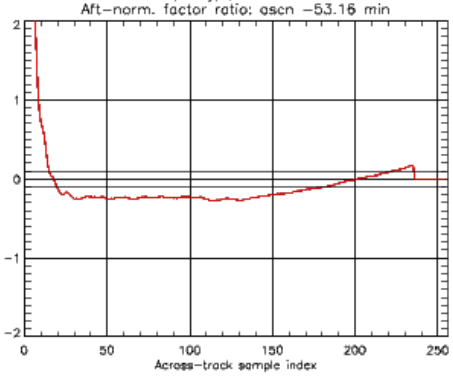



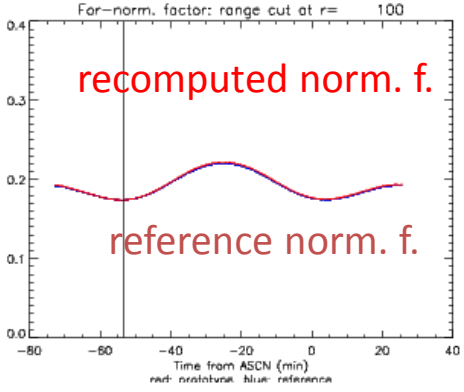

Difference across-track

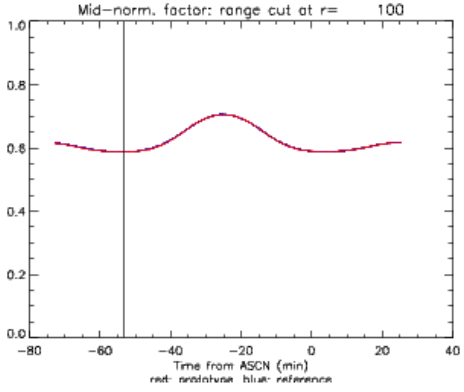


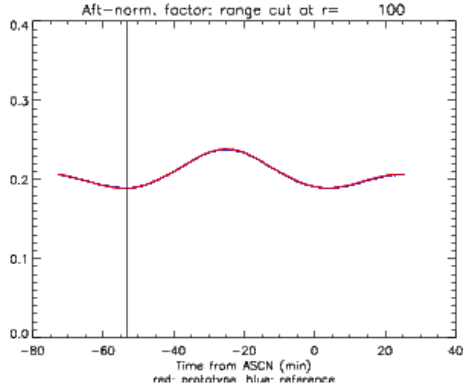




Normailization factors along-track



# Validation of the antenna diagram of ERS-1

- Summary:
  - Good agreement with LUT during phase G (35 days cycle)
  - Bad agreement with LUT during phase E (168 days cycle)
- Cause:
  - The comparison is performed against a LUT that is orbit and hence cycle-dependent.
  - It is probably the LUT of the phase G that was provided.
- Conclusion of the antenna pattern validation
  - The correct antenna pattern was provided
    - That antenna pattern will be the basis for the new antenna pattern.
  - The processor is able to process ERS-1 data

# Overview - Plan

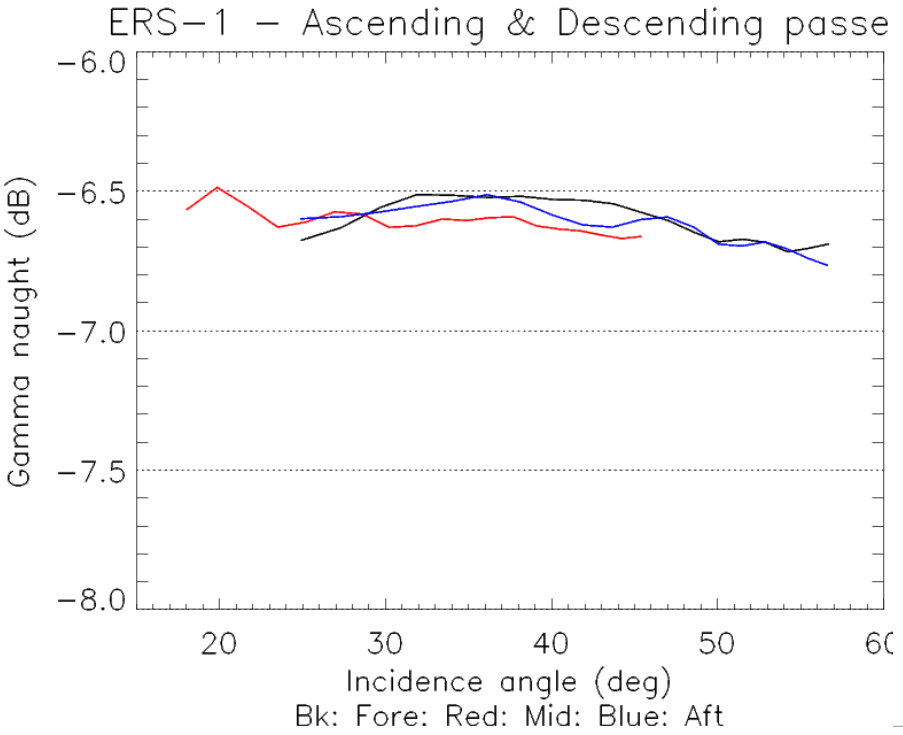
Plan

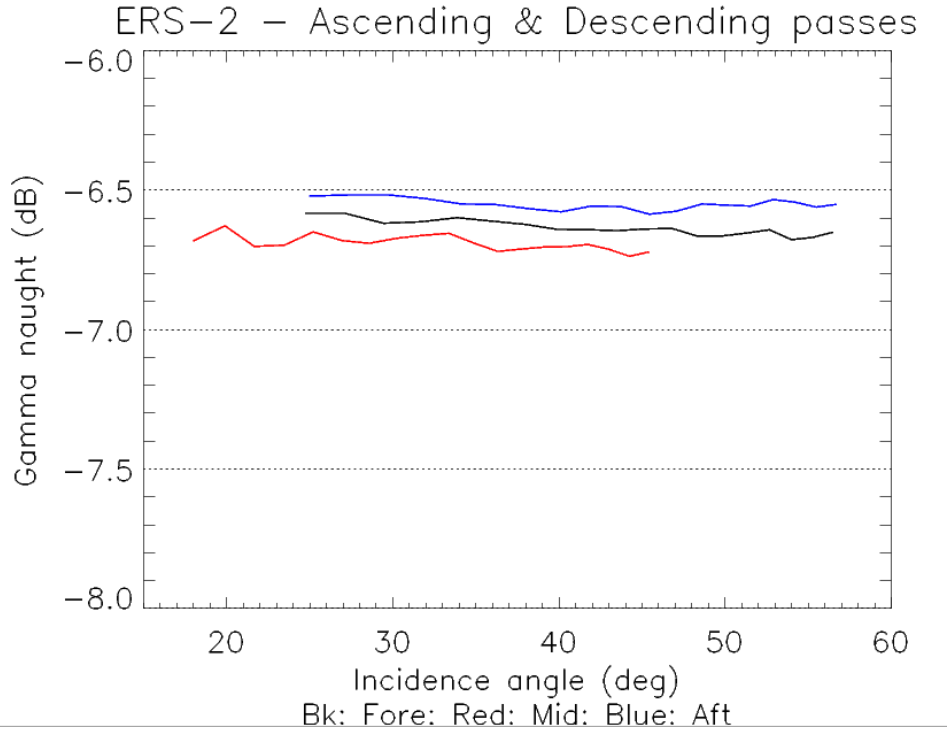
- Review calibration of ERS-2 (will be used as reference)
- Derive calibration coefficients for ERS-1
  - Require to know the antenna diagram used to produce the data
    - Validation of the WSP/ASPS for ERS-1/AMI processing
  - Actually deduce calibration coefficients (new antenna pattern)
    - Validate by processing a significant dataset using new antenna pattern
      - G-POD
    - Check calibration of processed data
- Assess temporal stability of ERS-1

# ERS-1 antenna pattern extraction: Calibration Dataset

- ERS-1
  - Format: CCSDS
  - Source: IFREMER
  - Time: from 01/01/1996 to 30/04/1996
- ERS-2
  - Format: ASPS
  - Source: ESA
  - Time: from 01/01/1997 to 14/04/1997
- Issue
  - Data are not collocated in time
    - stability (issue for rainforest cross-calibration)
  - At the moment, the amount of reprocessed ASPS data in 1996 is not sufficient

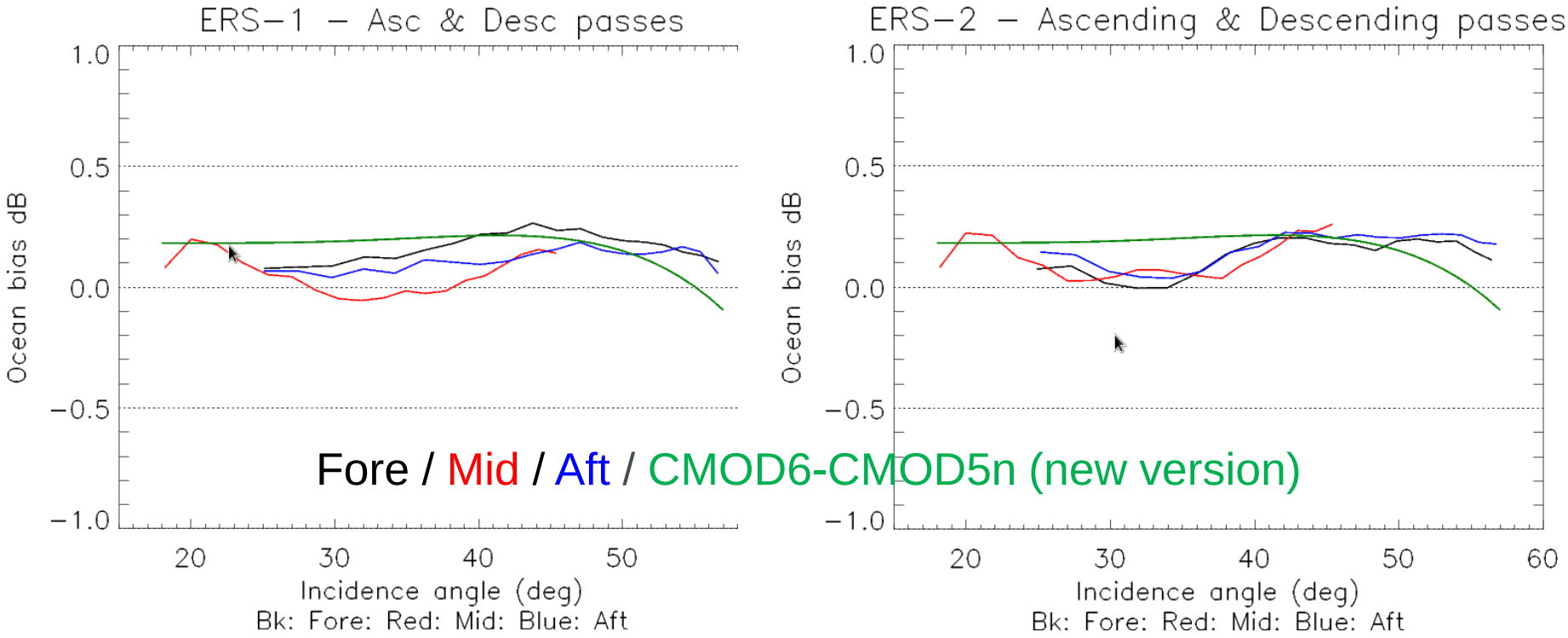
# ERS-1 / ERS-2 over Rainforest: gamma0 pattern




- ERS-1 pattern slightly decreasing at far swath
- ERS-2 pattern very flat as expected

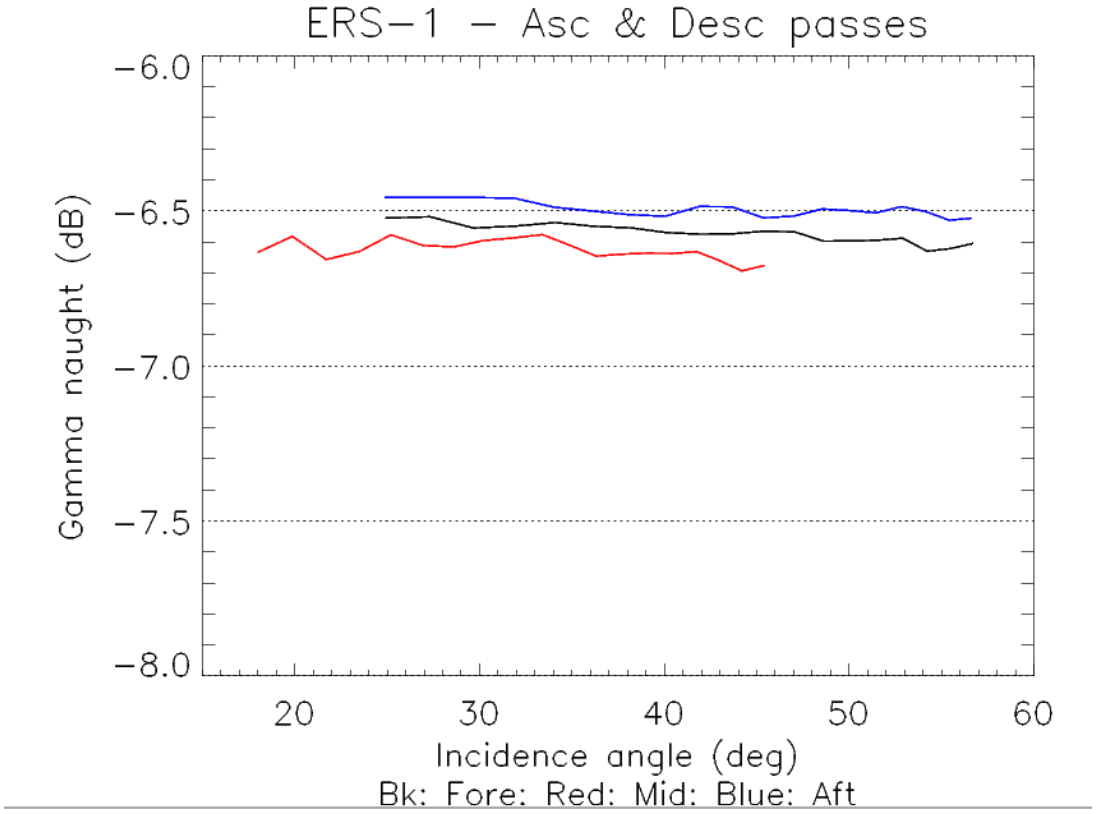
# ERS-1 / ERS-2 NOC: bias CMOD6b



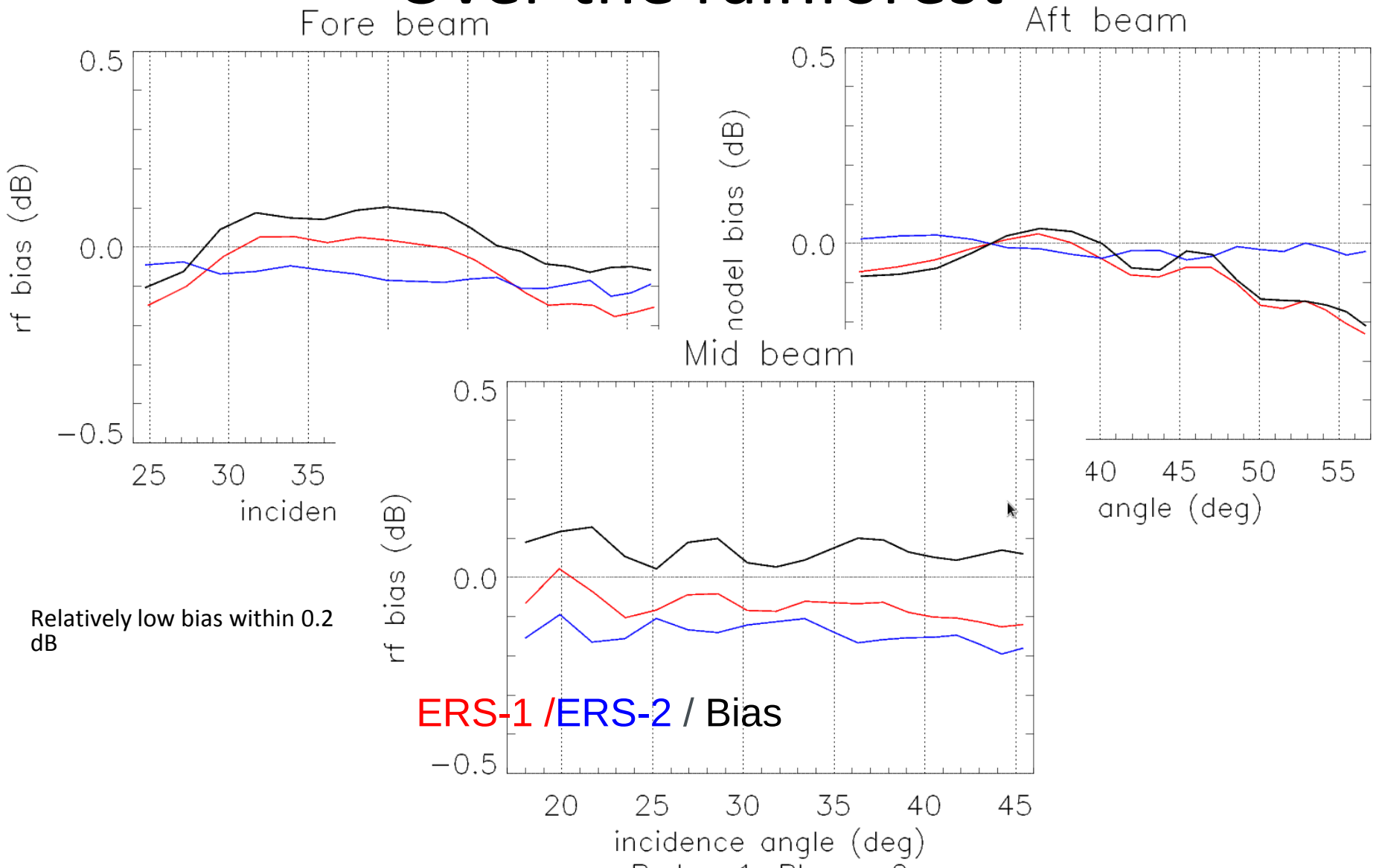

- Mean values are very close
- The agreement is not very bad between scatterometer and CMOD6

# Effect of ERS-2 correctcion on ERS-1 gamma pattern

- The model bias wrt to **ERS-2 (over the Rainforest)** is used to « correct » ERS-1 s0
  - As if it were the new calibration coefficients
- Using these « corrected » s0, compute the gamma nough
  - Gamma nought looks similar to what is obtained with ERS-2 data

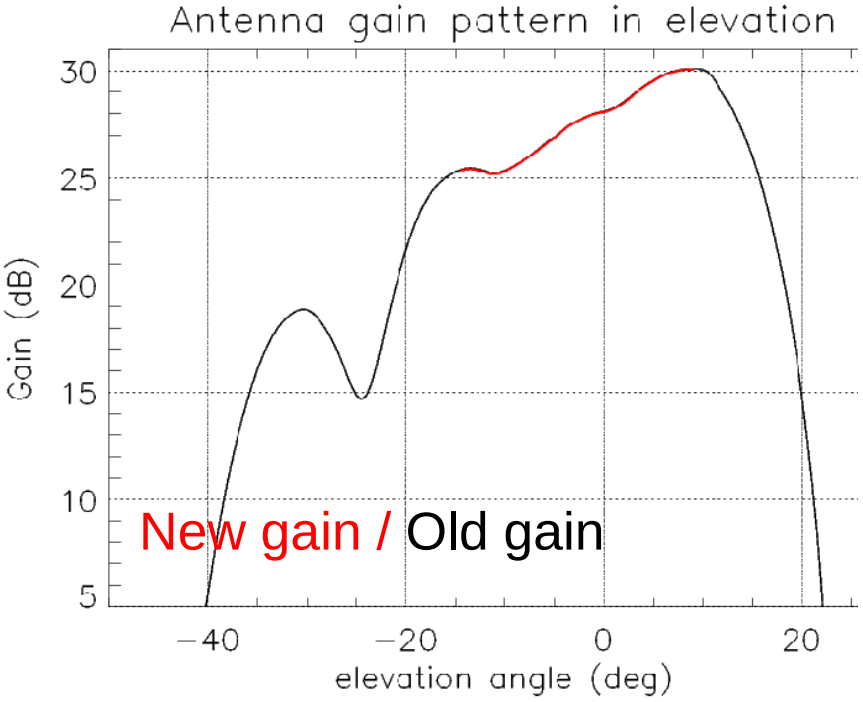


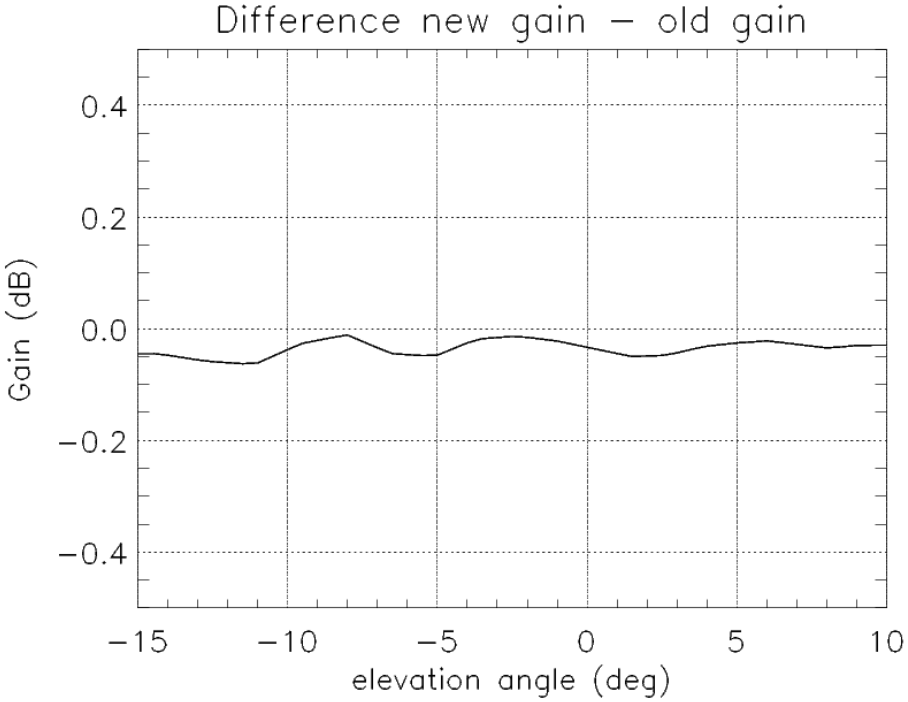
# ERS1 – ERS2 cross-comparison
# Over the rainforest




Relatively low bias within 0.2 dB

# ERS1 new antenna gain from bias -- Preliminary




- New antenna gain is synthetized from the bias

# ERS-1 antenna pattern extraction

- Summary:
  - The procedure is in place
  - ASPS ERS-2 data during tandem phase is partially lacking
    - Is coming in as we speak.

# Overview - Plan

Plan

- Review calibration of ERS-2 (will be used as reference)
- Derive calibration coefficients for ERS-1
  - Require to know the antenna diagram used to produce the data
    - Validation of the WSP/ASPS for ERS-1/AMI processing
  - Actually deduce calibration coefficients (new antenna pattern)
    - Validate by processing a significant dataset using new antenna pattern
      - G-POD
    - Check calibration of processed data
- Assess temporal stability of ERS-1

# Validating of ERS-1 antenna diagram

- Validation of ERS-1 antenna diagram:
  - Process a significant ERS-1 dataset (several cycles)
    - Using the « candidate » antenna pattern
  - Using those re-processed cycles
    - Confirm calibration (KNMI, TUW)
- The processing task:
  - Processing 1 orbit takes about 1 hour.
    - But can be done in parallel
      - About one week on 10 CPUs for 3 cycles
      - G-GPOD, or RMA

# Validating of ERS-1 antenna diagram

- Processing on G-POD status
  - Software was delivered and correctly installed
    - Minor issue with the compilation of an external library
  - The main issue is the availability of IDL licences
    - Run-time mode was attempted
    - Current status: « demo-mode » is entered in stead of « run-time » mode.
      - Causes an abort of the program when calling the external library
      - Still working on that.
- If all else fails, processing could be performed at RMA.

# Overall Summary

- Issues
  - Decision on reference for new ERS-1 antenna pattern
    - CMOD6b: agreement with ASCAT, but (small) discrepancy wrt ERS-2
    - Rainforest: good agreement with ERS-2 but discrepancy wrt ASCAT
    - Ideally, one would confirm limit of validity of the constant gamma0 model over the rainforest using another source
  - ASPS ERS-2 data during tandem phase lacking
    - Necessary for cross-calibration/comparison over rainforest.
    - Still being added as we speak.
  - G-POD issues running IDL processor
    - All hope is not lost + existance of alternate solution (RMA)

# Way ahead

- Way ahead
  - Finalize determination of new ERS-1 antenna pattern
    - Preliminary values already available
  - Validate antenna pattern
    - Process some cycles
      - Using G-POD to process data
      - Or RMA computing infrastructure.
    - Validate processed data (RMA, KNMI, TUW, ECMWF)