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# Analysis of the ASCAT wind inversion residual: Towards an improved C-band Geophysical Model Function

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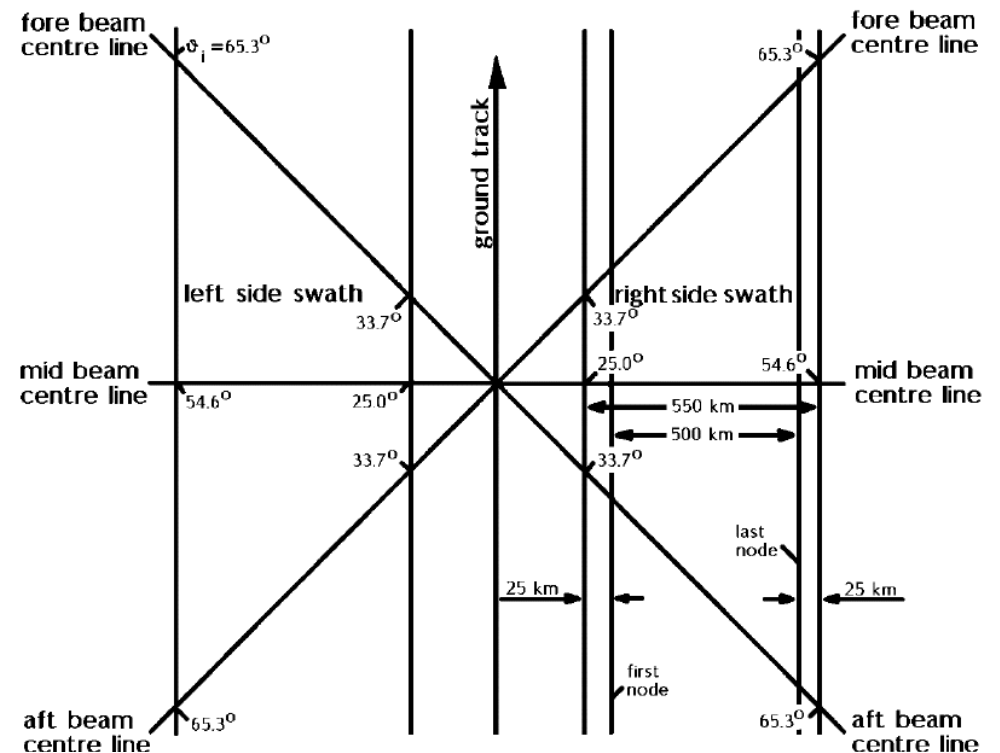
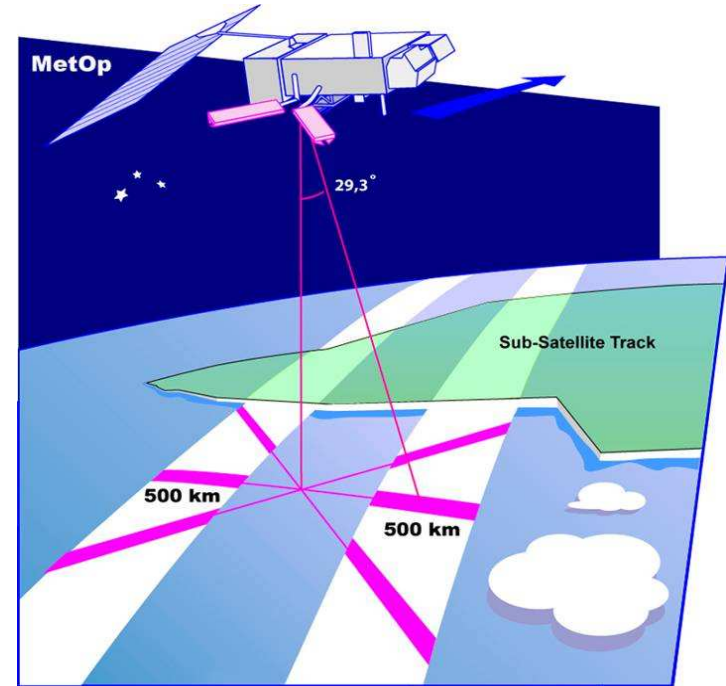


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# ASCAT Instrument

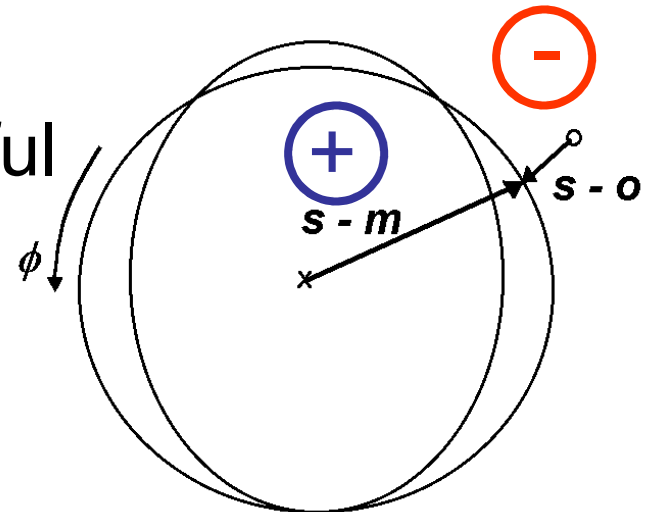
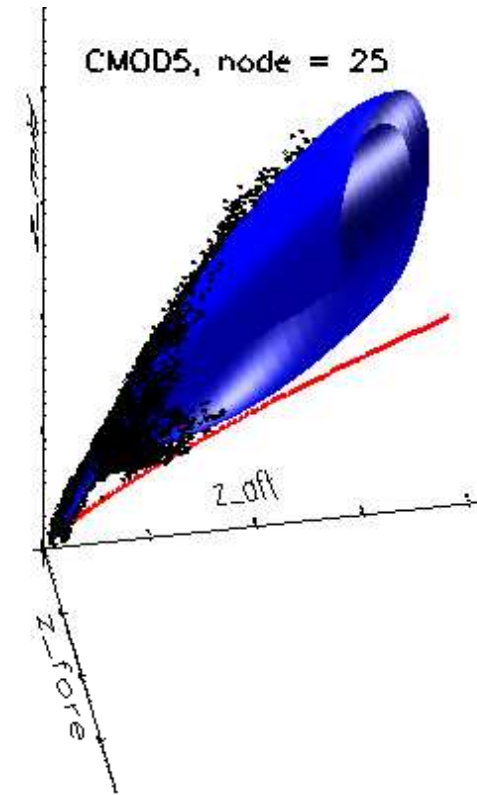
- Real aperture radar
- C-band (5.25 GHz)
- VV polarization
- 3 fan-beam antennas in each side
- Coverage: 2 x 550 km
- Sampling: 25 & 12.5 km
- Primary application: sea surface wind observation
- ERS heritage



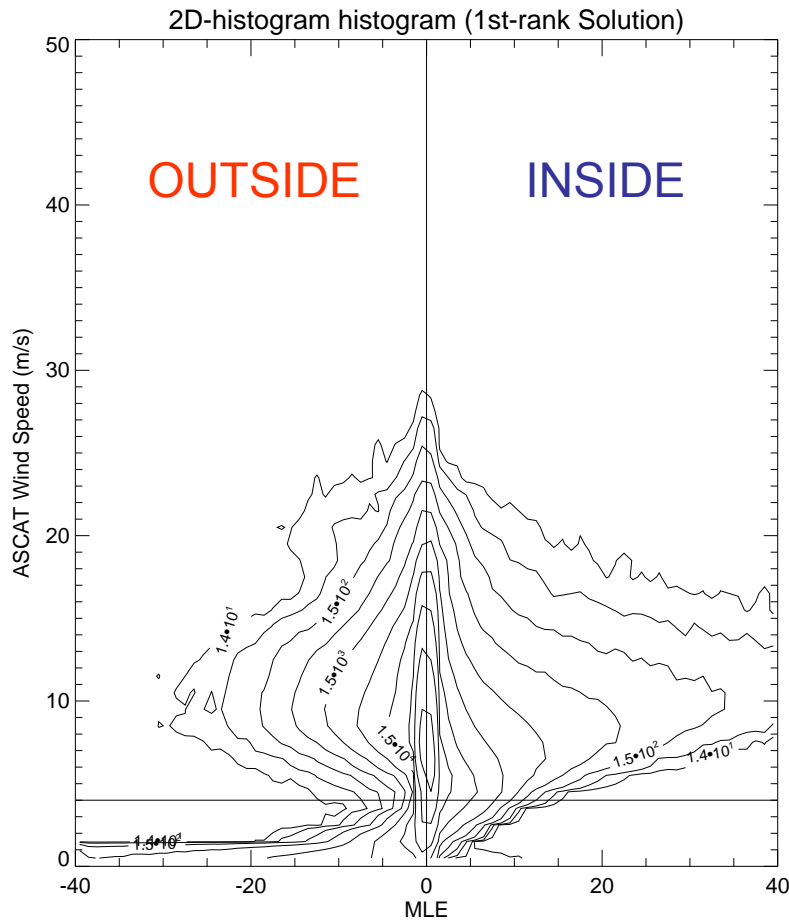
# Introduction

$$\sigma^o = GMF(v, \phi, \theta, p, f)$$

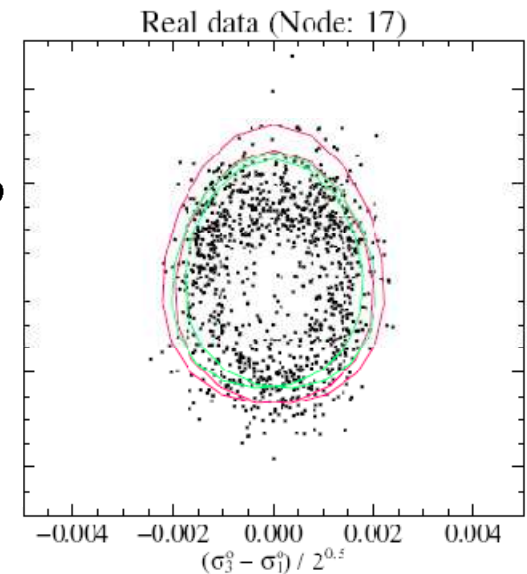
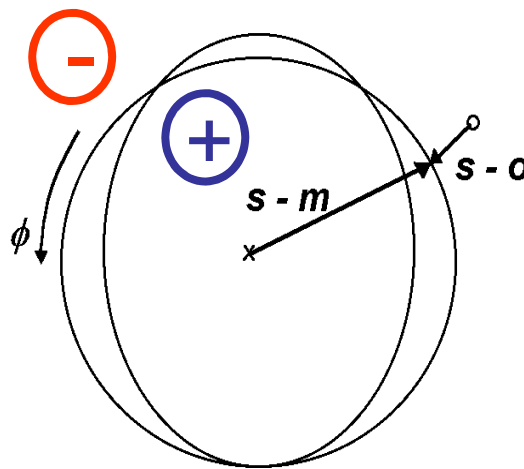
- CMOD-5 GMF in 3D measurement space: conical shape
- Inversion residual (MLE) can be interpreted as the minimum (squared) distance between measurement triplet and cone surface
- MLE “sign” analysis can be useful in identifying
  - GMF errors
  - QC issues
  - Geophysical patterns



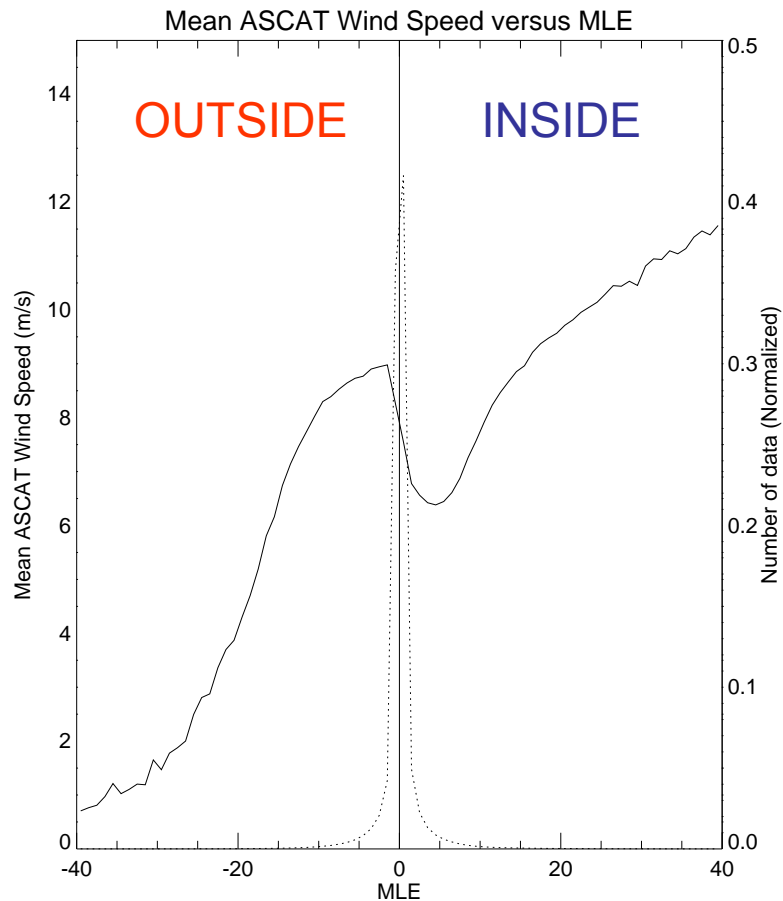
# CMOD-5 GMF errors



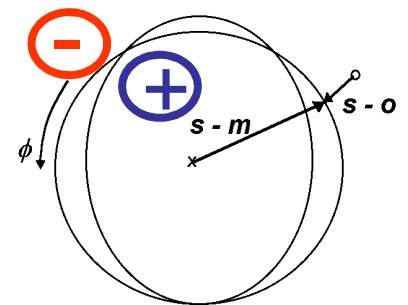
- Reasonable symmetry at medium-high winds
- Around 4 m/s most triplets inside the cone
- At very low winds, opposite effect



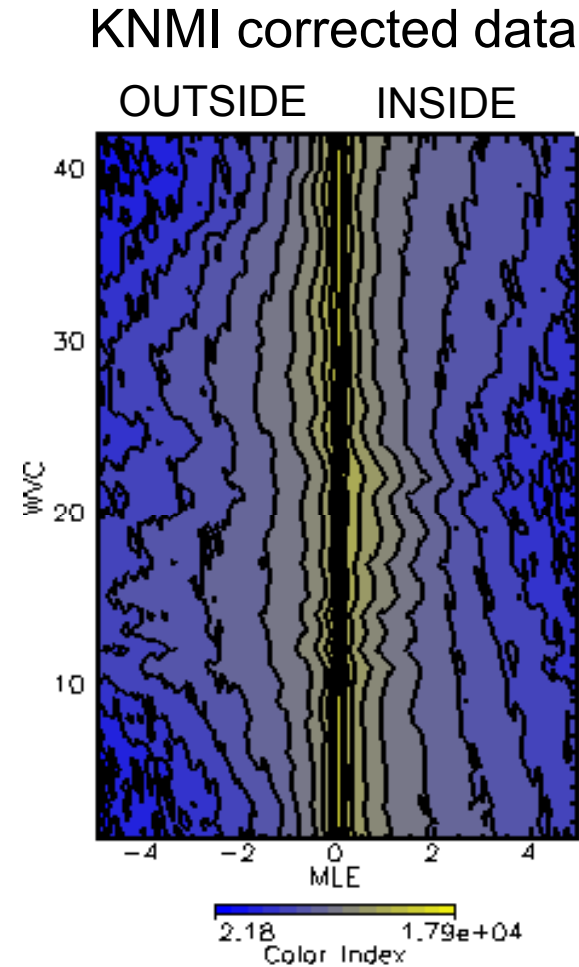
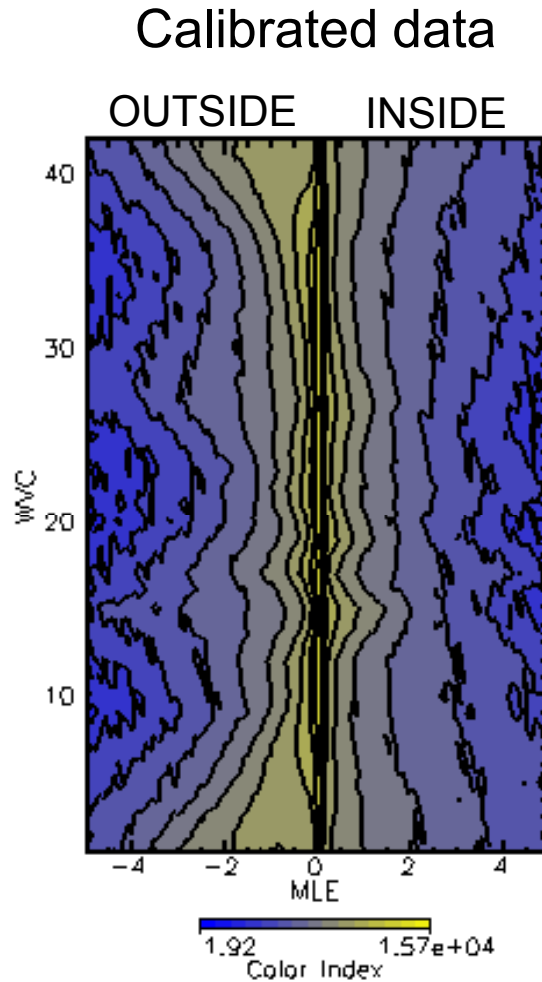
# CMOD-5 GMF errors



- At large MLE values:
  - Most high winds **inside** the cone
  - Most low winds **outside** the cone
- At small MLE values:
  - Effect of 4 m/s wind gap **outside** the cone shows up.

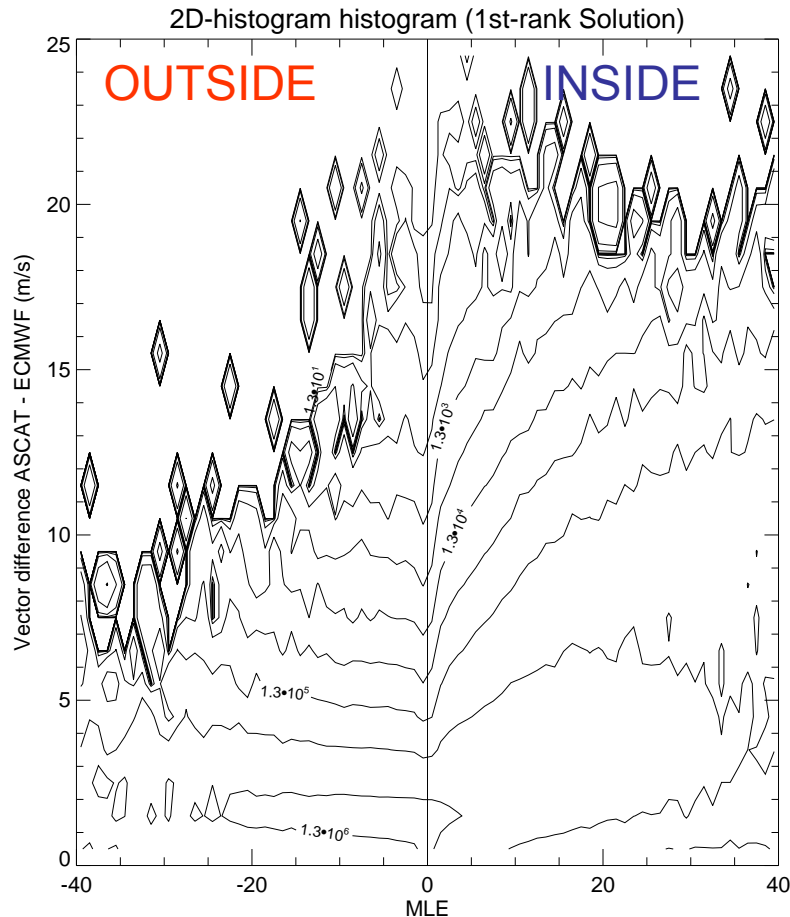


# CMOD-5 GMF errors

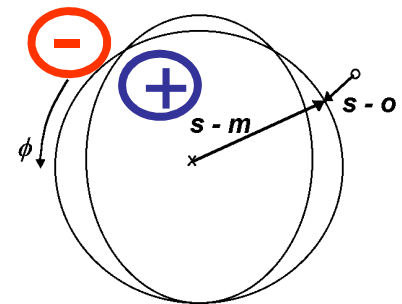


- Outer swath nodes: more triplets outside
- After correction, more symmetry and lower MLE values

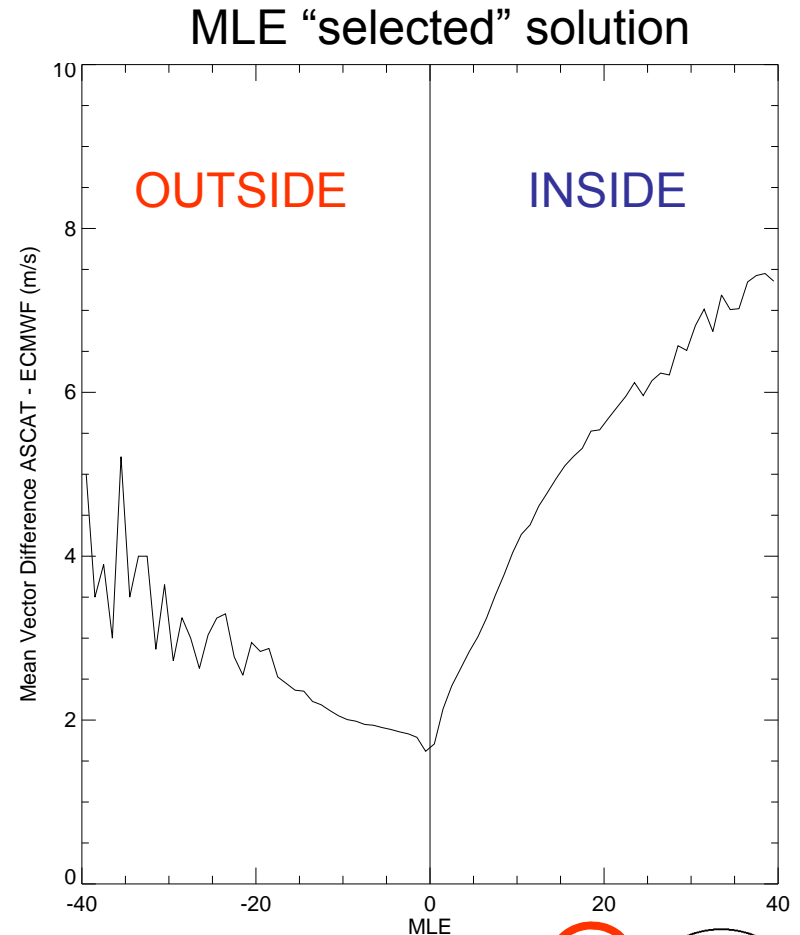
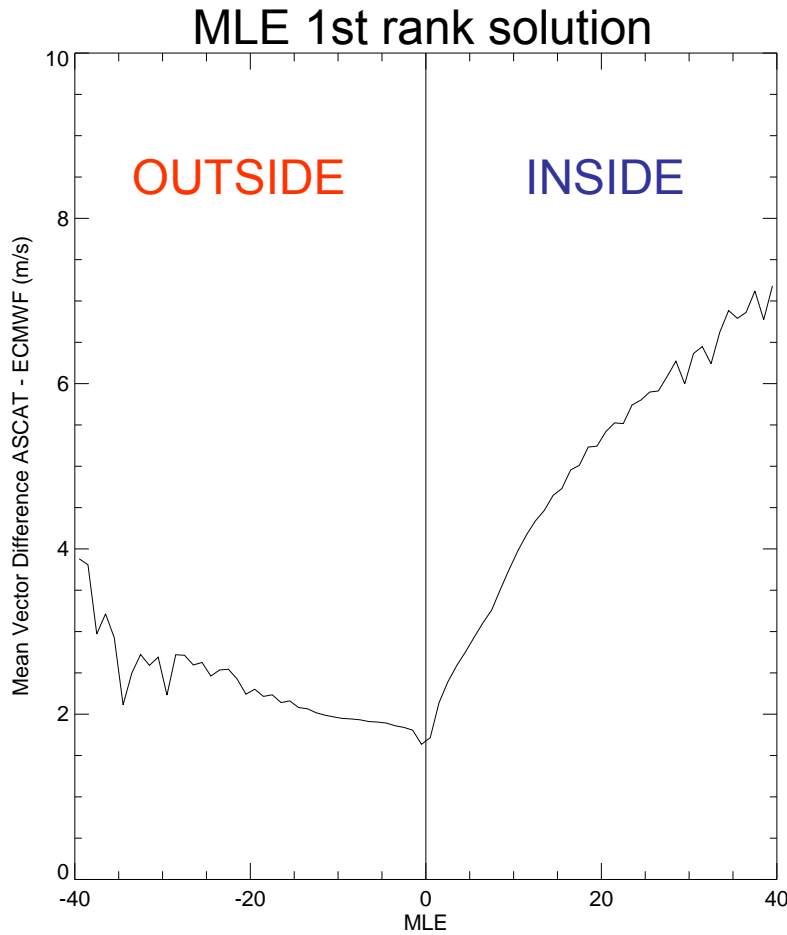
# QC issues



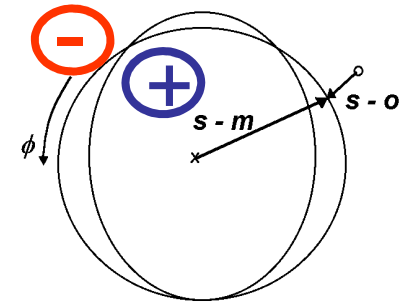
- MLE as a QC indicator: different behaviour depending on sign
- MLE more sensitive to wind quality **inside** the cone
- Triplets **outside** the cone result in better quality winds
- Different QC threshold depending on MLE sign?



# QC issues



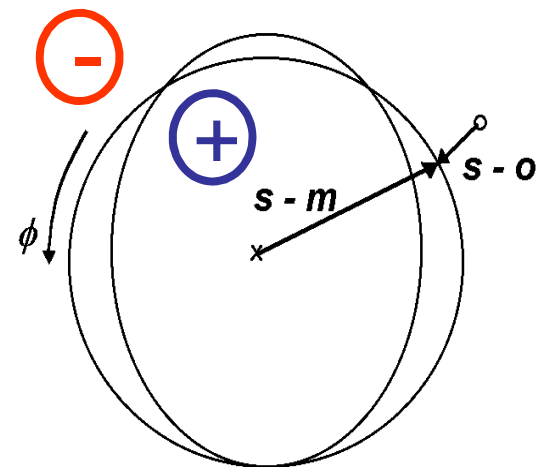
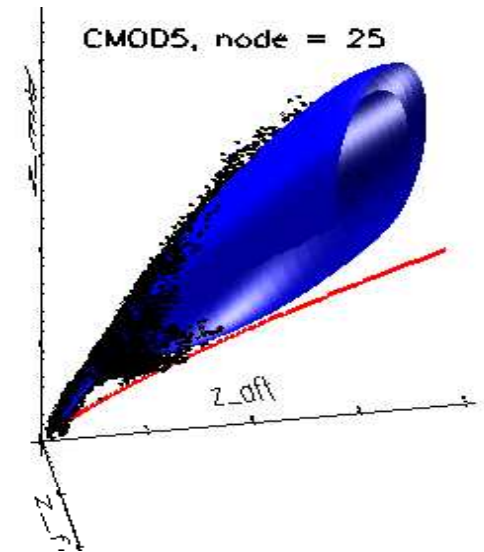
- MLE "selected" more sensitive to data quality than MLE 1st rank

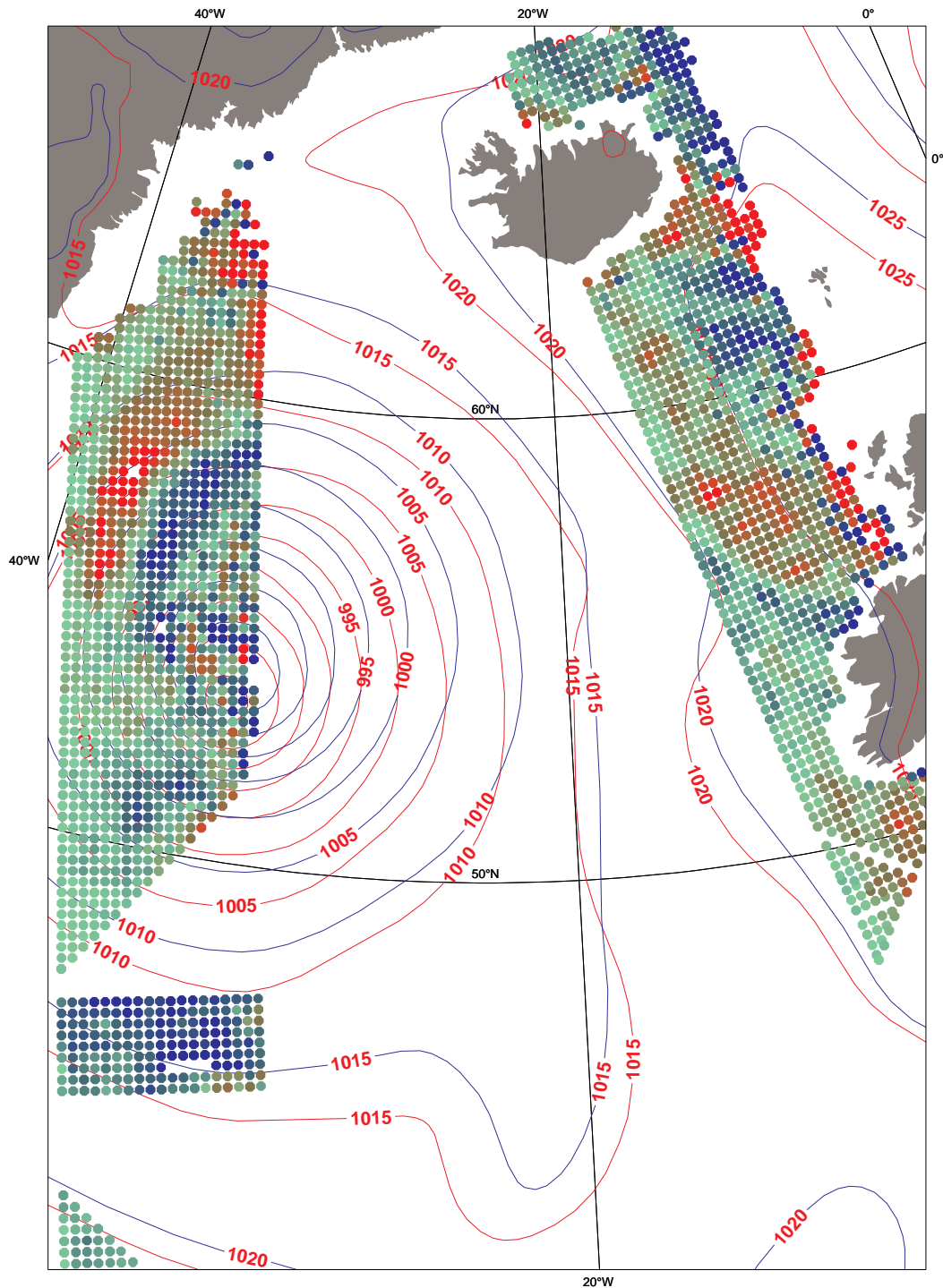


# Can we measure more than mean wind?

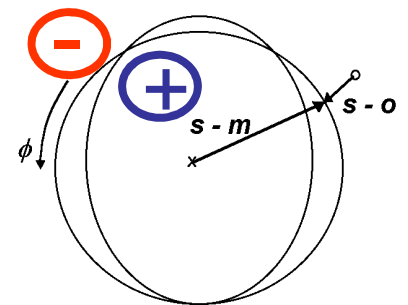
$$\sigma^o = GMF(v, \phi, \theta, p, f)$$

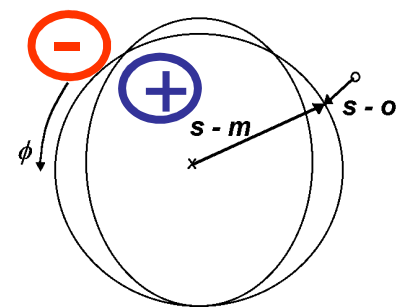
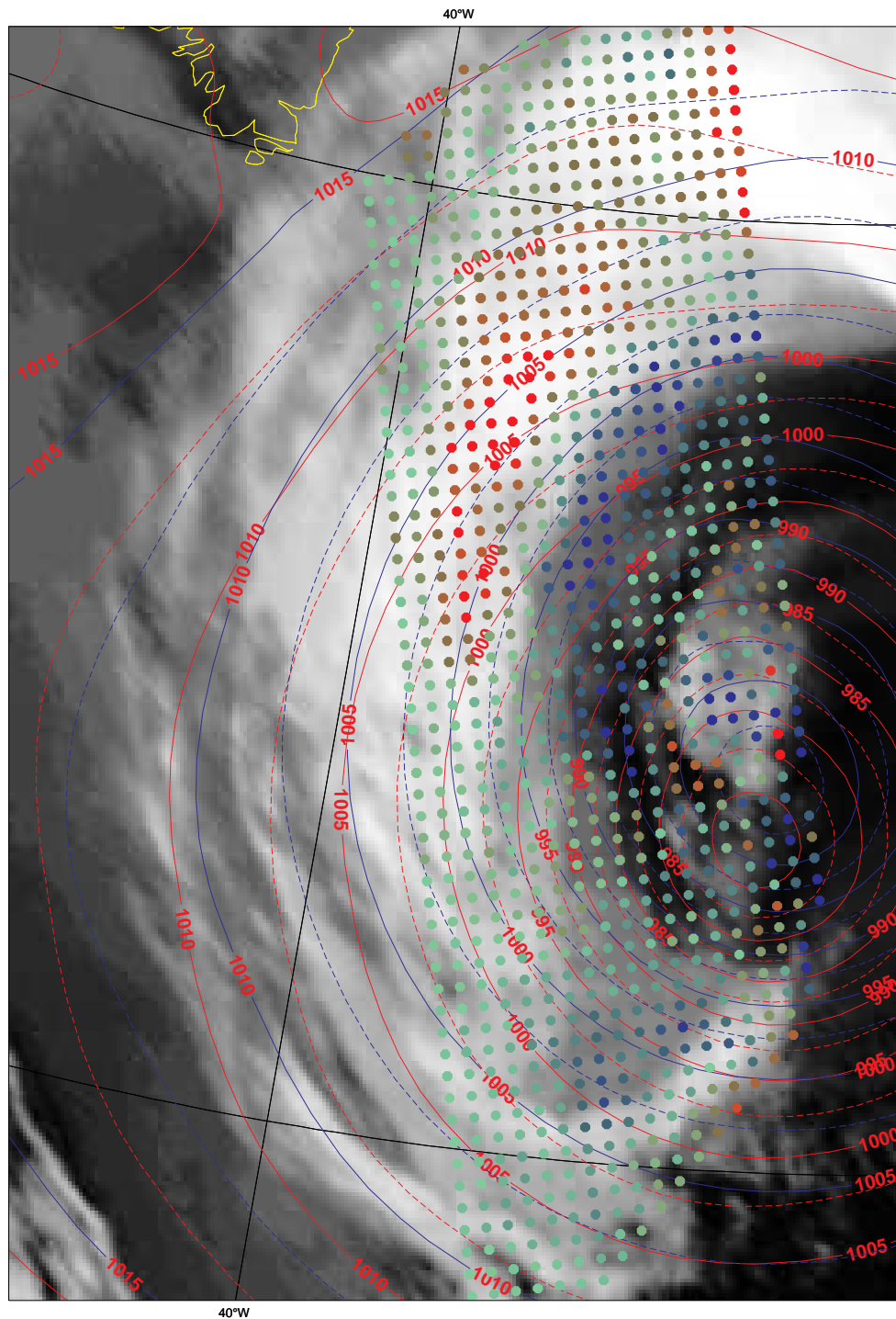
- Geophysical phenomena such as high spatial and temporal wind variability, sea ice, stability, wave age, rain (etc.) affect backscatter signal
- If retrieved wind quality  $\downarrow \rightarrow$  QC
- Identify geophysical patterns in 3D measurement space
- Is MLE sign related to wind gust?



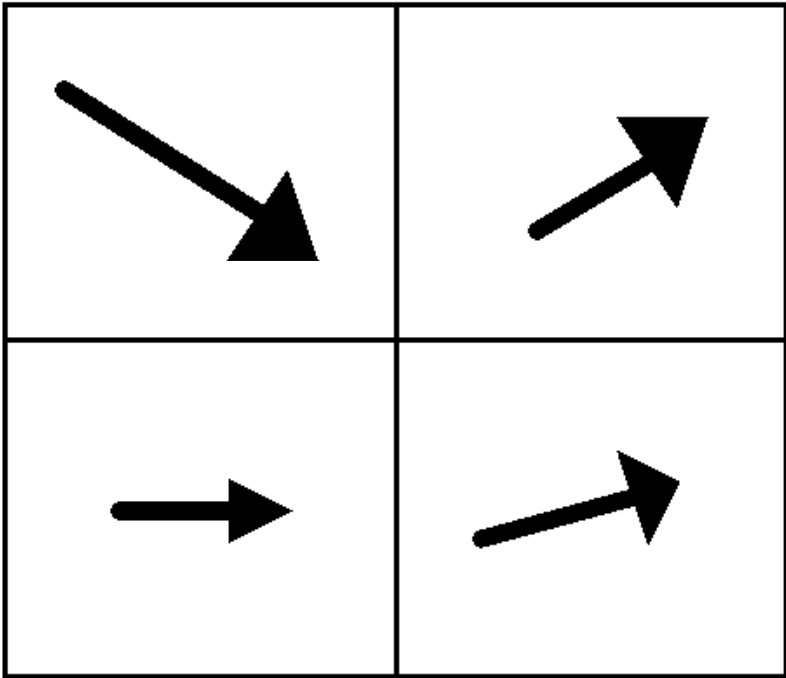
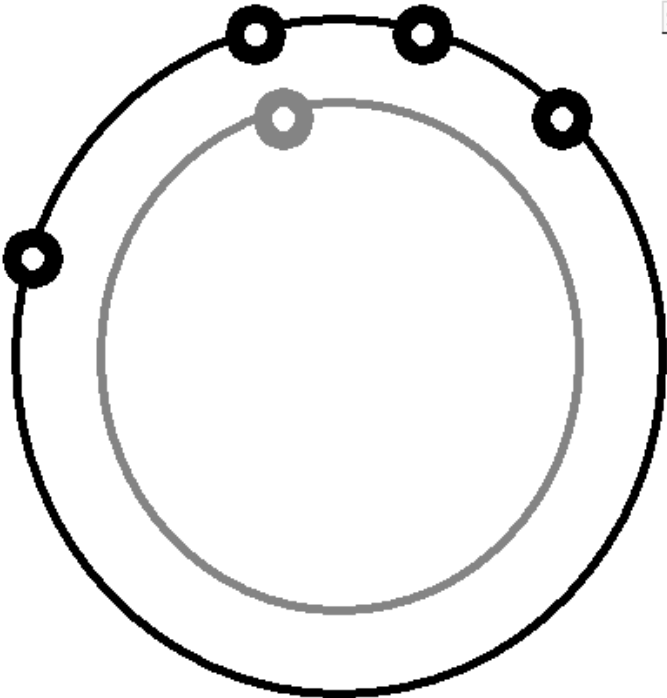


- Warm steady-flow air discerned from polar gusty air.
- Noise at edges of the swath





# Effect of wind variability in the 3D measurement space



# Concluding remarks

- MLE sign analysis proves to be useful for ESCAT & ASCAT. Why not for QuikSCAT?
- CMOD upgrade (CMOD-6):
  - Improved fit at low & very low winds
  - Improved fit at high incidence angles
  - Improved fit at high winds? See NOAA campaign results
- MLE-sign dependent QC? Not before CMOD upgrade
- MLE-sign-based wind gust estimation seems feasible.