Examining cold pool signatures of oceanic systems using ASCAT wind retrievals of varying resolutions

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BACKGROUND

Physical Phenomenon

- Outflow boundaries that emanate from cold pools can occur in different scales and travel up to 100$^\text{nds}$ of km.

Data

- ASCAT is on board MetOp- A, B, C and wind retrievals are reported at spatial resolutions of 25 km, 12.5 km.
- An Ultra High Resolution (UHR) ASCAT product has been developed in Lindsley et al. (2016) with spatial resolution of 3.5 km.

Methods

- A novel technique to identify cold pools in scatterometer wind retrievals has been recently introduced in Garg et al. (2018).
DATA & METHOD

ASCAT UHR
• Image reconstruction method (AVE) -> resolution enhancement.

• Full-resolution (SZF) level 1B containing $\sigma^0$ measurements.

• ASCAT Wind Data Processor (AWDP)

• Near-coastal coverage based on land contribution ratio:
  • Spatial response function estimate (footprint)
  • Land indicator function (rasterized map)

Gradient Feature (GF)
• Wind gradient: $|\nabla \vec{V}| = \left[ \frac{\partial u}{\partial x} + \frac{\partial v}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial v}{\partial y} \right]$  
• Concave hull algorithm

• Sobel technique for edge detection

• Thresholds for GF:
  • Background noise (primary)
  • Bias (secondary)

• Alpha shapes
MOTIVATION

• How do vector winds, induced by cold-pool, change with different product resolutions?

• How do the thresholds for the detection of gradient features change with resolution?

❖ Currently, 4 case studies have been explored.
CASE STUDY

- GF at 12.5 km identifies features associated with wind changes near precipitation.

- GF at 12.5 km is sensitive to the GF thresholds.
• Higher resolution GF products capture more features at a finer scale.
CONCLUSIONS

• ASCAT 25-km product is able to identify features associated with cold pools, but it is not sensitive to variation in the thresholds.

• ASCAT 12.5-km and 3.5 km products can capture smaller scale features associated with precipitating-wind changes and are sensitive to the GF threshold.

• UHR responds to features driven by large and small scale precipitation, in heavy or light rain rate.
ONGOING WORK

• ASCAT UHR algorithm has been setup in MSFC-UAH.

• Additional analysis needs to be done to evaluate the importance of the gradient wind features, including rain flags and maximum likelihood estimation metric.

• RADAR and buoy observations will be incorporated as ground truth when available.
Thank you for your attention!
Back-up slides

**UHR** 3.5km Gradient Wind
03:05 UTC (20180522)

**ASCAT** 12.5km Gradient Wind
03:05 UTC (20180522)
**Coastal product**
Threshold 1 = 6.8e-5
Threshold 2 = 1.2e-4

**UHR product**
Threshold 1 = 10e-4
Threshold 2 = 4e-4
ASCAT GF 25km

- GF at 25 km is able to capture the outflow boundary ahead of the oceanic precipitating system.
- GF at 25 km is not sensitive to the GF thresholds.
ASCAT GF 3.5km

- GF at 3.5 km provides finer scale feature associated with precipitation and outflow boundaries.
- Caution needs to be taken within precipitation regions.
- GF at 3.5 km is sensitive to the GF thresholds.
- One order of magnitude lower threshold in comparison with lower resolution products.