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 100nds 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).

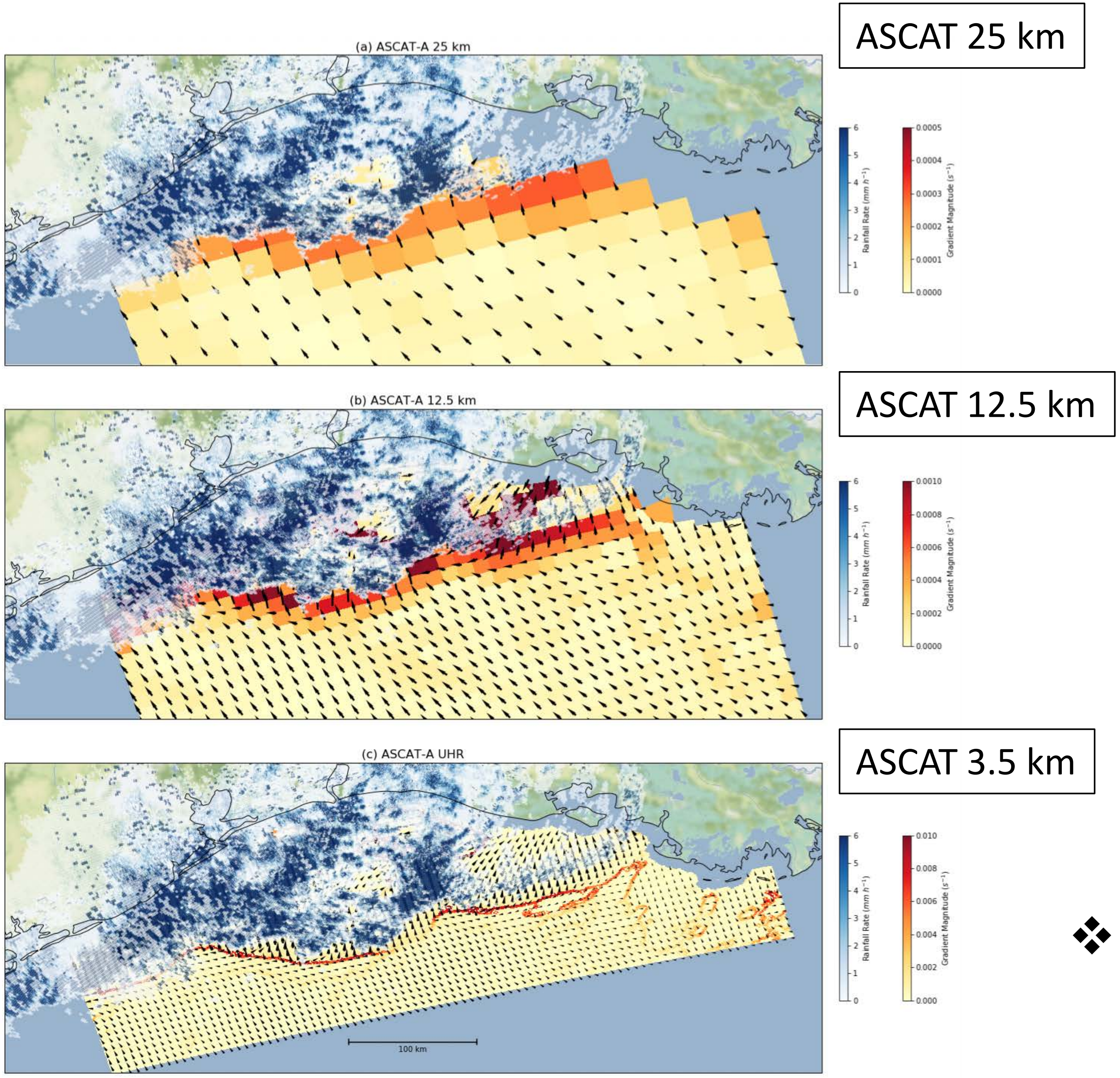
DATA & METHOD

ASCAT UHR

- Image reconstruction method (AVE)
  -> resolution enhancement.
- Full-resolution (SZF) level 1B containing σ^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: $\left|\nabla\vec{V}\right| = \begin{bmatrix} \frac{\partial u}{\partial x} + \frac{\partial v}{\partial x} \\ \frac{\partial u}{\partial y} + \frac{\partial v}{\partial y} \end{bmatrix}$
- Concave hull algorithm
- Sobel technique for edge detection
- Thresholds for GF:
  - Background noise (**primary**)
  - Bias (**secondary**)
- Alpha shapes



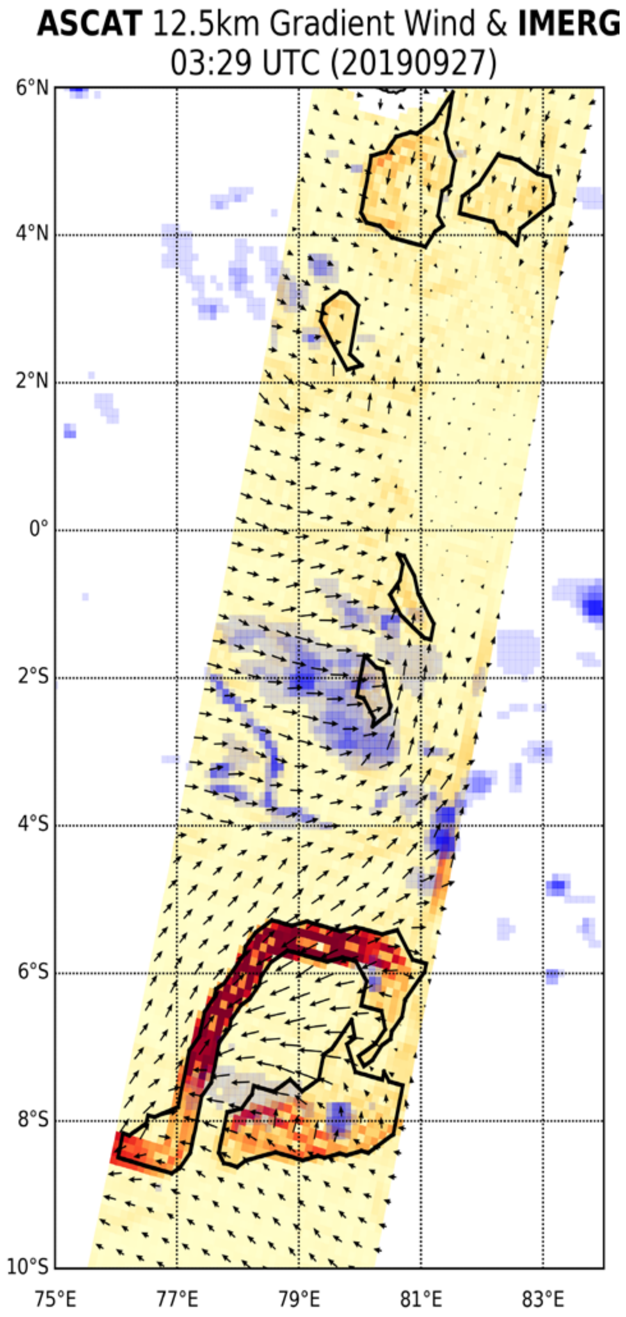
MOTIVATION

- 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?

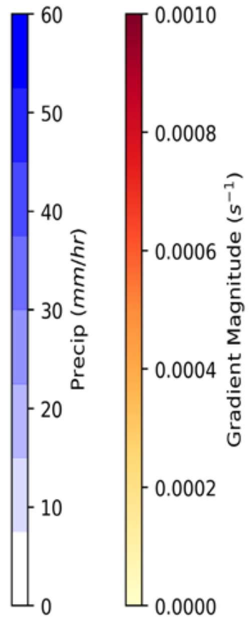
❖ ***Currently, 4 case studies have been explored.***

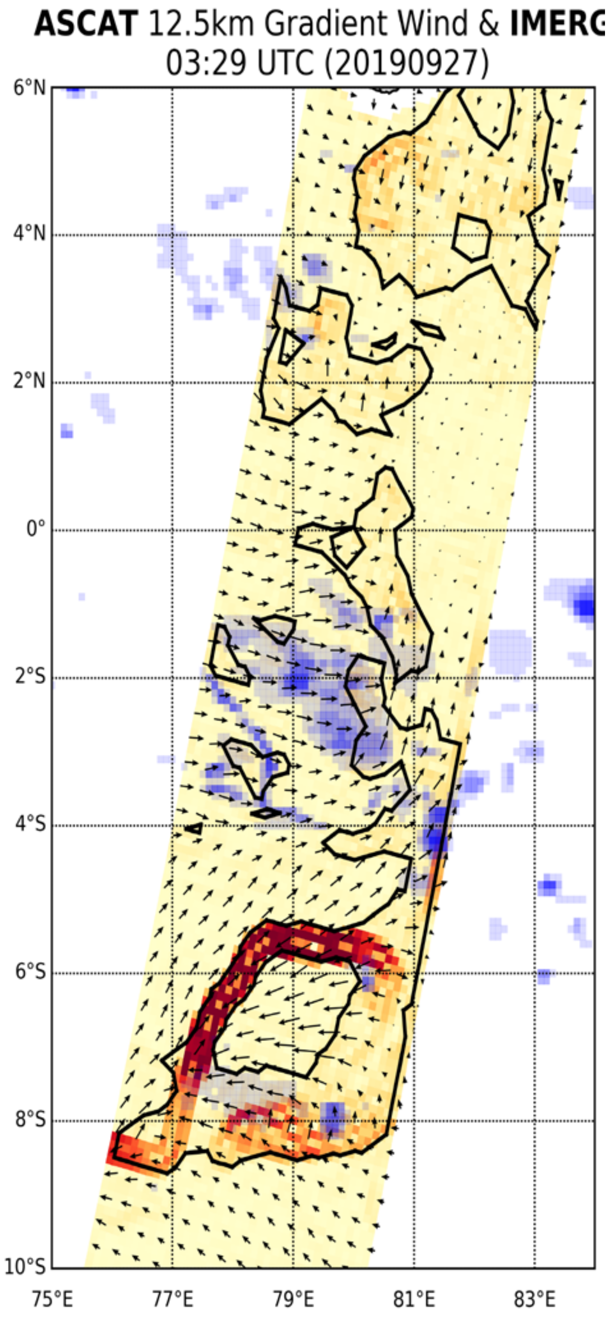
CASE STUDY



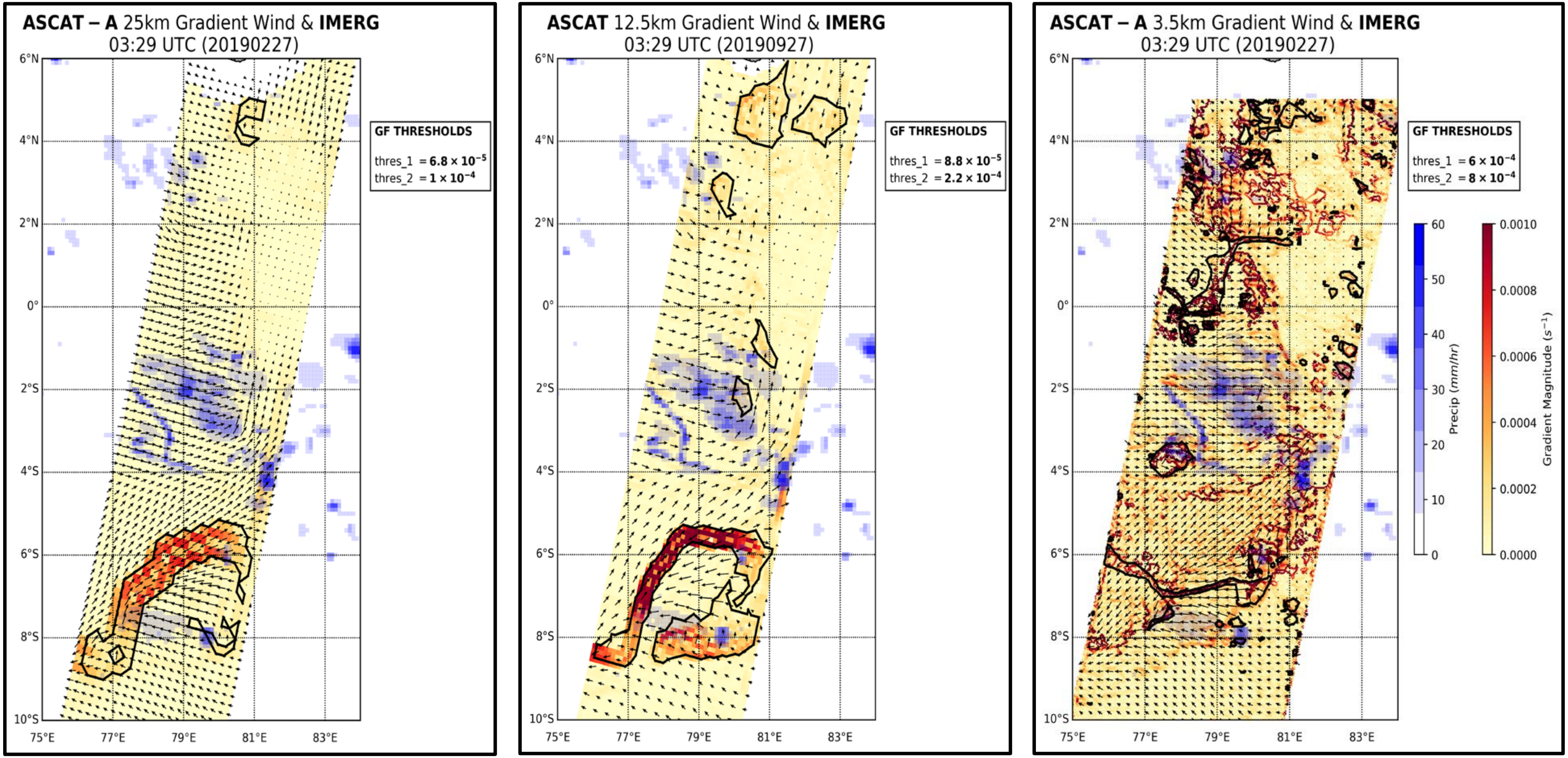
INDIAN OCEAN

GF THRESHOLDS
8.8 vs 4 (x 10^{-5})
2.2 vs 2 (x 10^{-4})





- 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!