

Wave current interaction observations and predictions using satellite data

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Simulated wave rays vs. satellite observations



Observations :

Sentinel1 SAR images

Altimeter Significant wave height (CCI Sea State dataset)

Simulation :

wave-current interaction analytic equations solved numerically

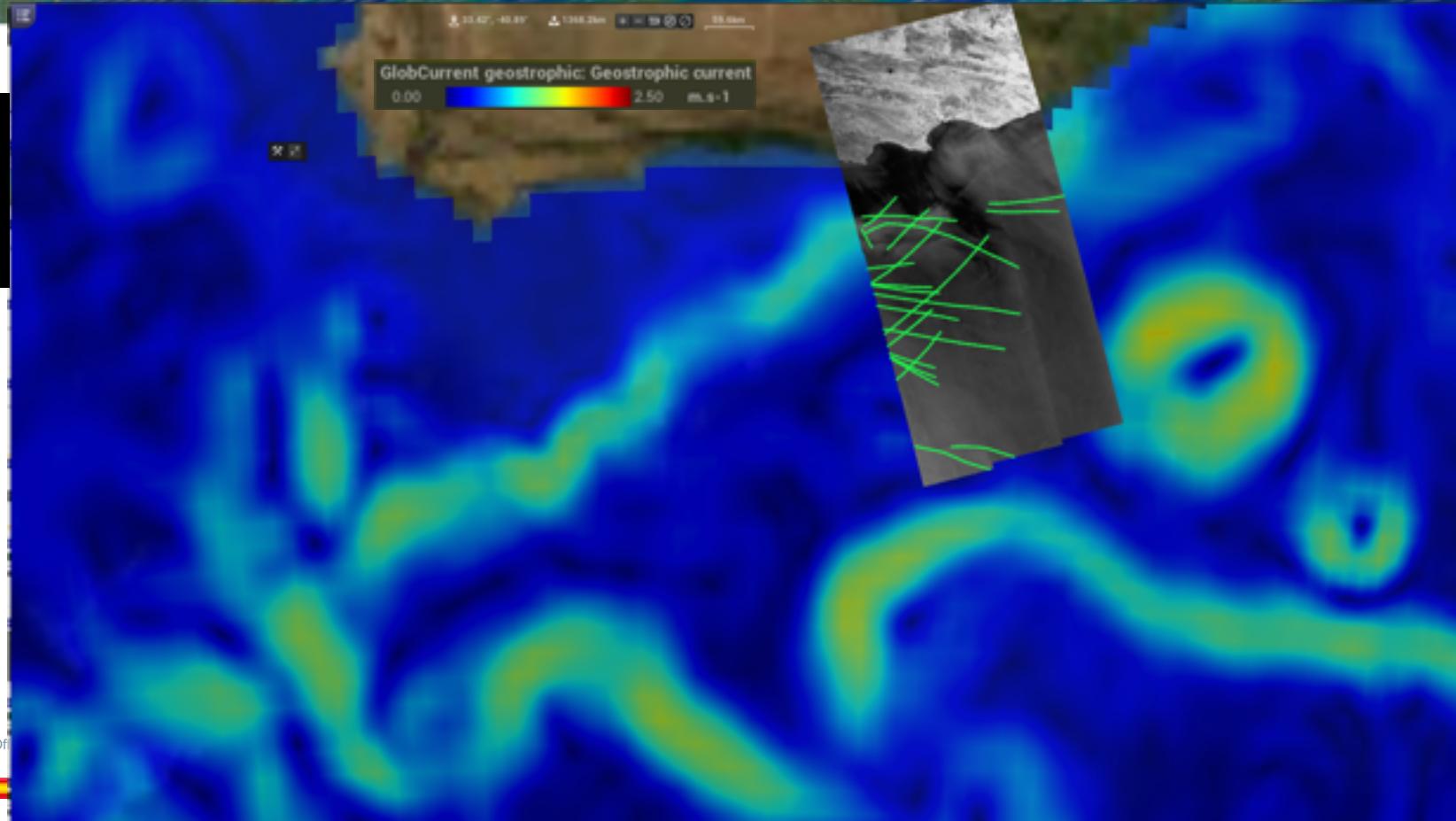
Input current from Model or observation based (altimeter sea level)

Incoming swell from Arpege forced Météo France MFWAM

CMEMS Model vs. Observed surface current



Sentinel 1
wave rays
observations



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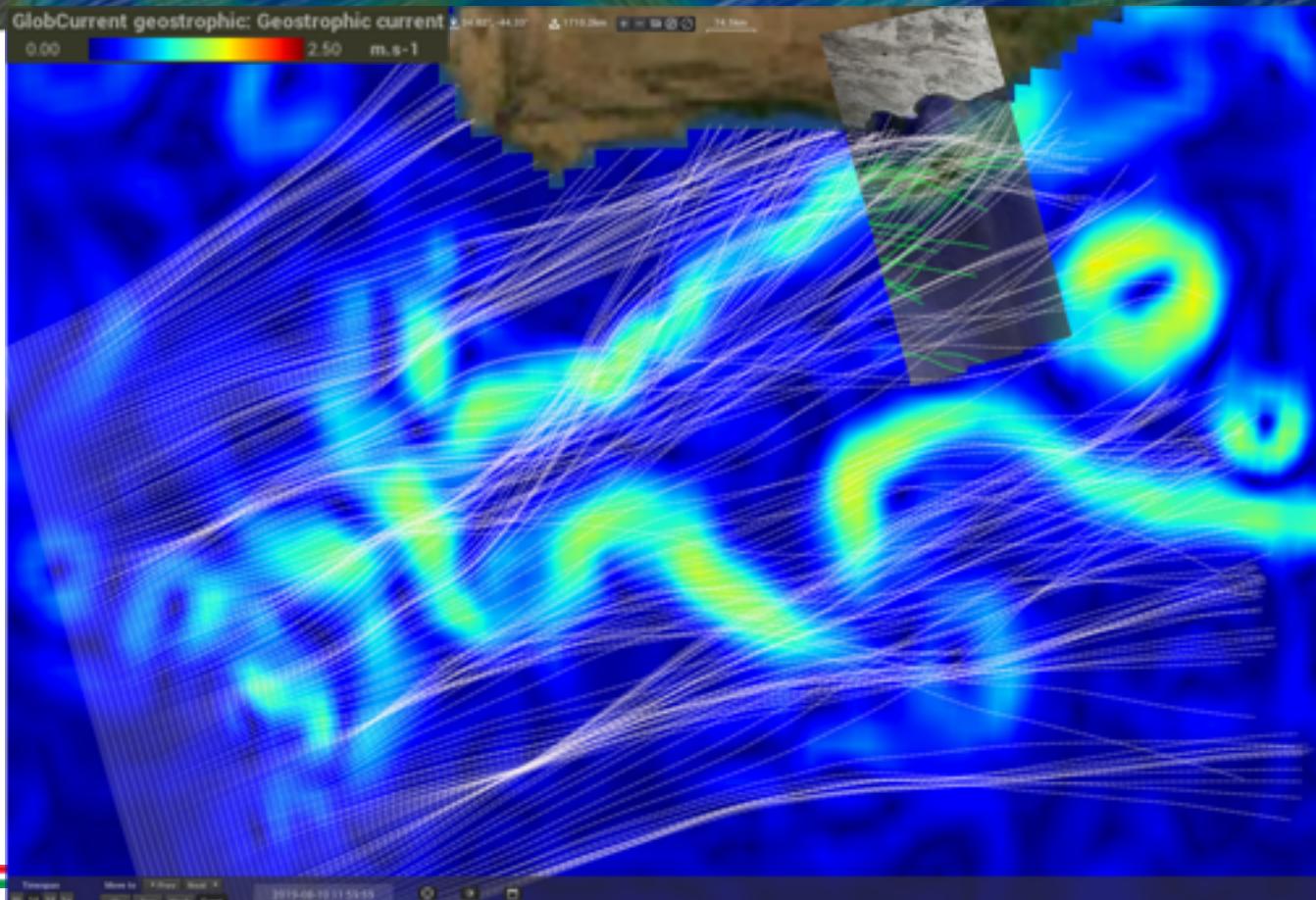


CMEMS Model vs. Observed surface current



**Sentinel 1
Observations**

**Simulated wave rays with
Geostrophic current**



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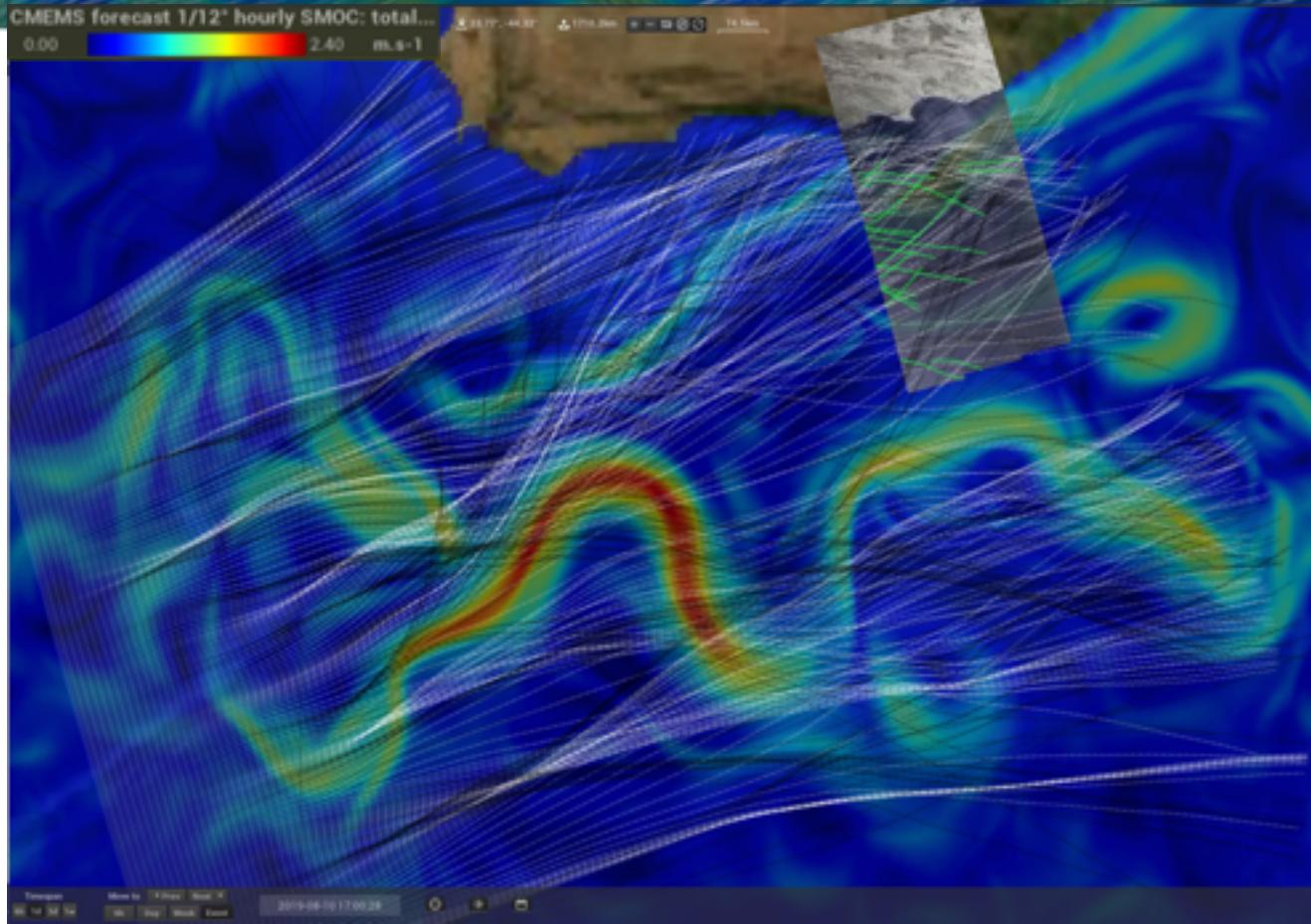
CMEMS Model vs. Observed surface current



**Sentinel 1
Observations**

Geostrophic

Mercator 1/12°



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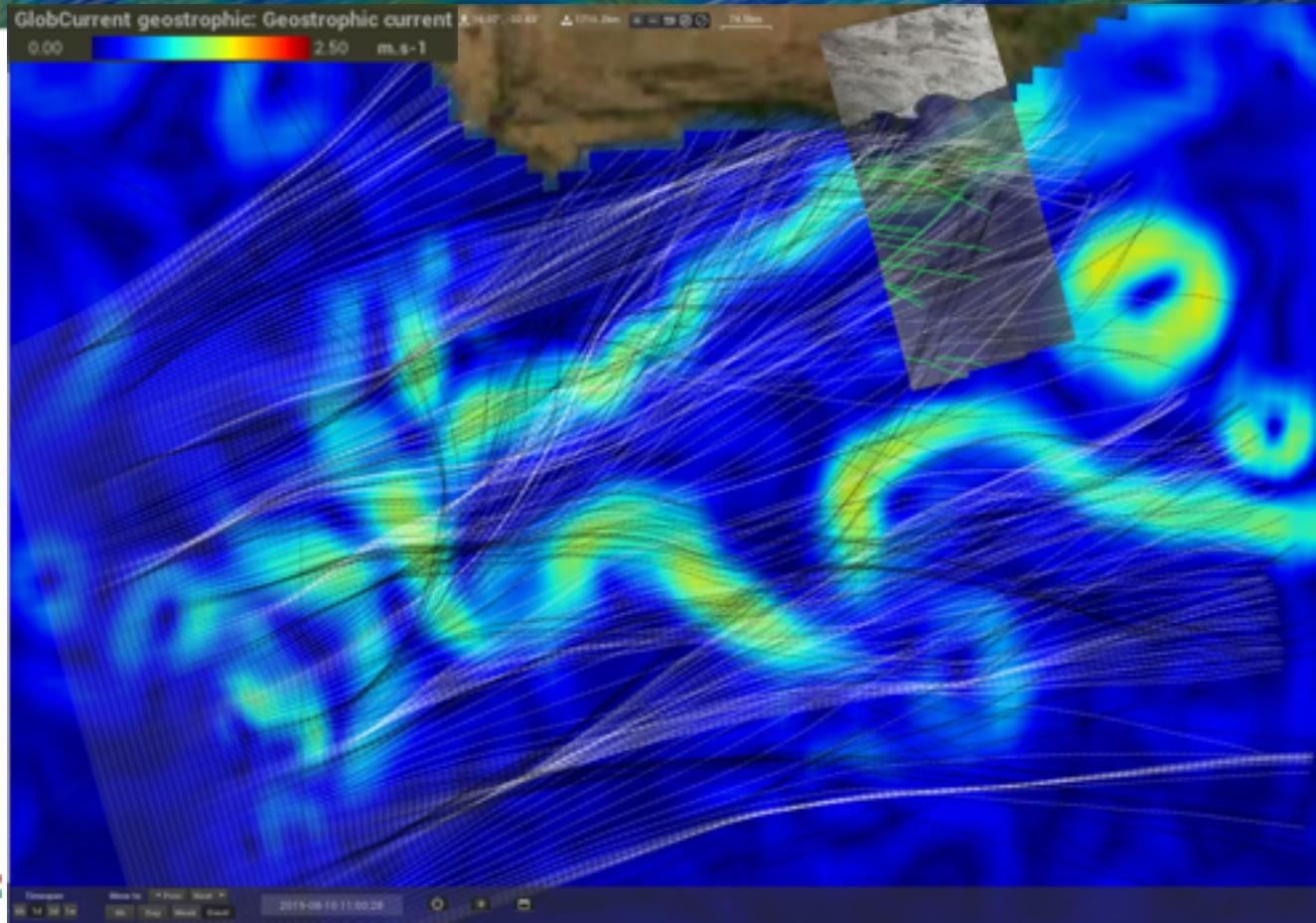
CMEMS Model vs. Observed surface current



**Sentinel 1
Observations**

Geostrophic

Mercator 1/12°



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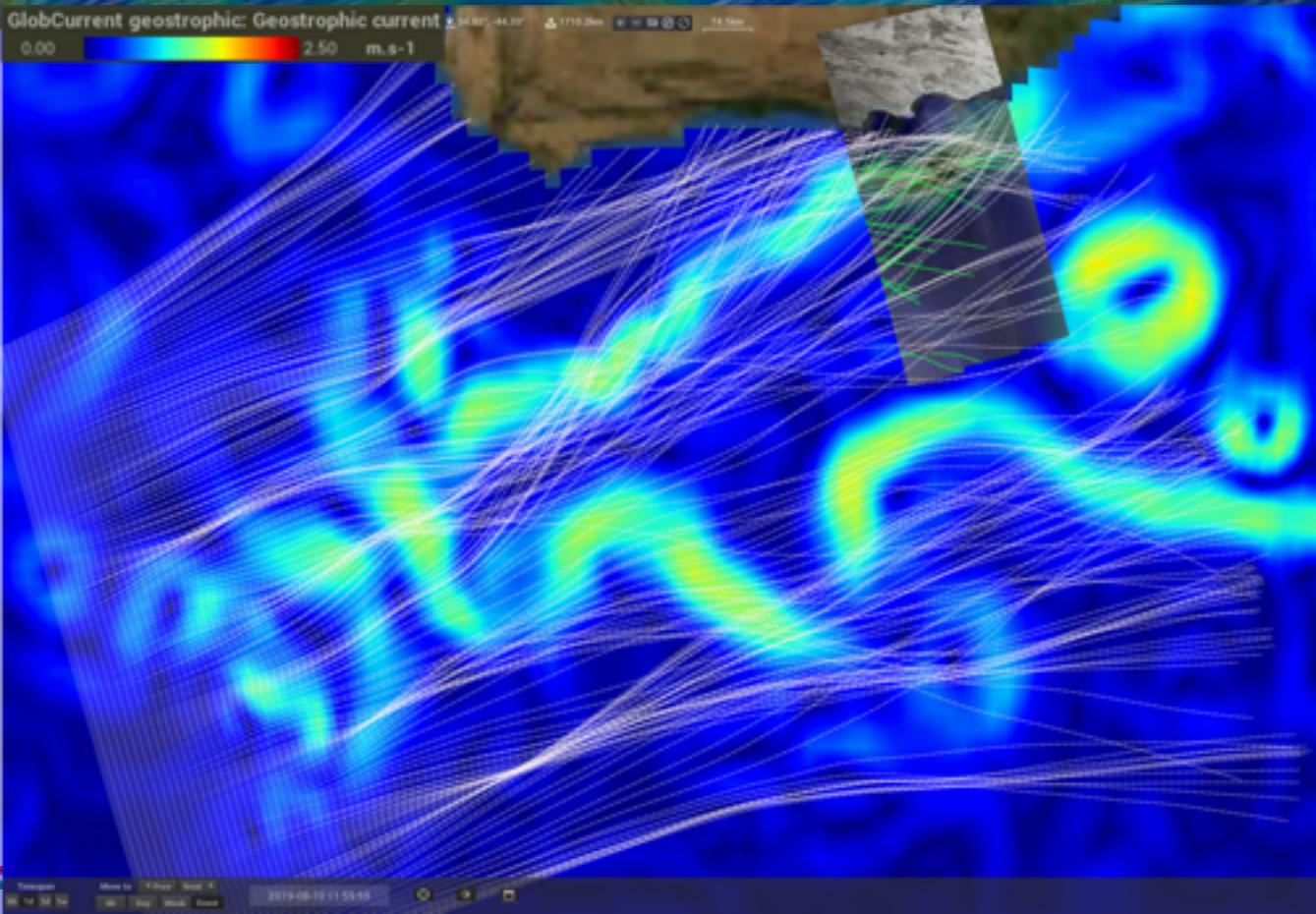


CMEMS Model vs. Observed surface current



**Sentinel 1
Observations**

**Simulated
wave rays with
Geostrophic +
random small
scales**



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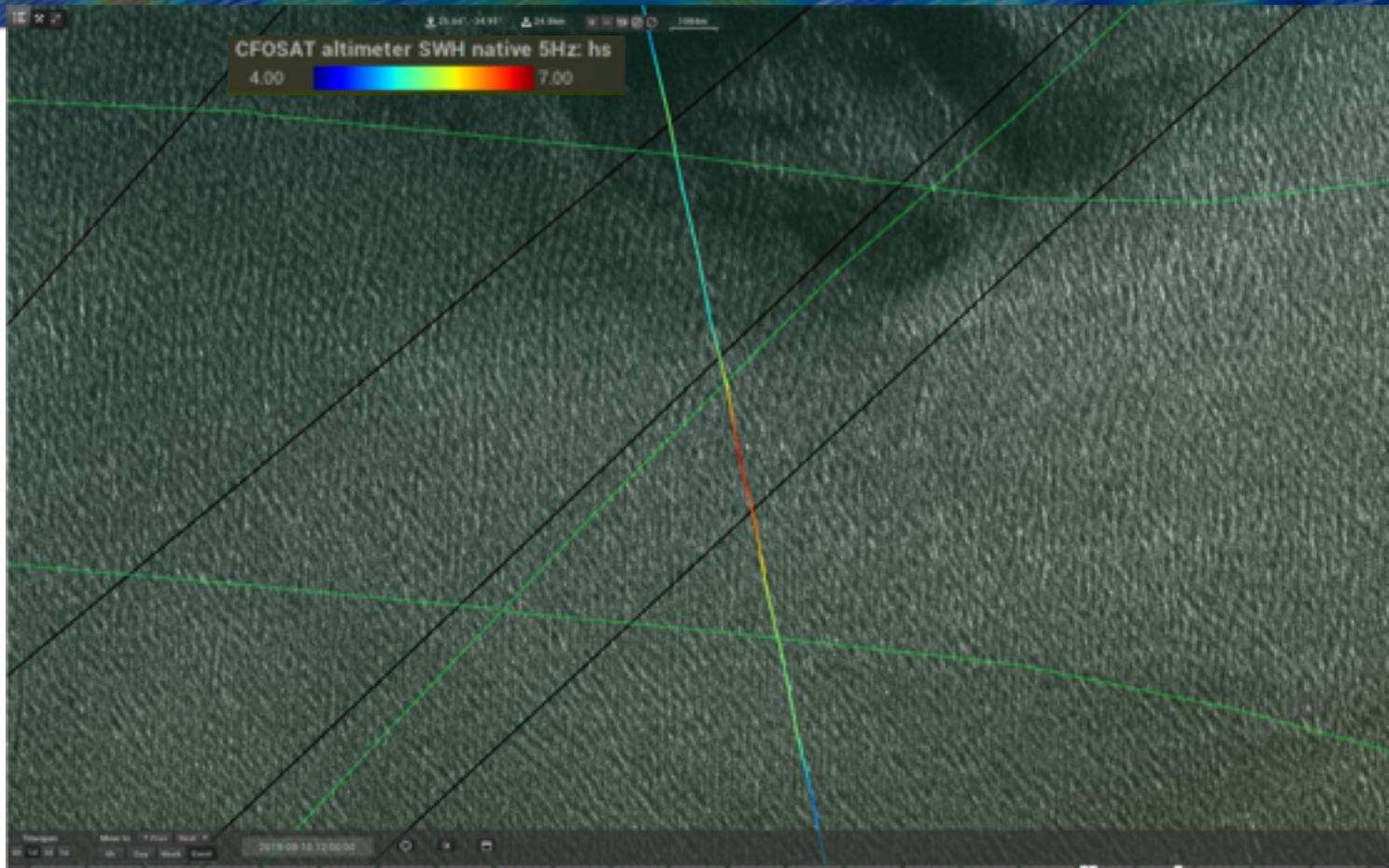


CMEMS Model vs. Observed surface current



**Sentinel 1
Observations**

Mercator 1/12°



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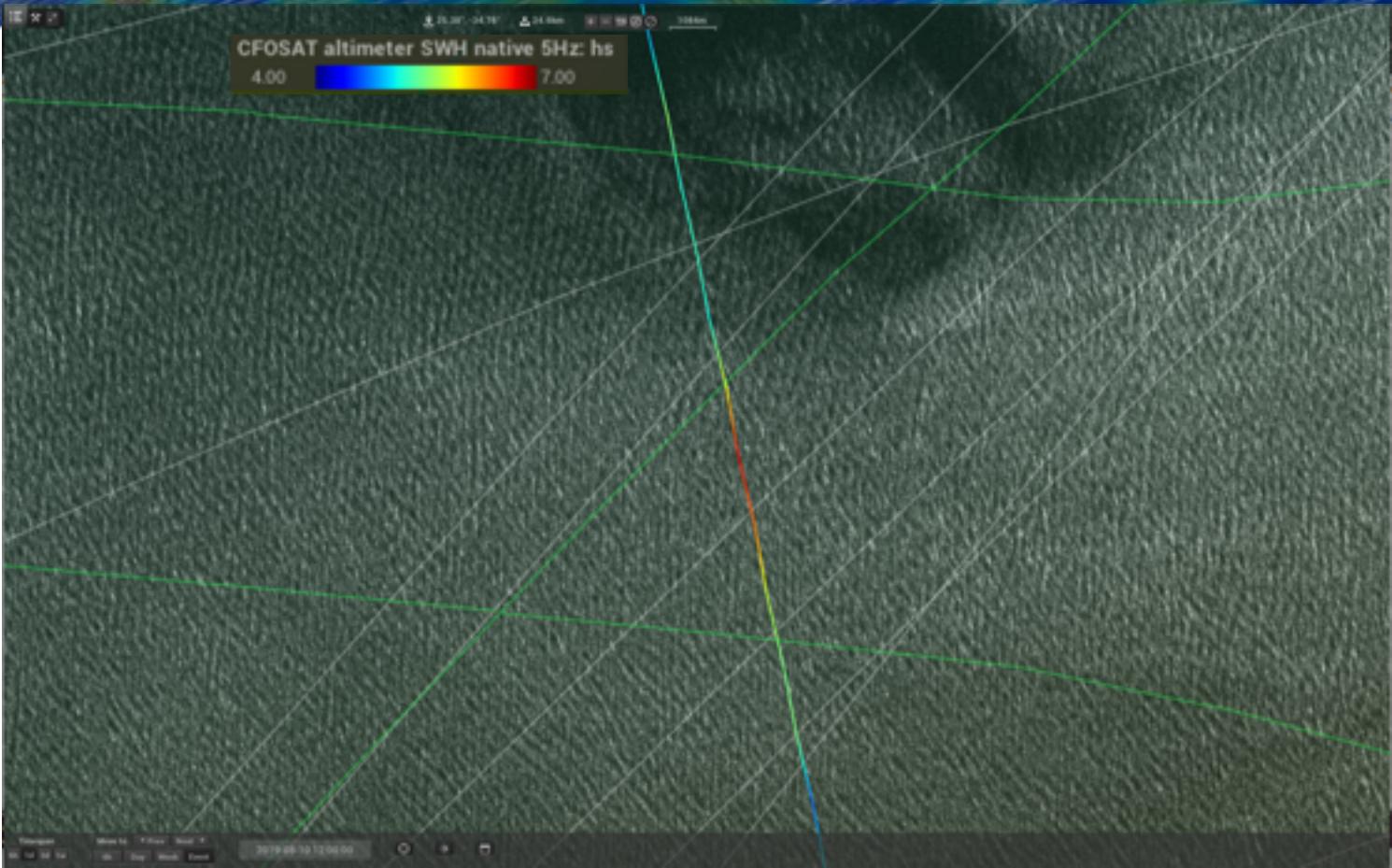


CMEMS Model vs. Observed surface current



Sentinel 1
Observations

Geostrophic



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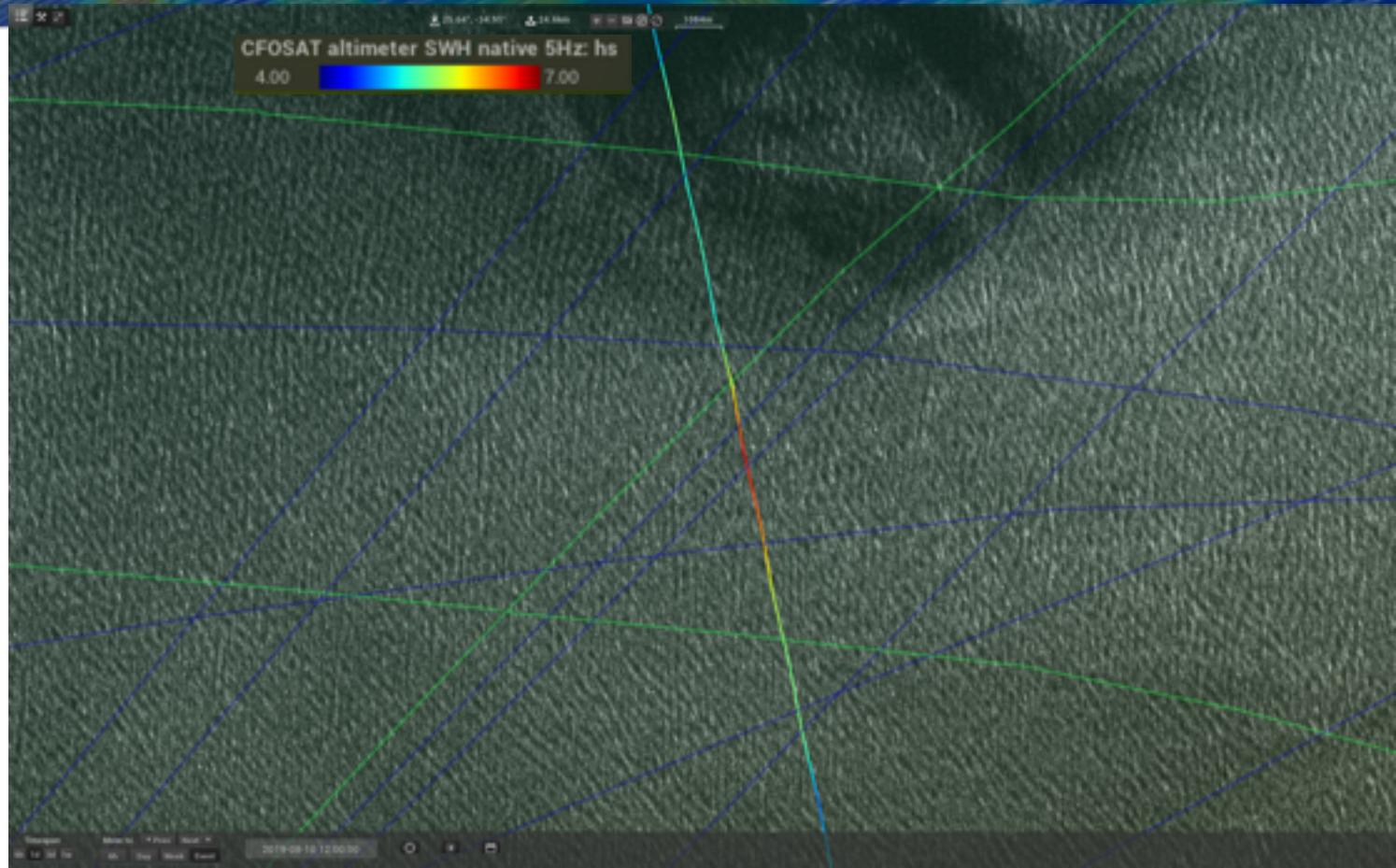
2019-08-19 12:00:00

CMEMS Model vs. Observed surface current



Sentinel 1
Observations

Geostrophic +
random small scale

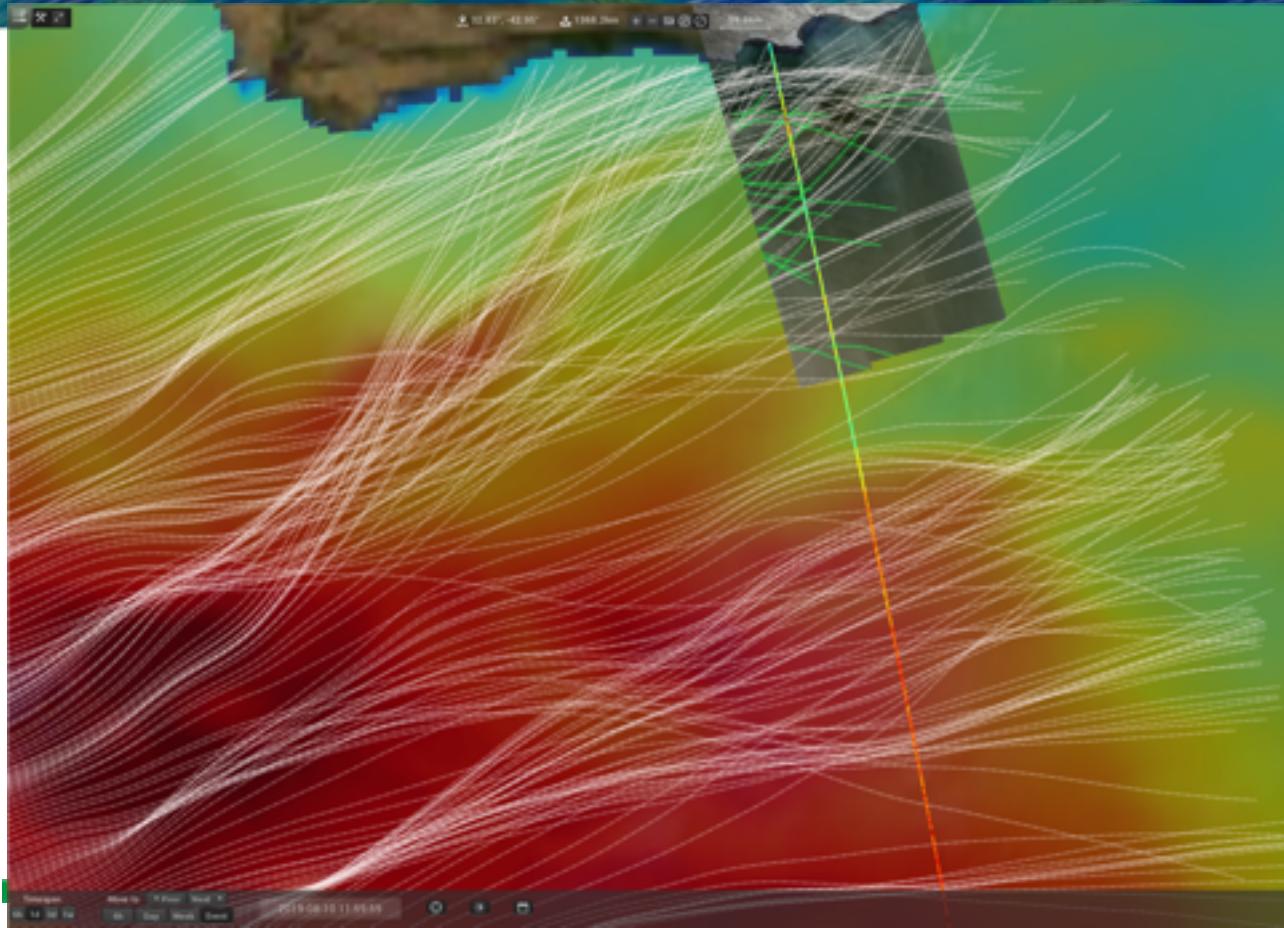


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Cross seas vs. high seas

Significant wave height from
Sea state model vs.
observations

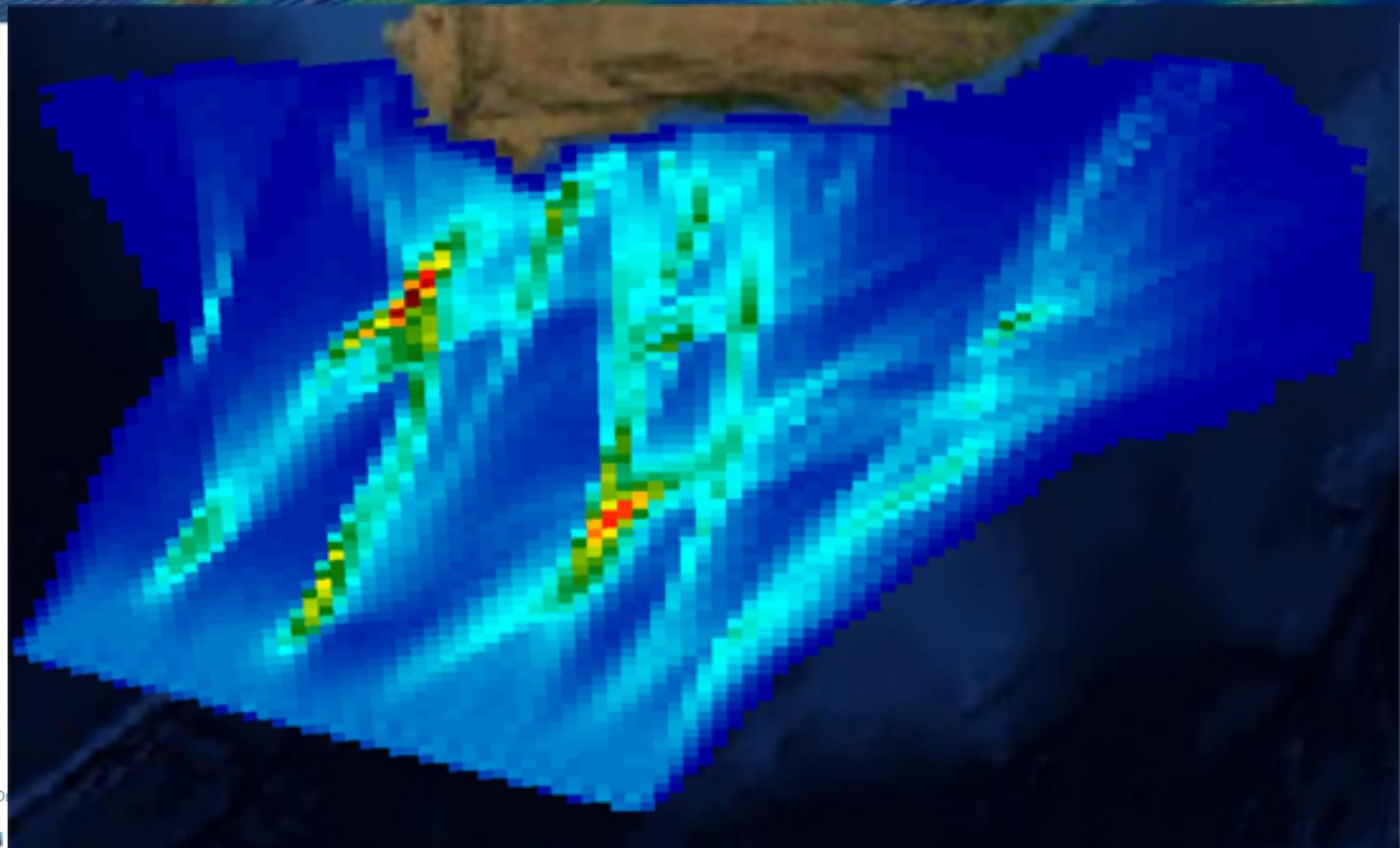


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Swell wave energy focussing

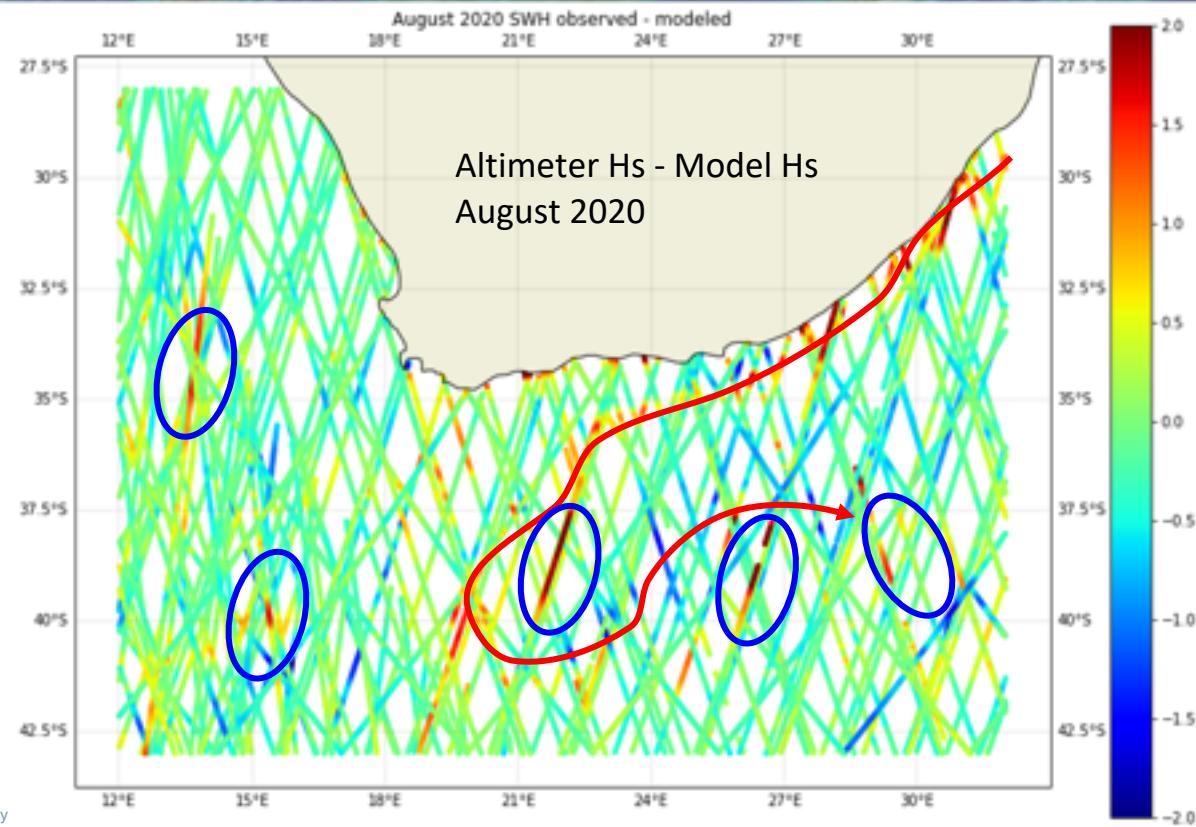
wave spectra
boundary
conditions from
Arpege forced
MFWAM swell :
No surface
current forcing !



Significant wave height (Hs) model under-estimation

Altimeter Hs :
CCI sea state
denoised Hs

Model Hs:
Arpege forced
Météo France
MFWAM (no
surface current
input)



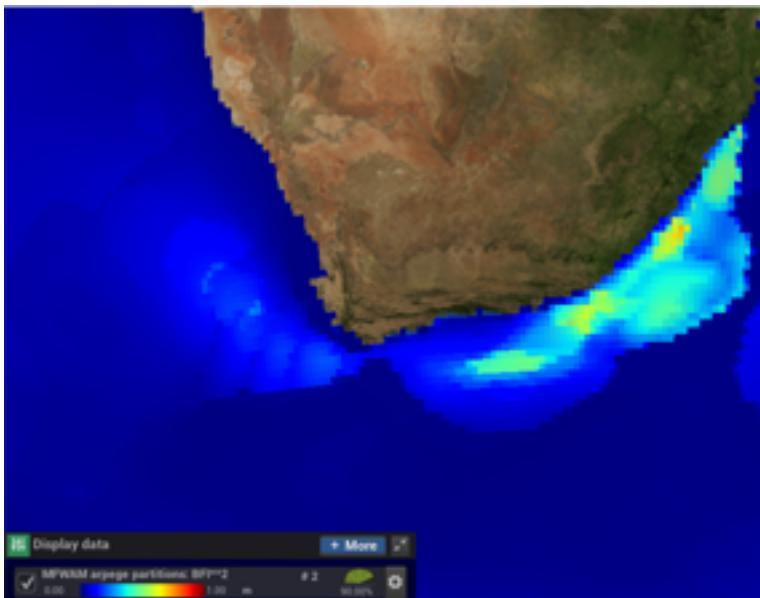
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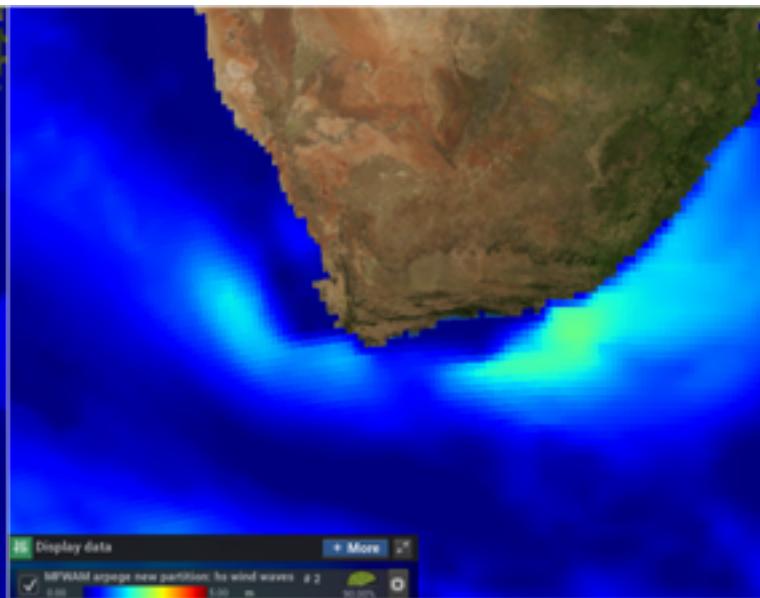
Benjamin&Feir Index (Frequency spread)

Arpege forced MFWAM sea state model estimation of BFI

BFI



Wind



Dangerous seas index WOC product

Location of dangerous seas for navigation

- Output : index of dangerous seas (green, yellow, red).
- combinaison of cross sea indexes (both probabilities and intensity) , wave height under-estimation by sea state model (altimeter based) and wavenumber/frequency spread (BFI).