Ocean Predict

SYMPOSIUM OP'24

In partnership with unesco Intergovernmental Oceanographic Commission

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

Integrating SWOT data into a deep learning model for real-time high-resolution prediction of ocean surface currents

Amélie Pesnec

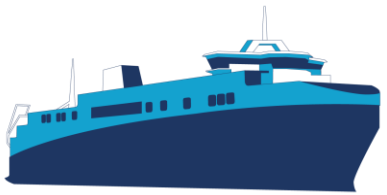
Hannah Bull

AMPHITRITE OCEAN DATA INTELLIGENCE

AMPHITRITE
OCEAN DATA INTELLIGENCE

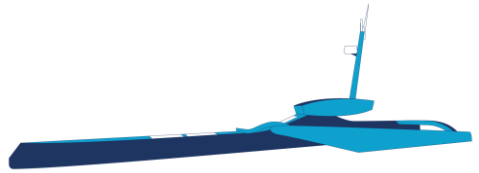
Ocean Predict

- Provide high-resolution ocean data, in a real-time manner, to make the right decision at sea
  - AI is used to fuse multiple satellite data
    - Applications:



Green Shipping

Defense



Environment

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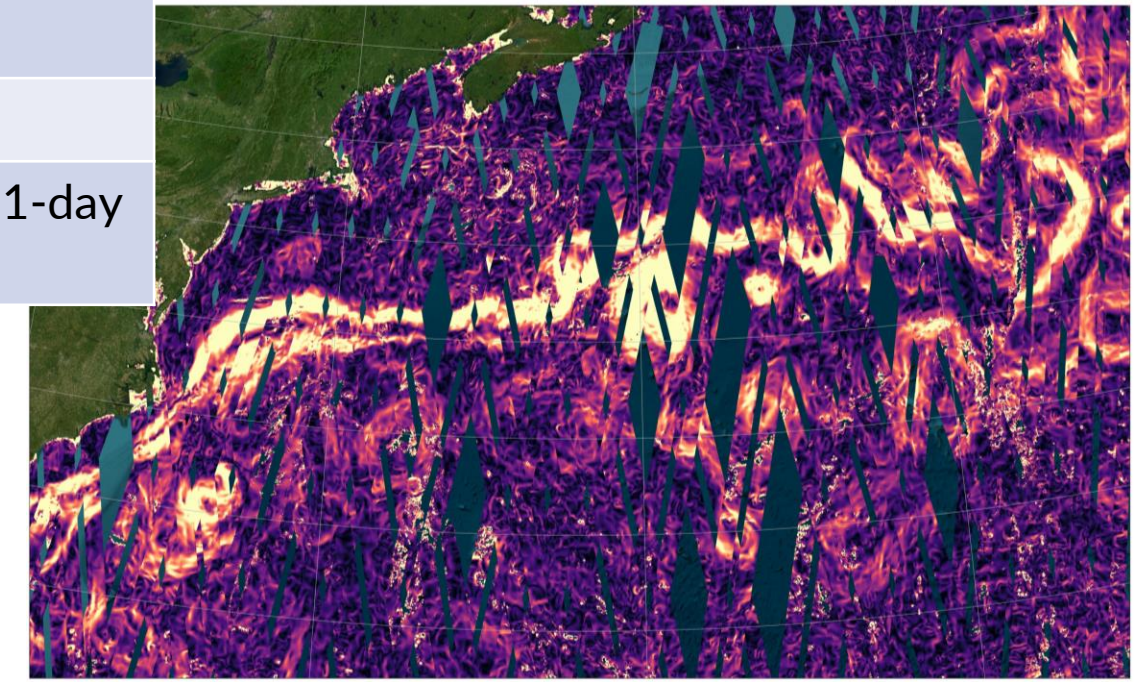
SWOT vs Nadir

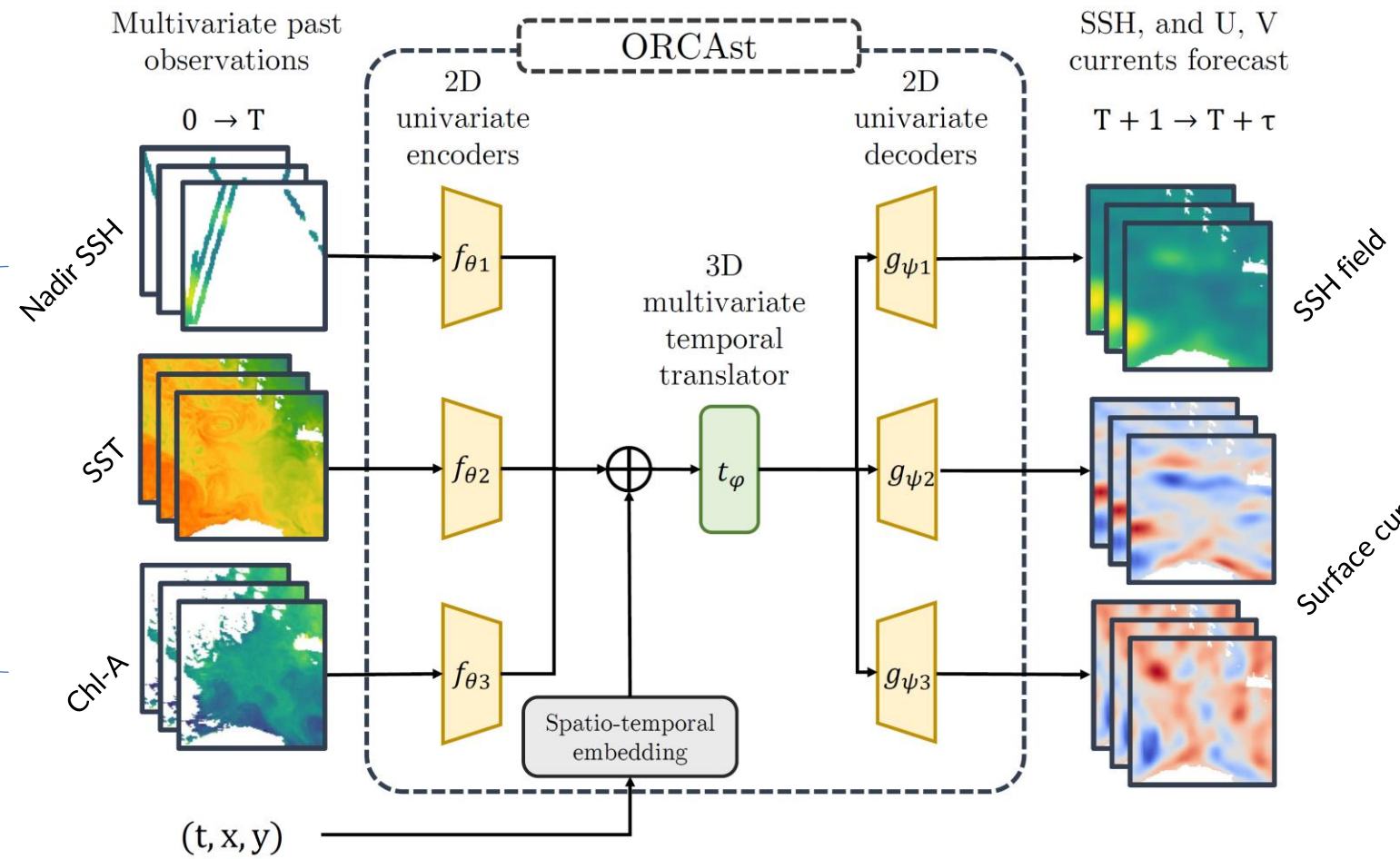
Nadir	SWOT
Multiple satellites	1 satellite
Many years of data	~1 year of data
Spatially sparse	120km swath
Effective resolution: 65km	Effective resolution: 15km
High temporal frequency	Low temporal frequency (21-day repeat orbit)



Credits: AVISO

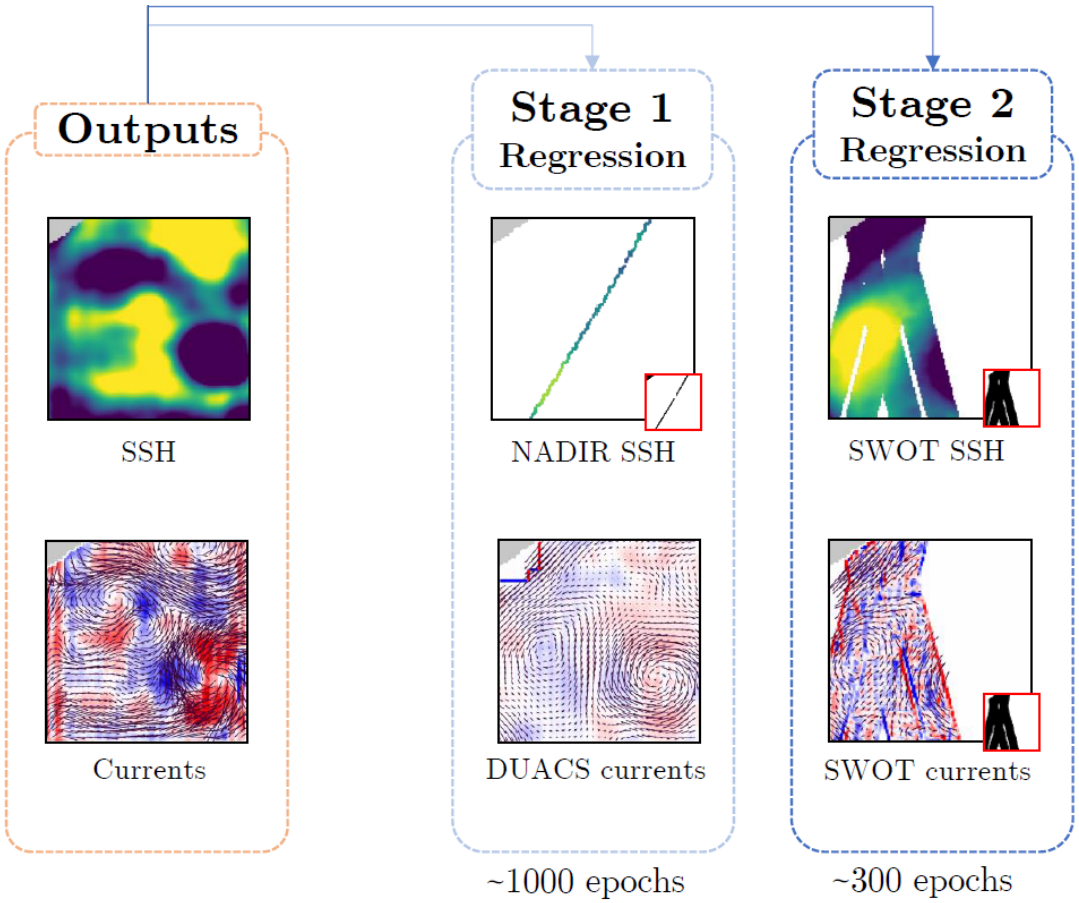
Our model architecture

Inputs:
Satellite observations



Outputs:
2D reconstructed surface currents

Multi-stage training strategy

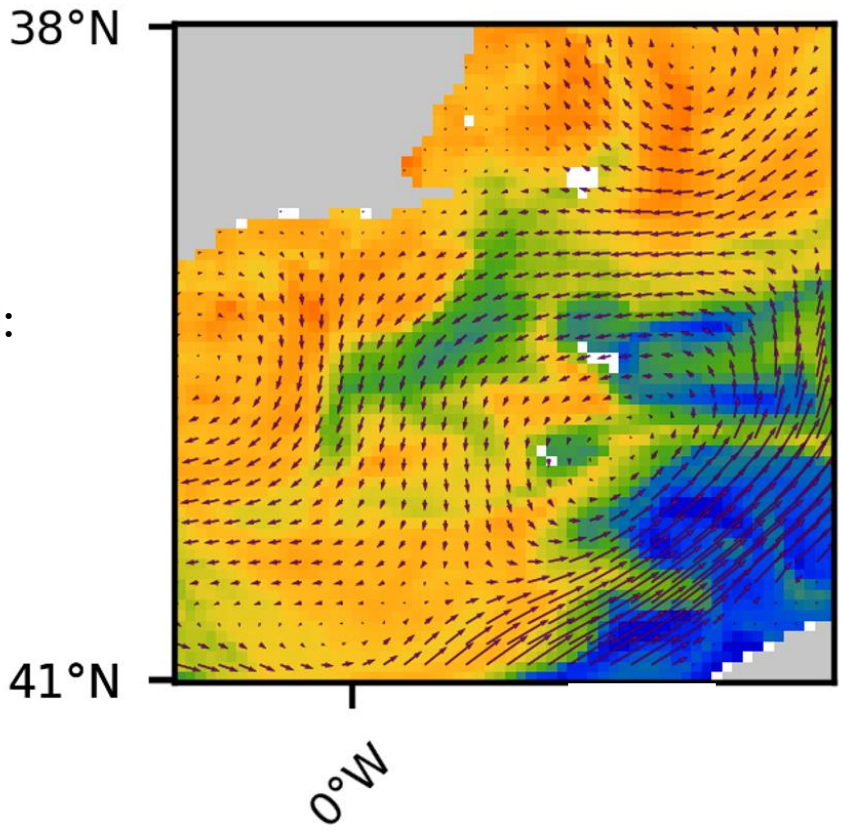


- Stage 1: Nadir and AVISO/DUACS as targets
- Stage 2: SWOT as targets

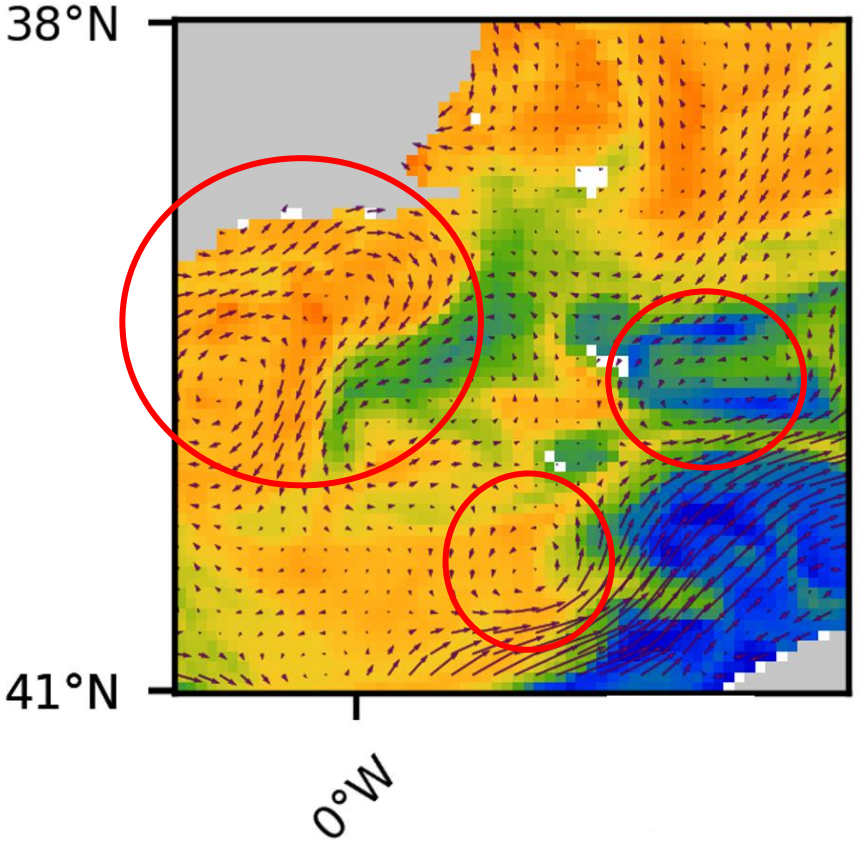
Data used as targets changes in the different training stages.

Multi-stage training strategy

Background:
L3 SST



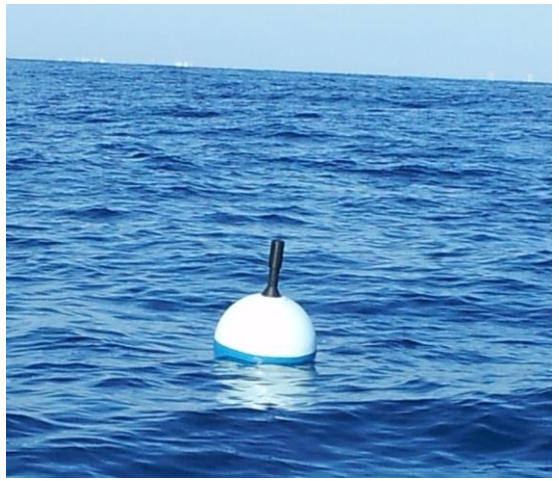
Before training with SWOT

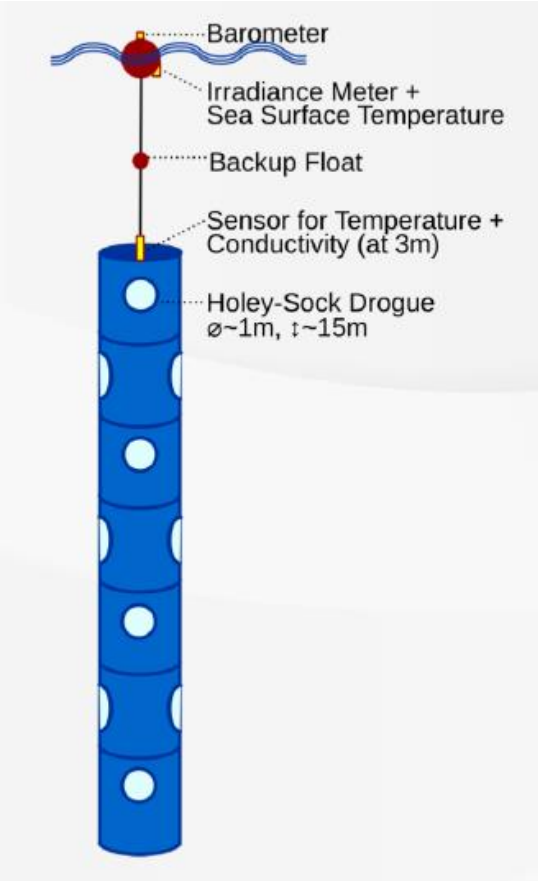


After training with SWOT

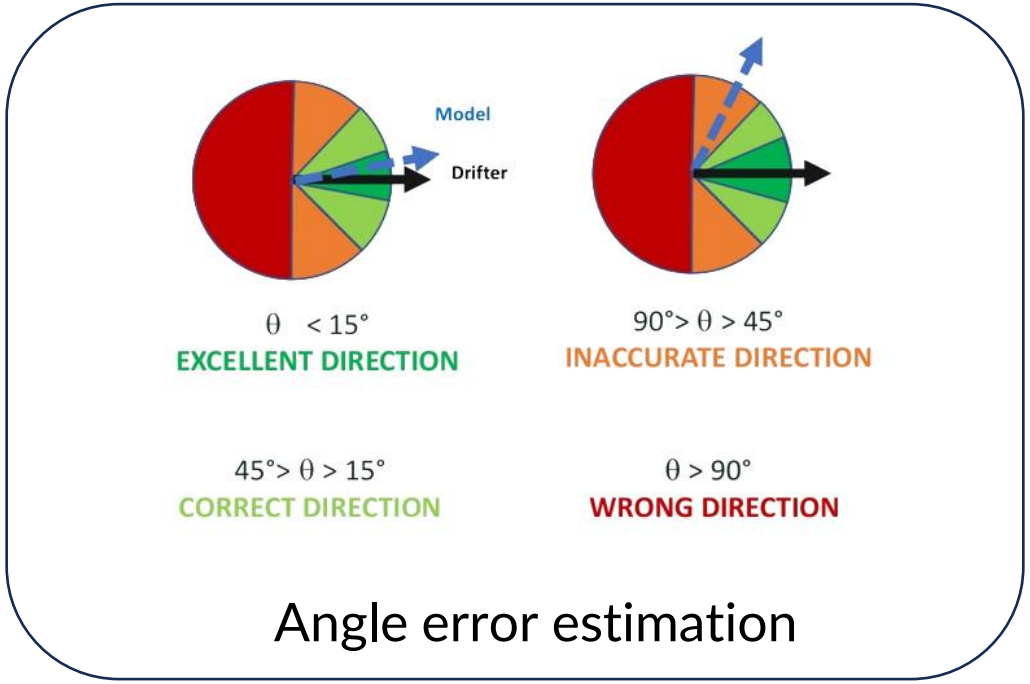
Evaluation process

We compare our output currents with currents measured by **drifter buoys**.



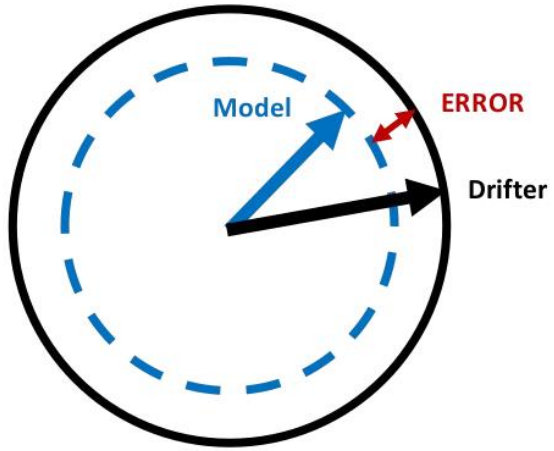


Evaluation process



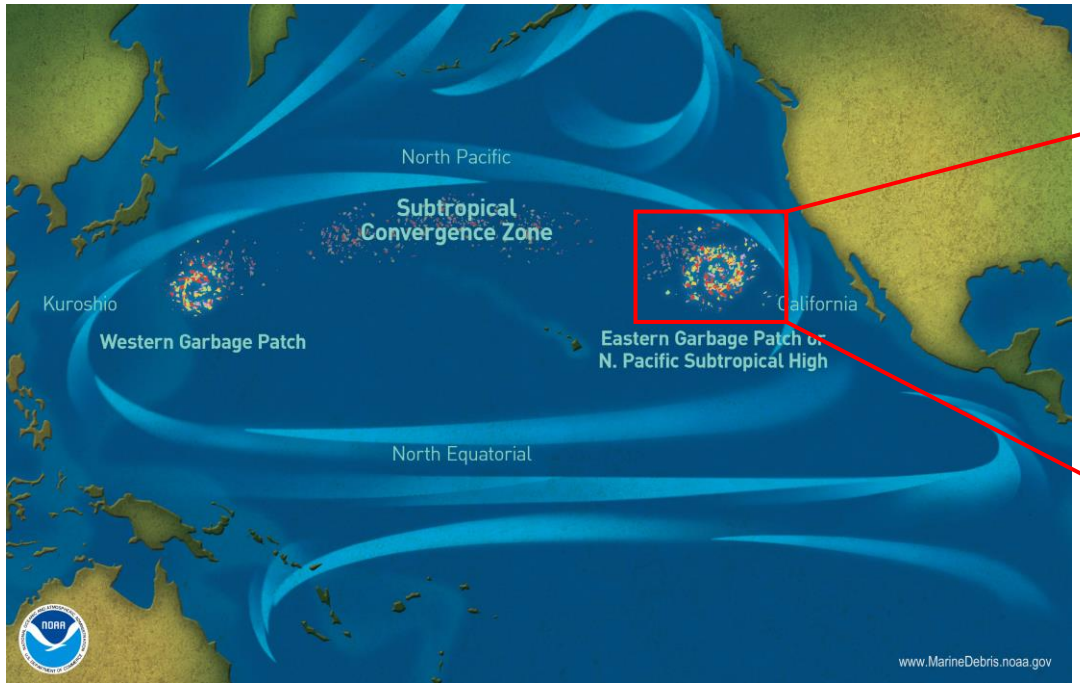
Angle error estimation

Evaluation process

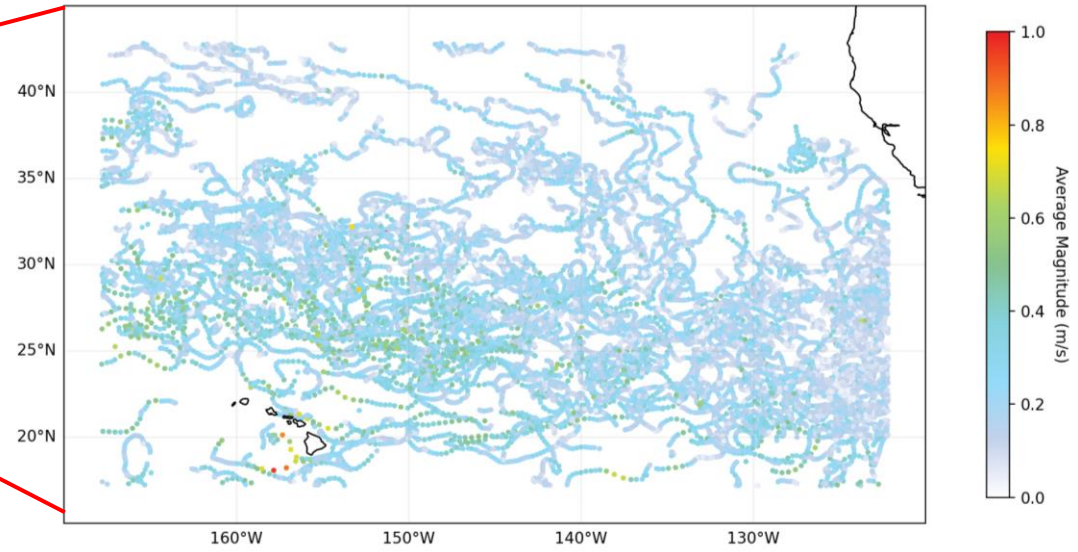


Magnitude error estimation

Results in the Great Pacific Garbage Patch

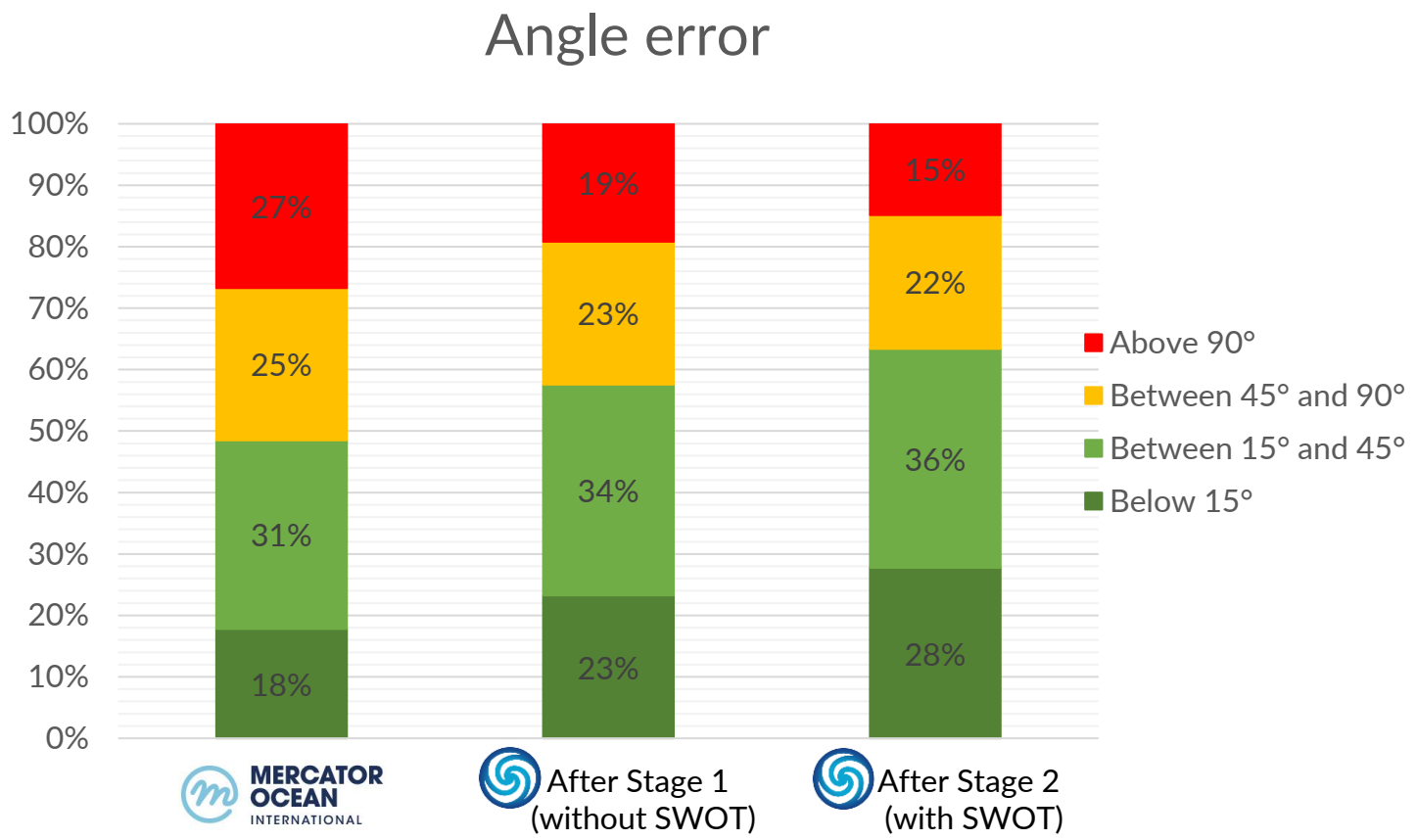


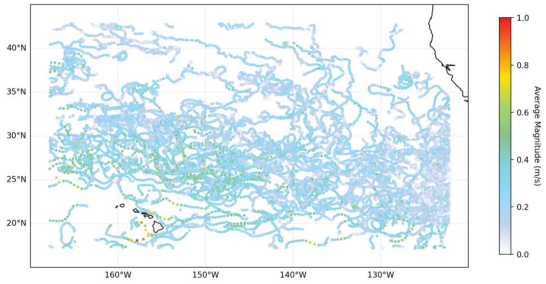
THE OCEAN CLEANUP



Drifter data between March and September 2024

Results in the Great Pacific Garbage Patch

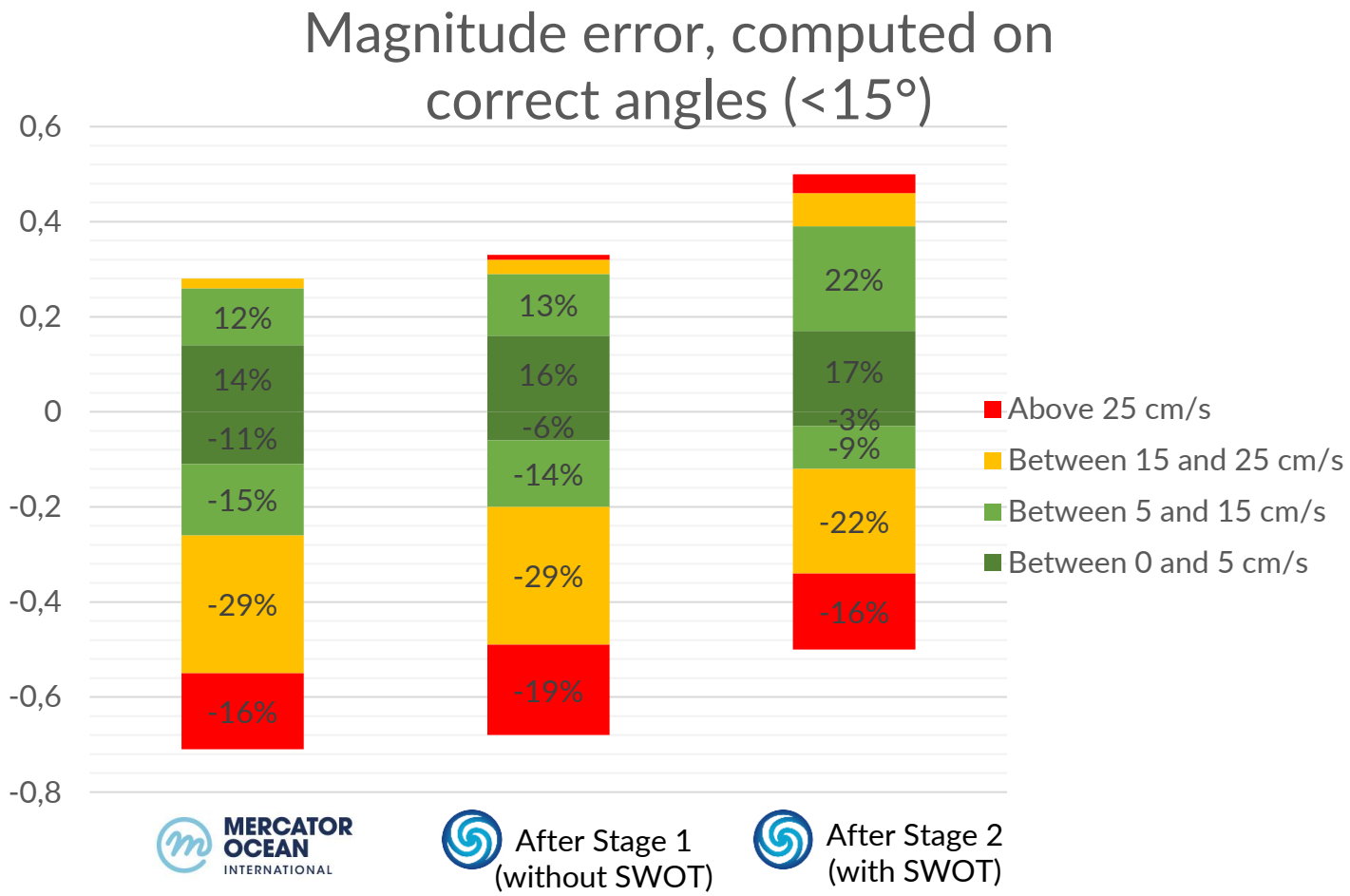


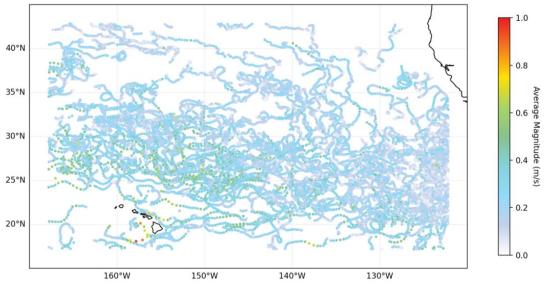


Evaluation done with drifter data between March and September 2024

Training with SWOT data as targets gives us more accurate predictions.

Results in the Great Pacific Garbage Patch

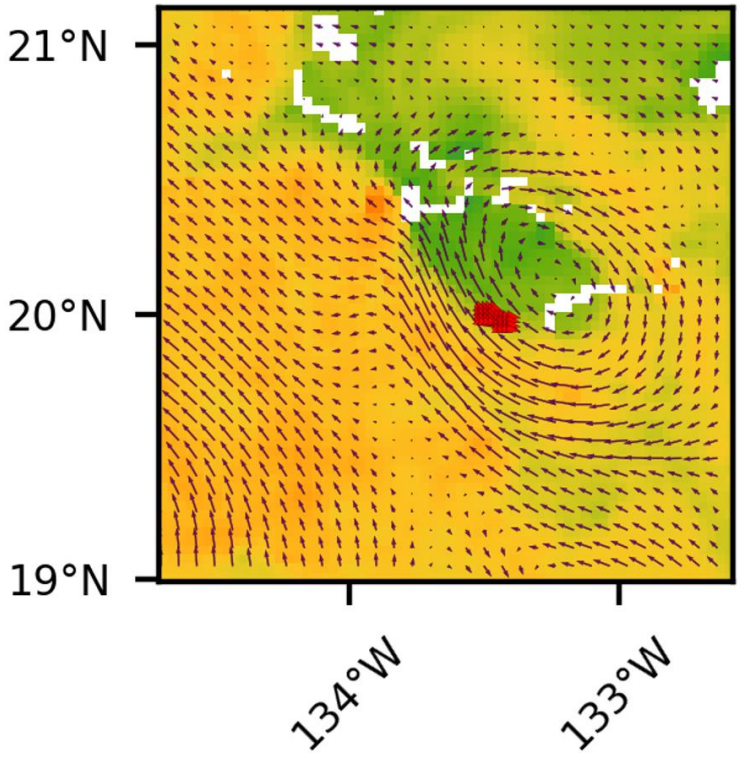




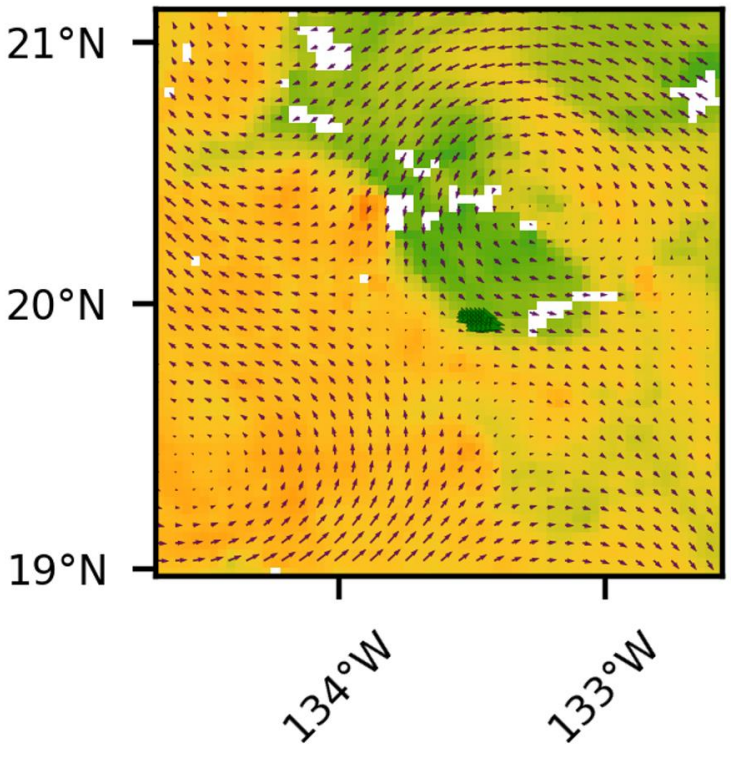
Evaluation done with drifter data between March and September 2024

Training with SWOT data as targets alleviates the magnitude underestimation bias.

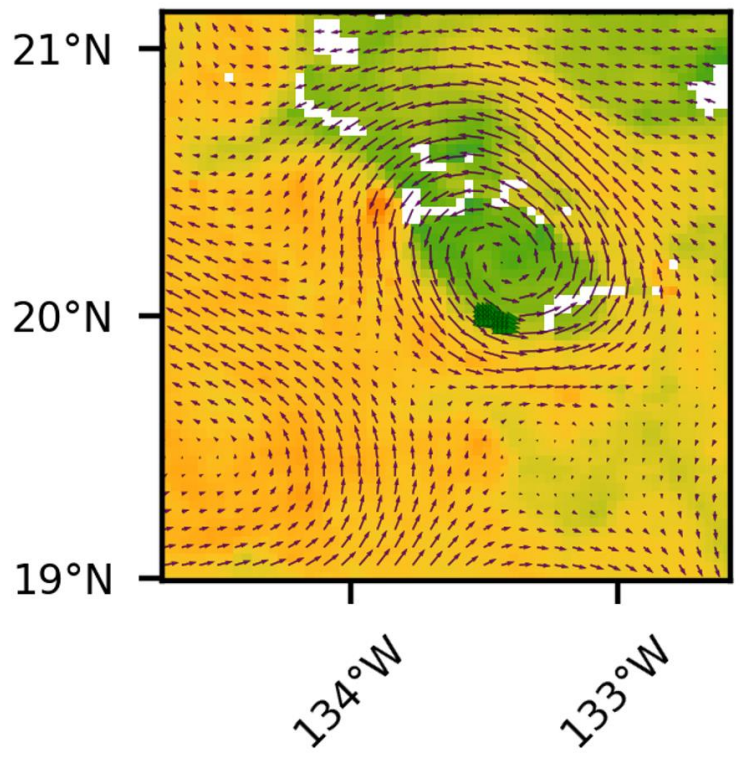
Results in the Great Pacific Garbage Patch



MERCATOR OCEAN INTERNATIONAL



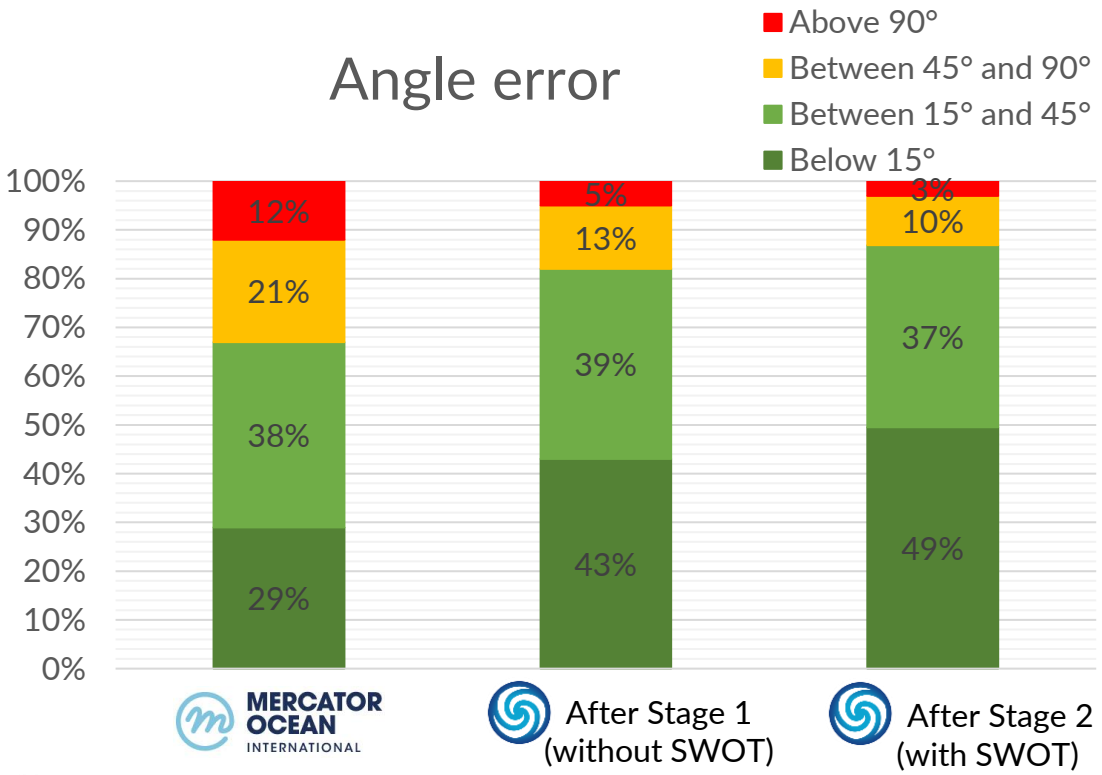
Stage 1
(without SWOT)

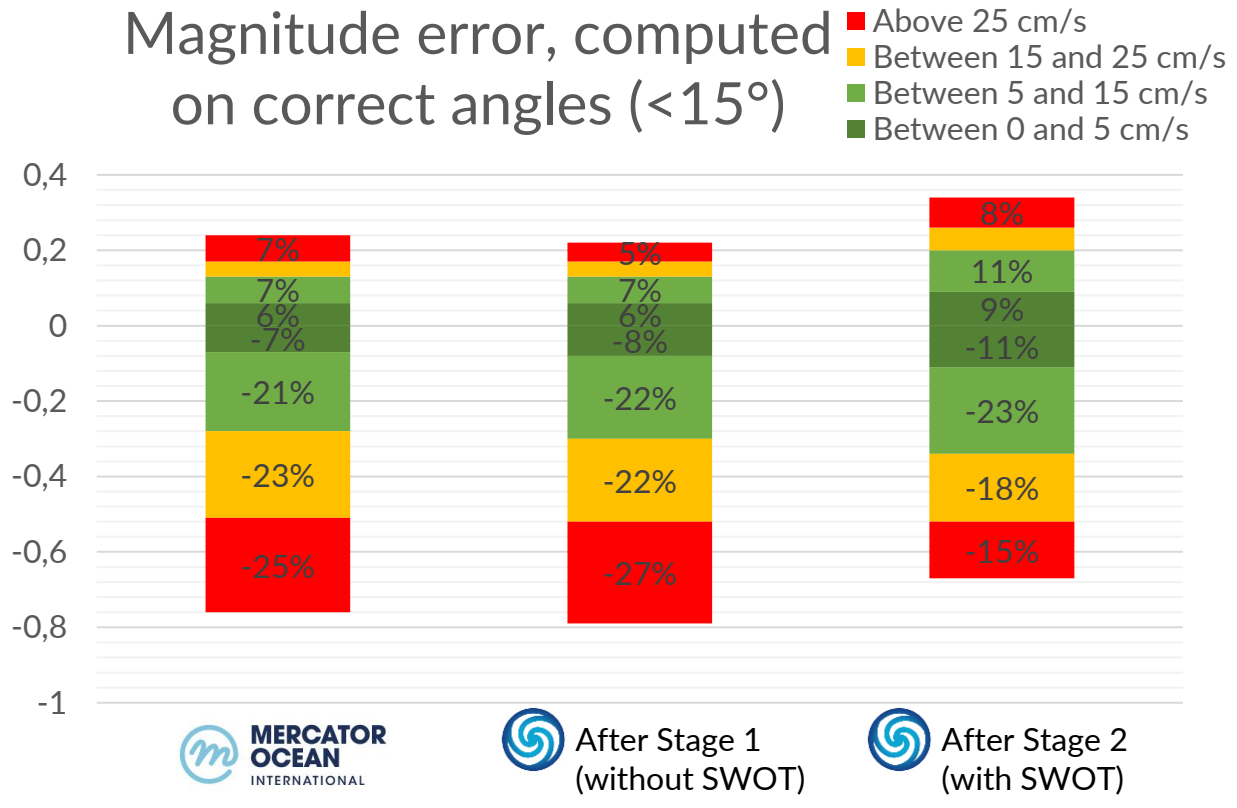


Stage 2
(with SWOT)

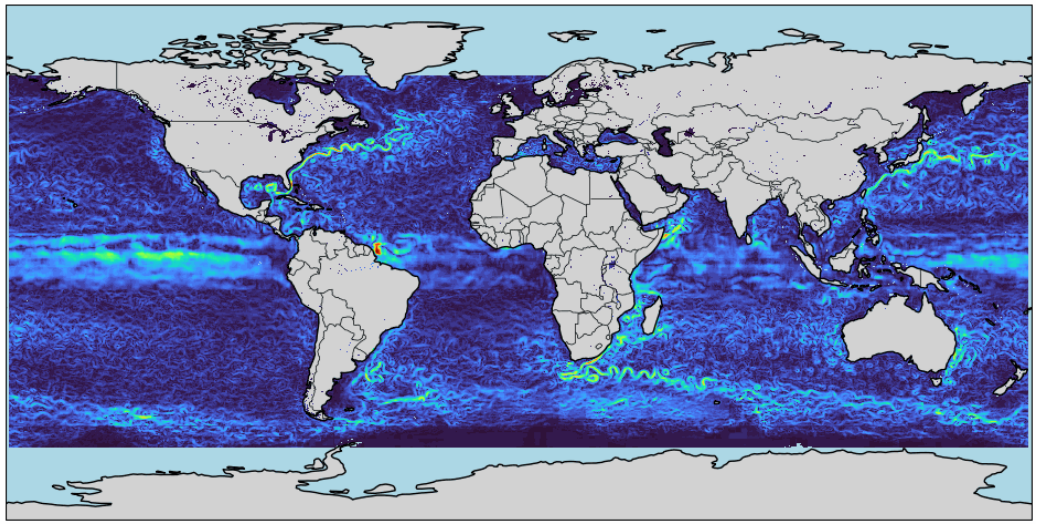
Results in the North Atlantic

After being trained with SWOT data as targets, both angle and magnitude performance are improved.





SWOT data for ocean currents
Amélie Pesnec



- Training with Nadir, SWOT… and drifters
- Not just nowcasts but 7-day forecasts
- Global model with state-of-the-art performance!

→ Inès Larroche, Thursday morning, Room IV