

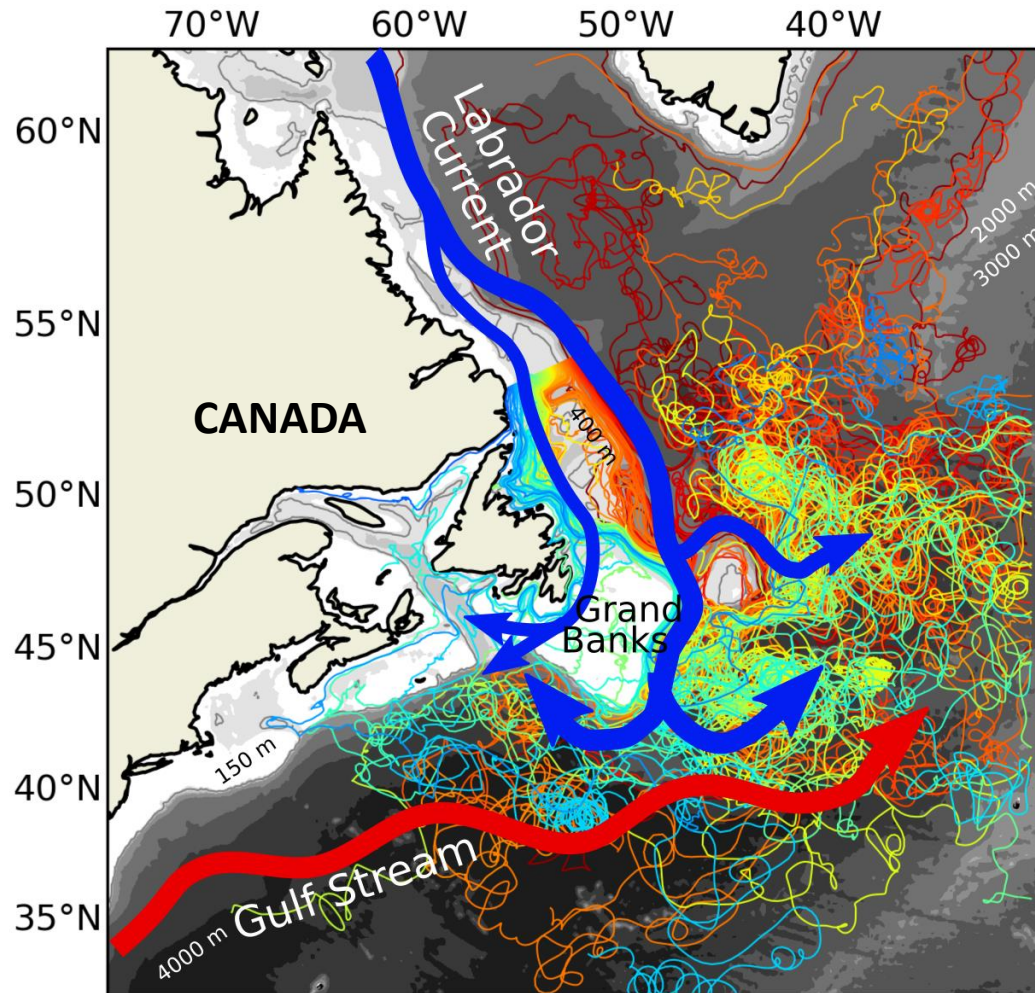
# Unsupervised clustering of Lagrangian trajectories in the Labrador Current

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# Background



## The retroflexion of the Labrador Current

- Feeds the North Atlantic with fresh water (Holliday et al., 2020)
- Modulates the input of oxygen on the northwest Atlantic shelf (Claret et al., 2018, Jutras et al., 2020), nutrient concentrations (Petrie et al., 1993), and temperature (Chen et al., 2020).

## What processes control the retroflexion's variability ?

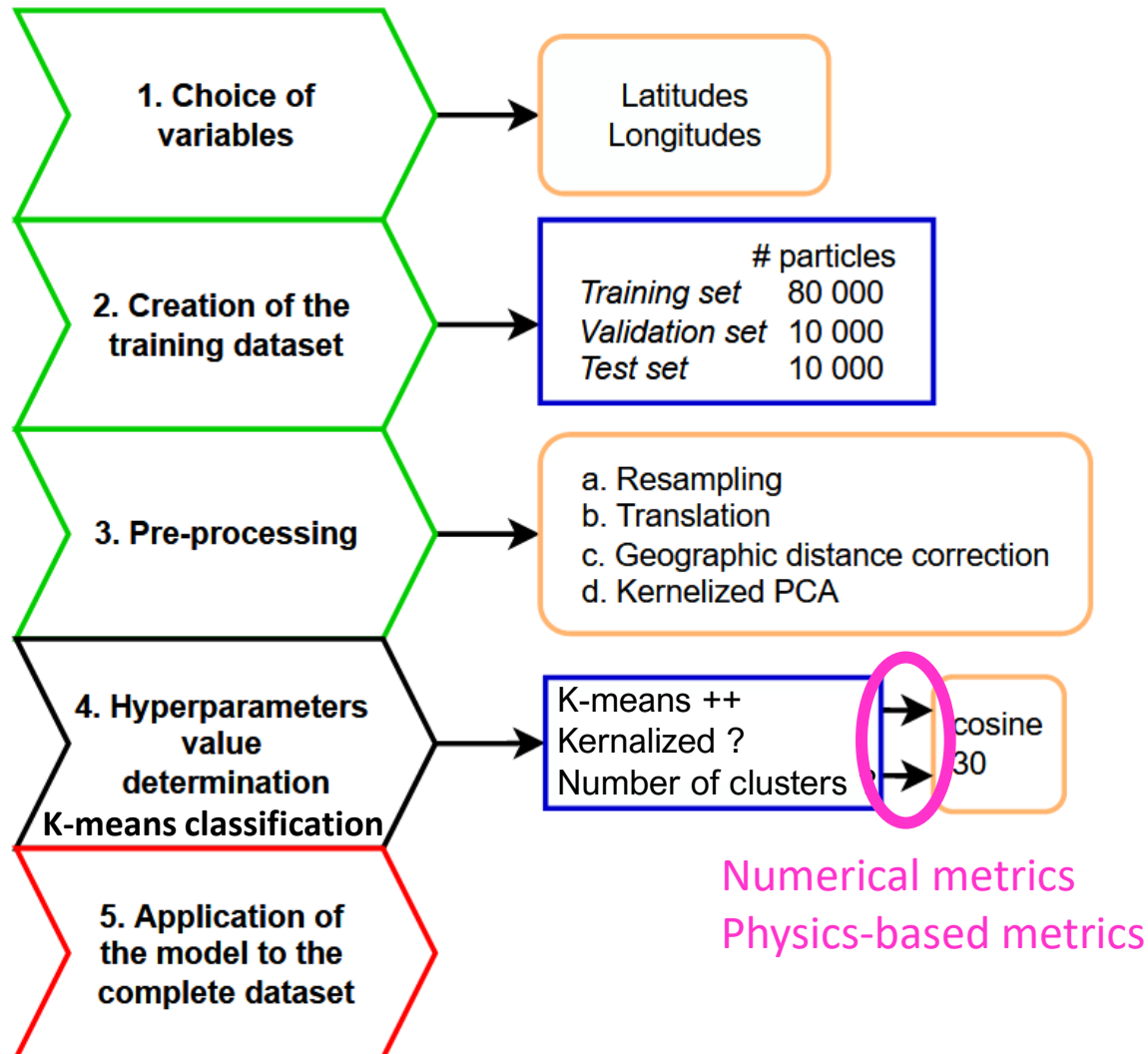
### Dataset

- GLORYS 12, ocean reanalysis
  - 1/12° horizontal resolution
  - Time period: 1993-2018

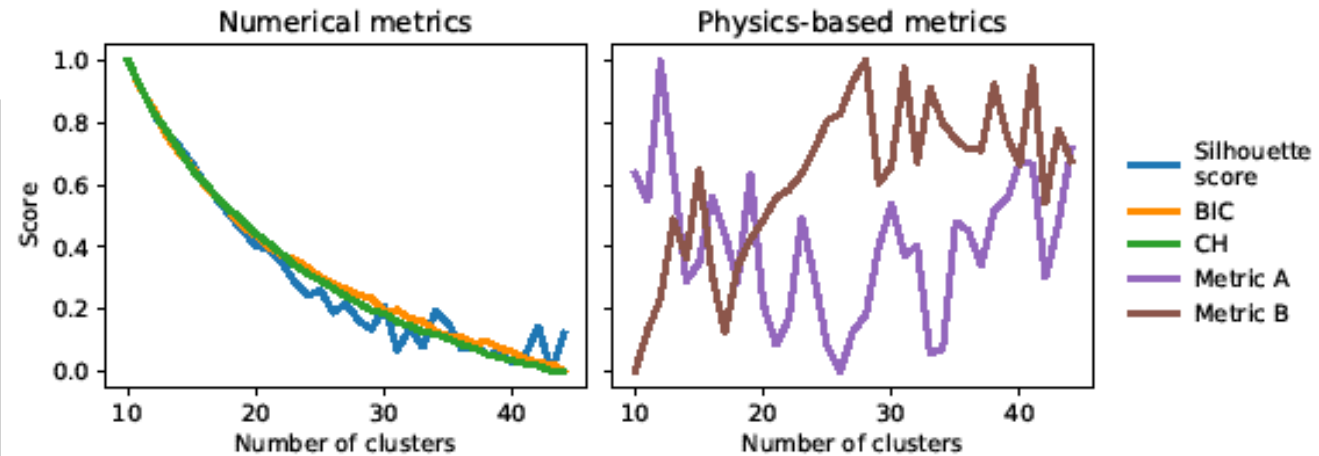
Lagrangian tracking of virtual particles with the OceanParcels Python package (Delandmeter & van Sebille, 2019)

→25 years of virtual trajectories

# Method – Clustering with k-means ++

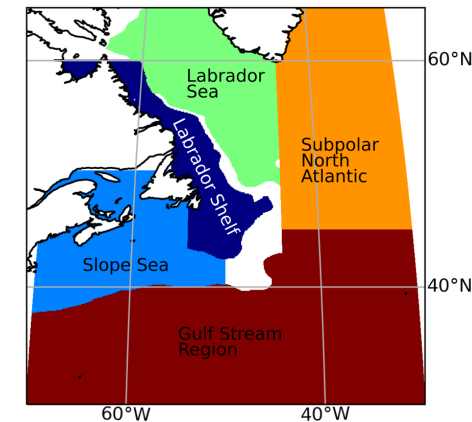


Numerical metrics  
Physics-based metrics

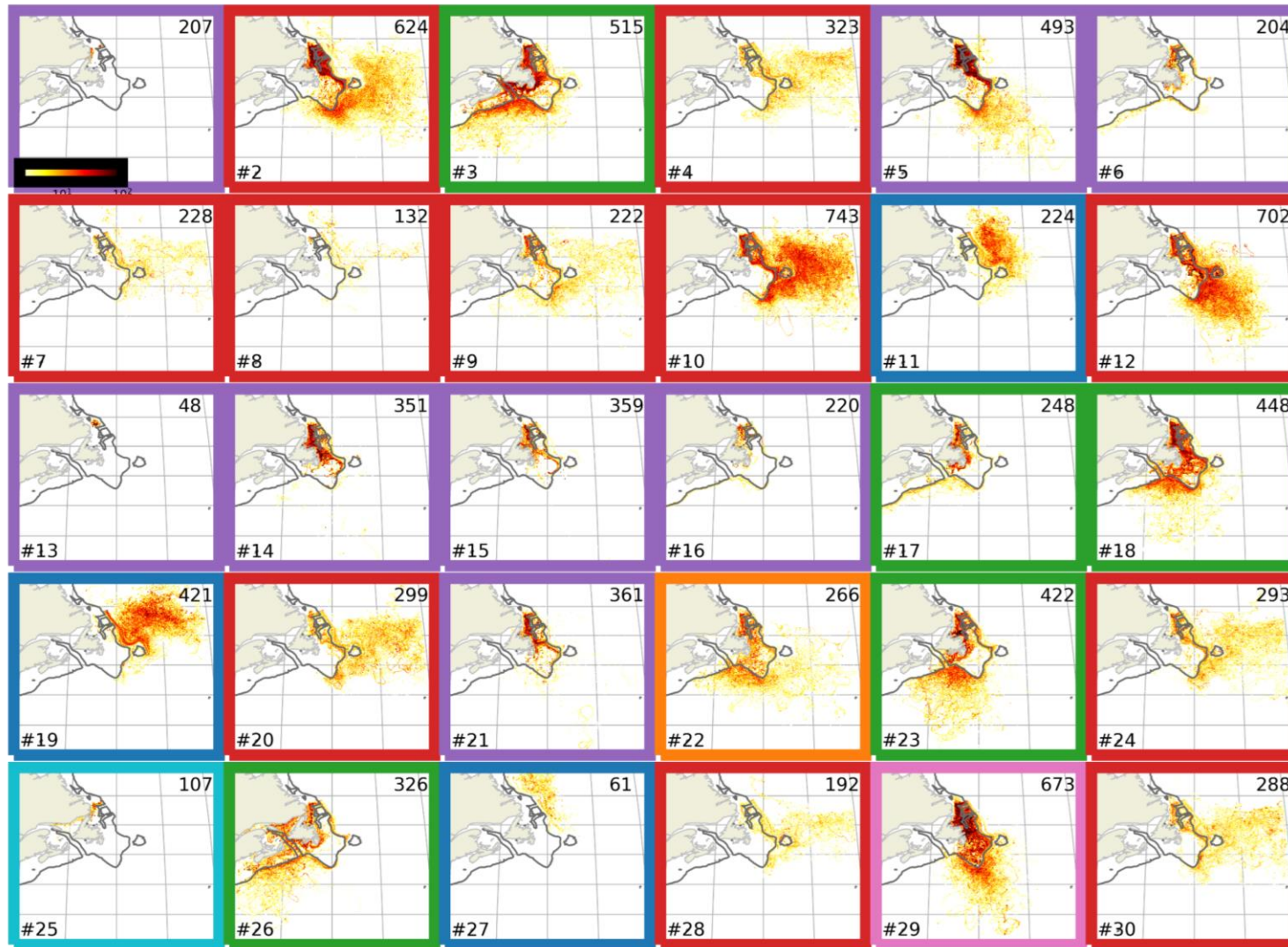


Metric A : how long particles stay in the same cluster as centroid

Metric B : what percentage in the most popular region ?



# Results – Super Clusters

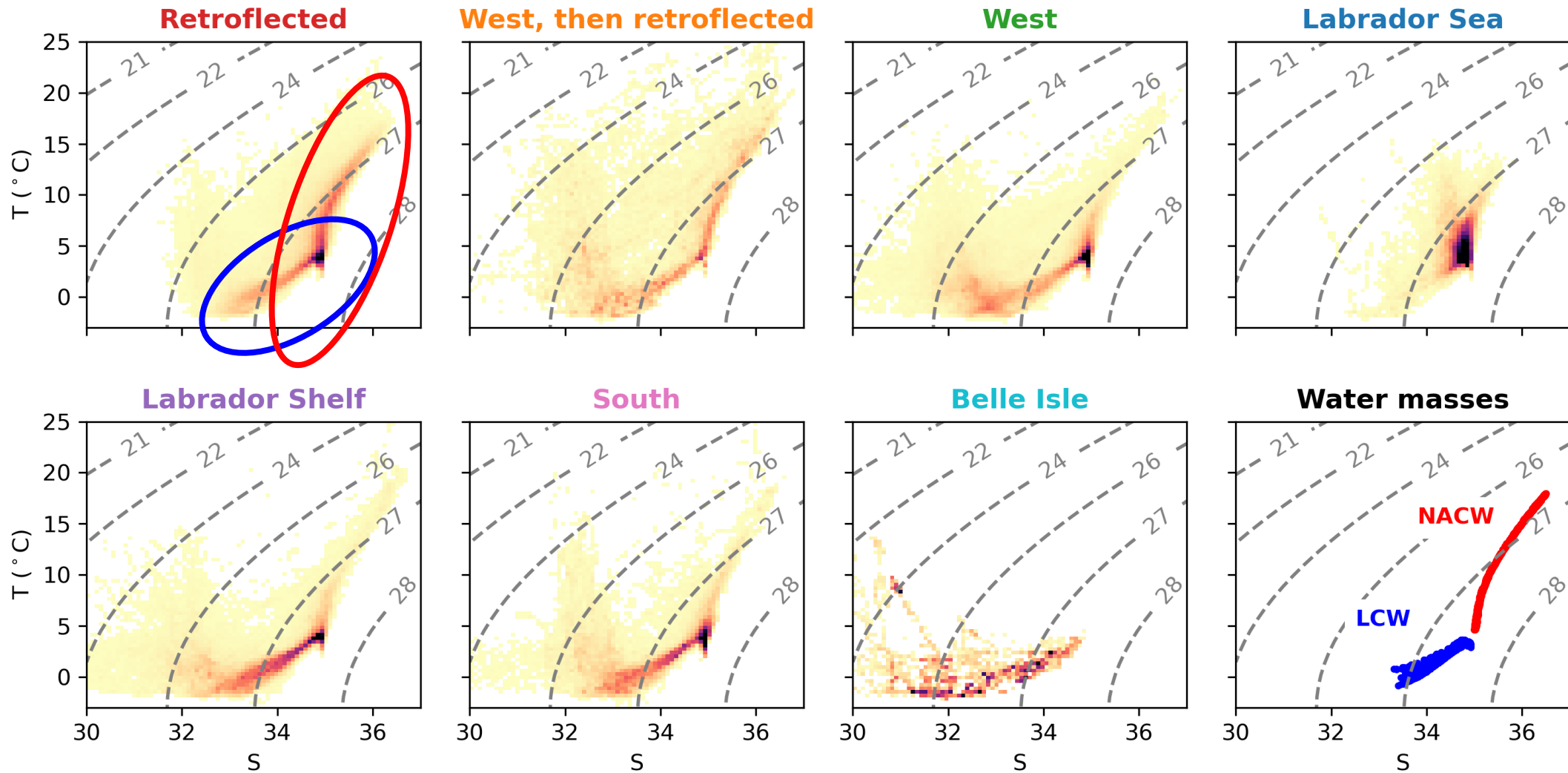


30 clusters but 7 identified Labrador Current pathways: grouping in **7 super-clusters** – “Expert” consultation

**Retroflected**  
**Feeds the Labrador Sea**  
**Stays on the Labrador shelf**  
**Feeds the Slope Sea**  
**Aims South**  
**Enters Belle Isle Strait**  
**Feeds the Slope Sea before being retroflected**

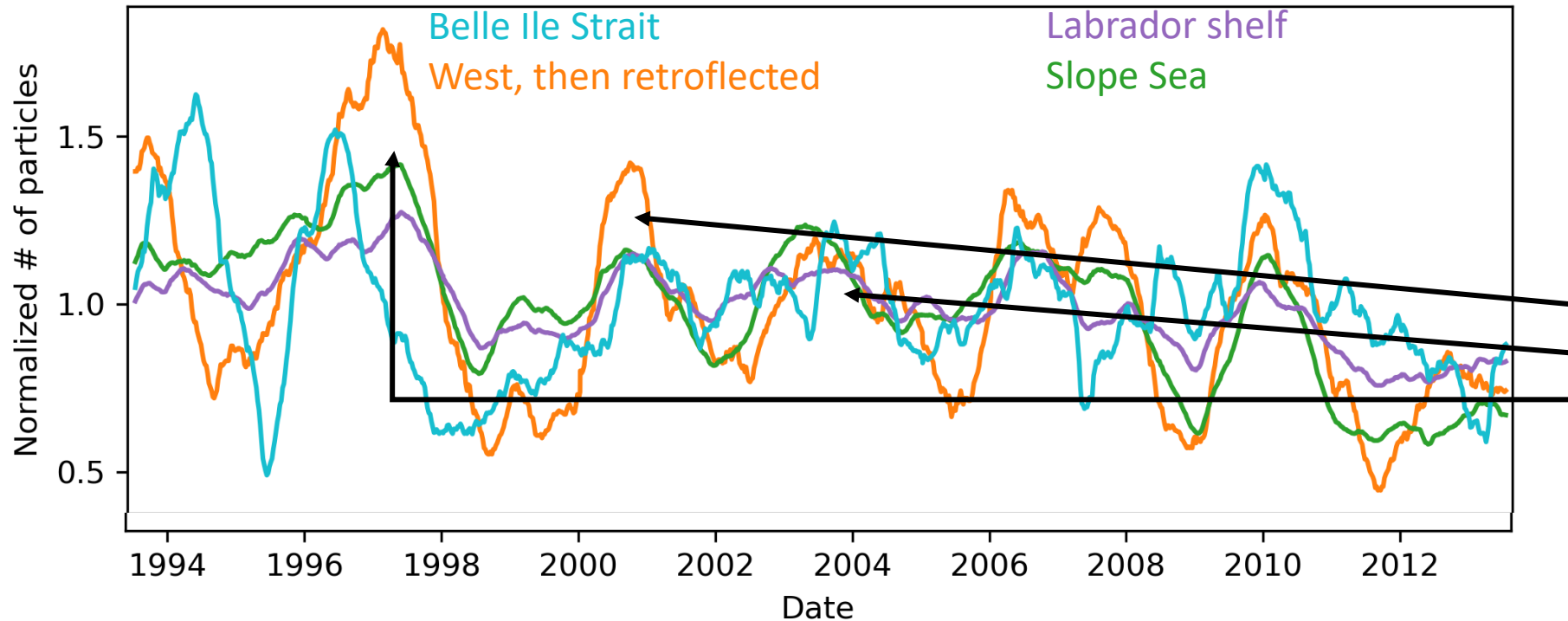
# Analysis – T/S graphs

→ Identification of the water masses



# Temporal evolution

Further analysis will explore the driving processes for the variability

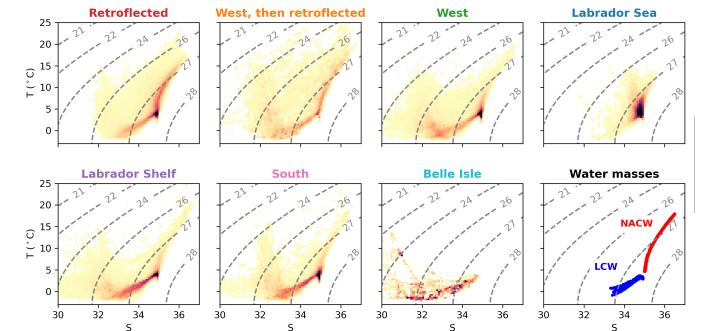
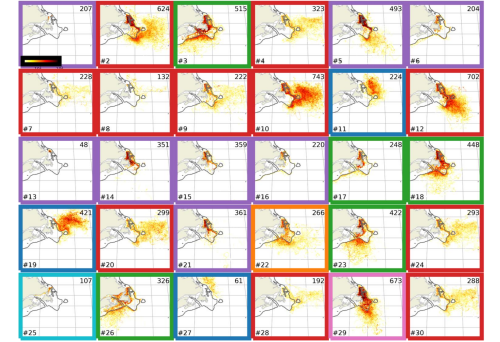


What drive these increase ?  
Why are they all correlated ?

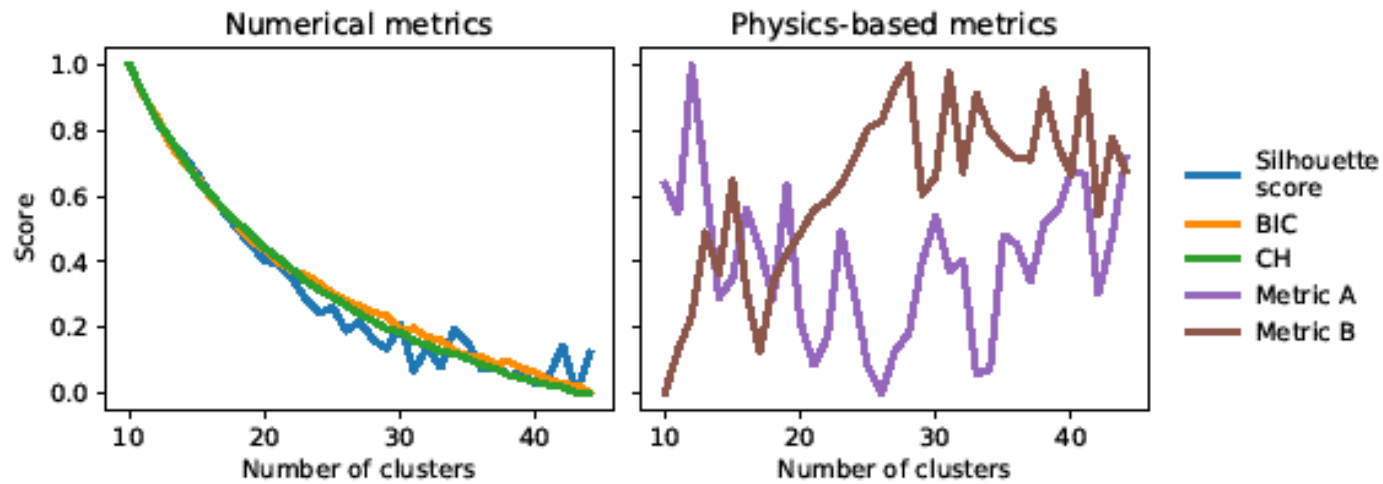
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# Conclusion

- A simple – yet effective - clustering method to identify main oceanic pathways
- Validation of the method through correct water masses identification

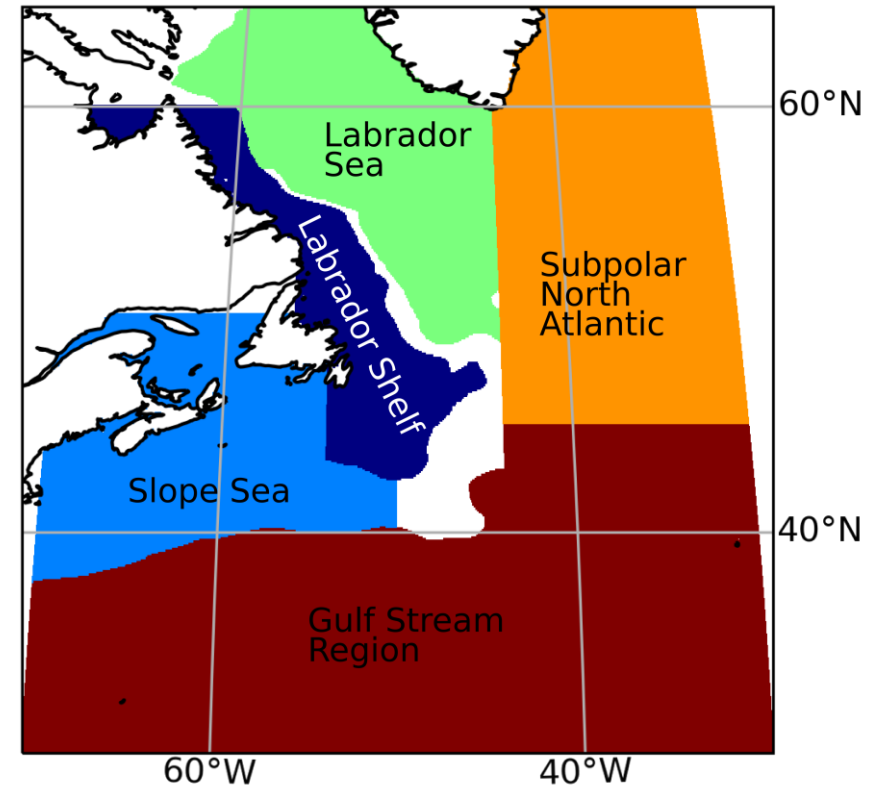


# Metrics

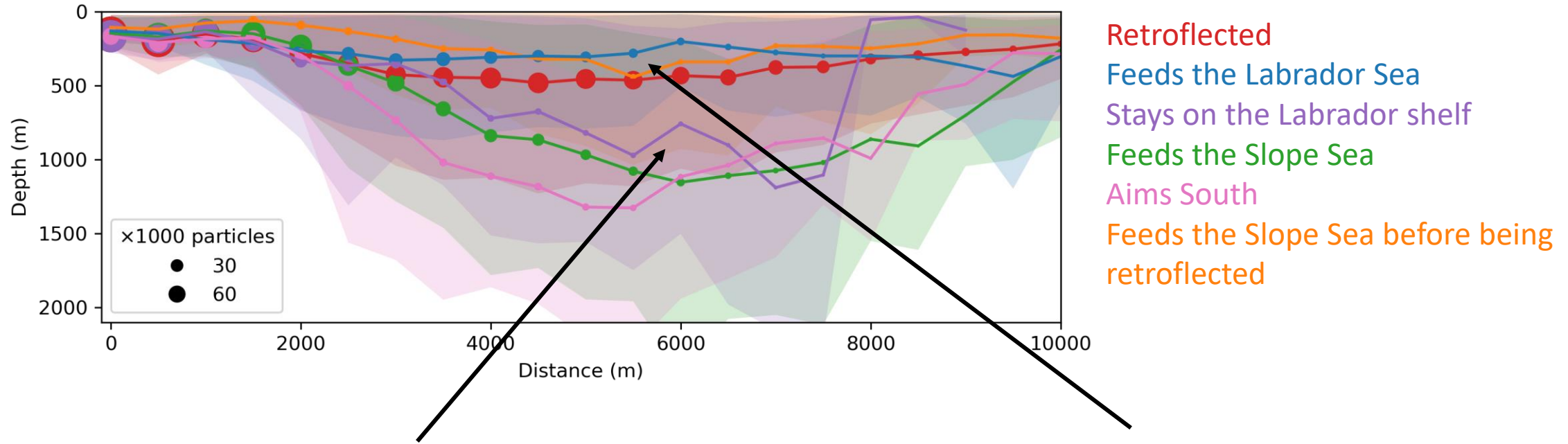


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# Further analysis



Deepening of the particles that dive below the front between the Labrador waters and the Gulf Stream

Retroflection is on average in the first 500m