



**EuroHPC**  
Joint Undertaking



**EuroHPC Summit Week 2022**

**#PRACEdays**

# Understanding the role of the ocean and sea ice small scale features in the Arctic



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## Context

- Mesoscale eddies are ubiquitous in the ocean and are fundamental for the large-scale circulation equilibrium, upper-ocean biology as well as pollutant spread
- Observations suggest that the mesoscale activity could be fundamentally different in ice covered and ice-free regions
- Yet, modelling these small scale feature (~10km) in the Arctic is so challenging that no numerical simulations representing them in the Arctic exists as yet
- It prevents us thus far to apprehend their specificities as well as their importance for the Arctic dynamics

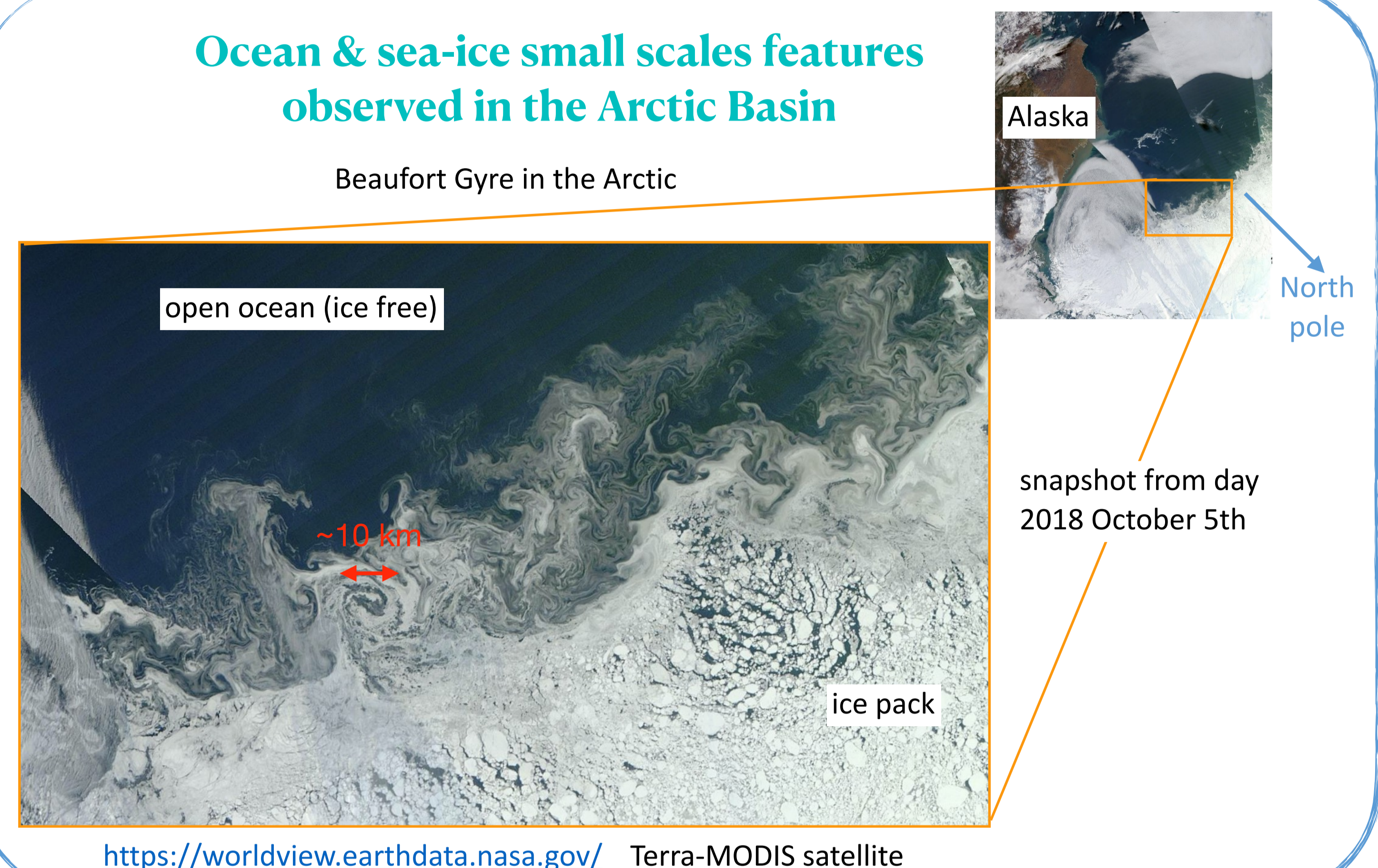
## Goal

- To improve the quantification and our fundamental understanding of the mesoscale dynamics in the presence of sea ice

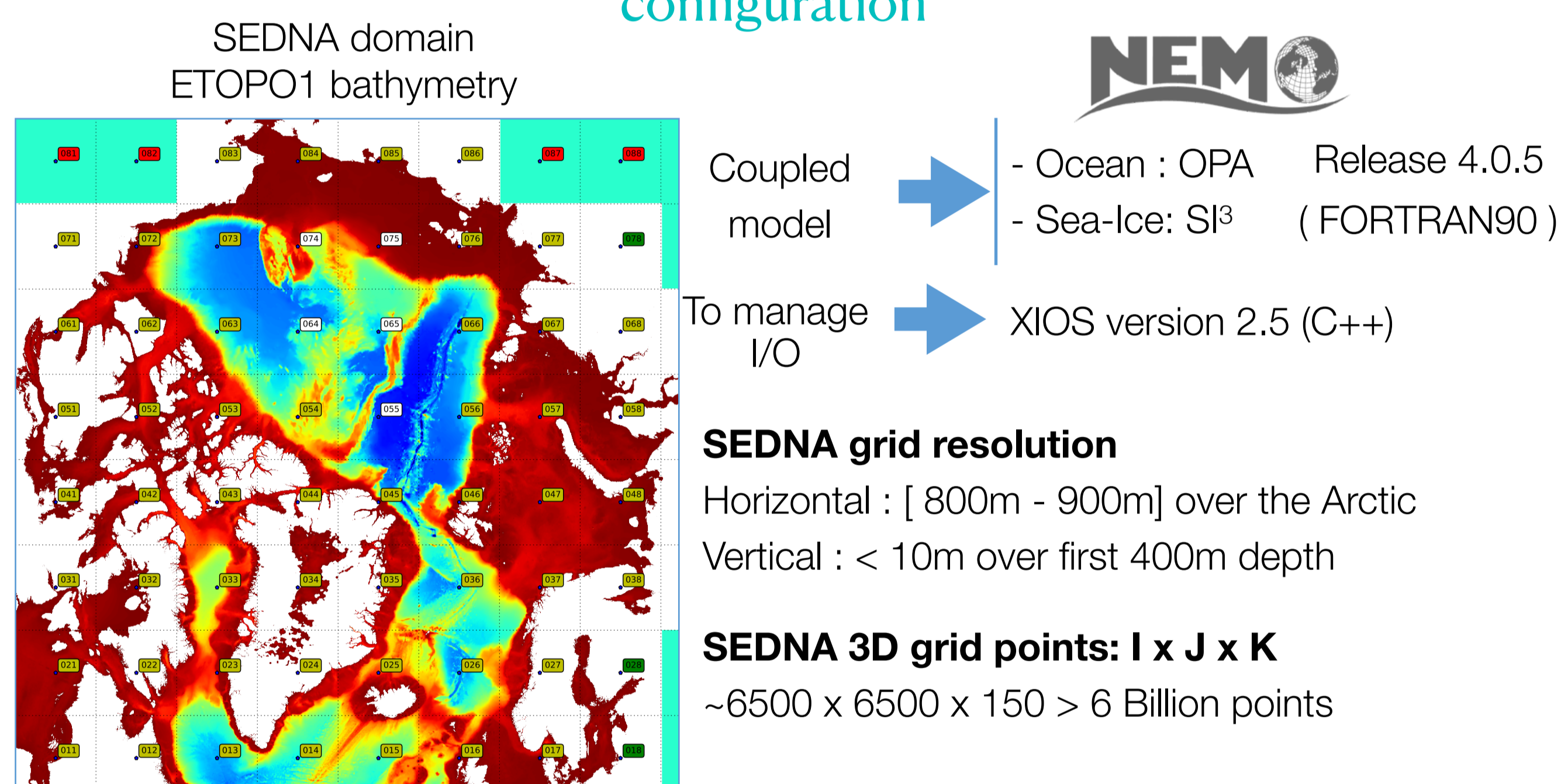
## Method

- Based on a new and pioneer coupled ocean-sea ice numerical configuration called SEDNA with a horizontal resolution  $\Delta x < 1\text{km}$  in the Arctic Basin
- Using huge HPC computing resources of the French TGCC computing center, we are currently running a simulation spanning the period 2009-2015

## Ocean & sea-ice small scales features observed in the Arctic Basin



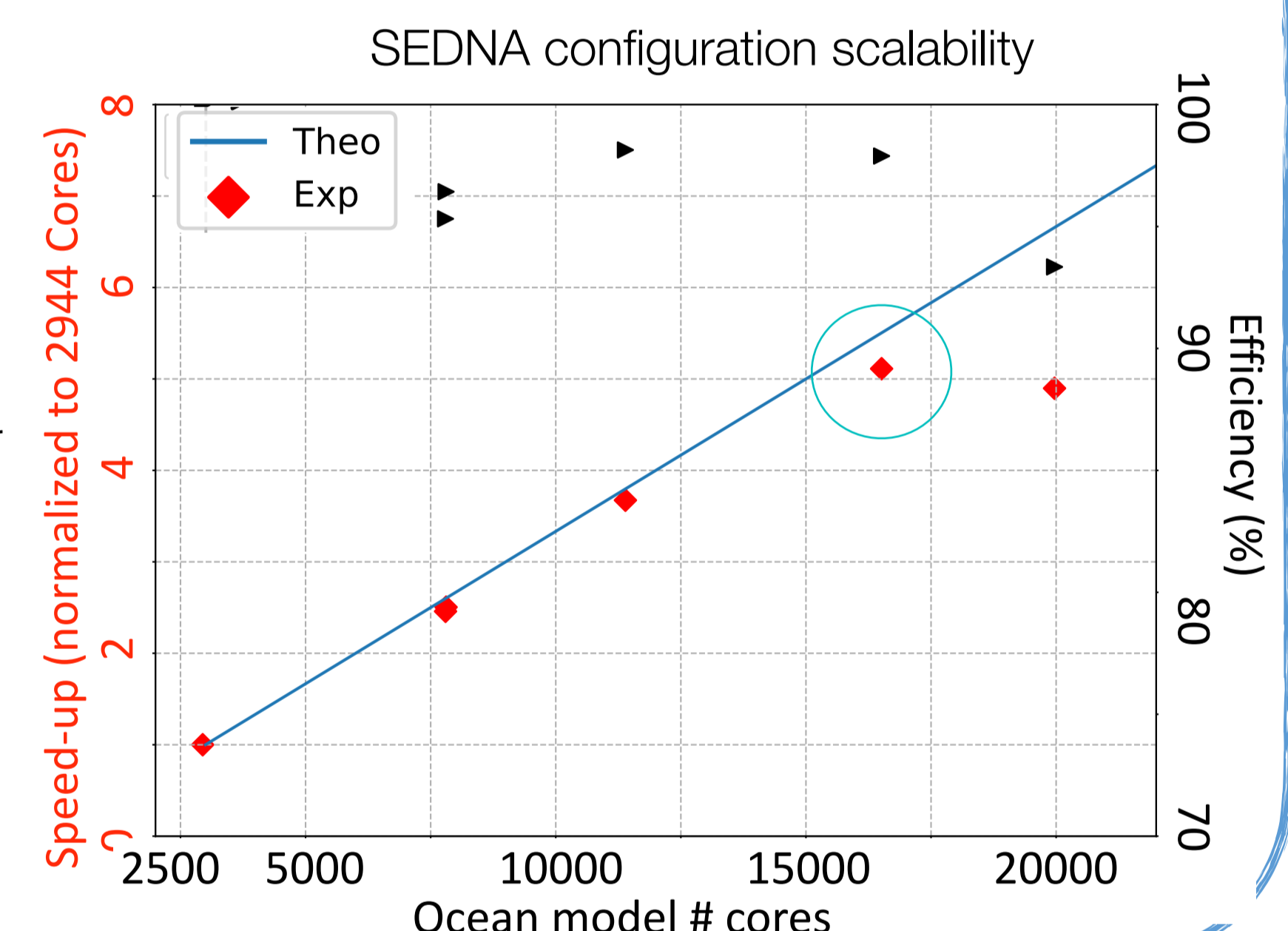
## The SEDNA (Sea ice - Eddy resolving ocean pan-Arctic) configuration



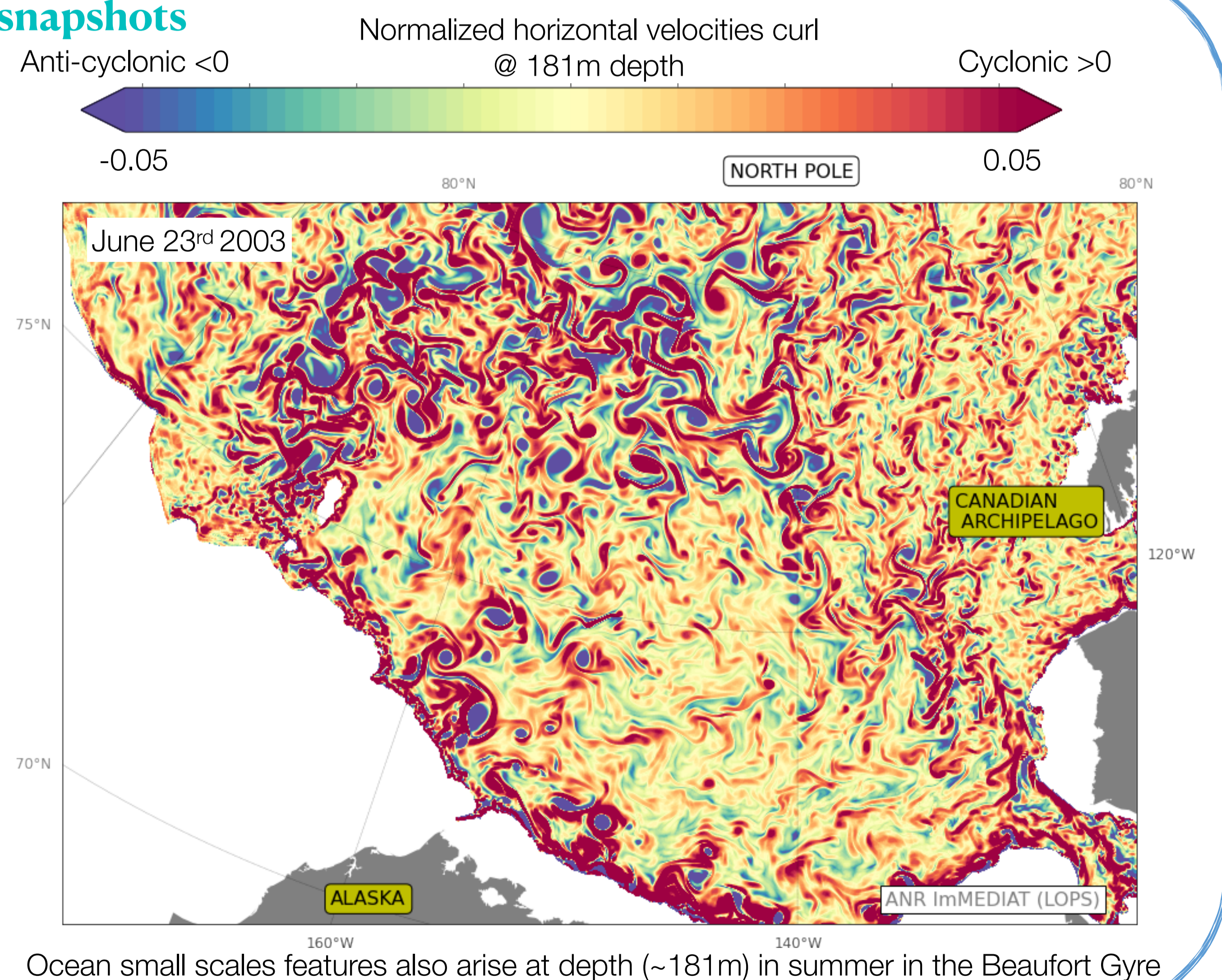
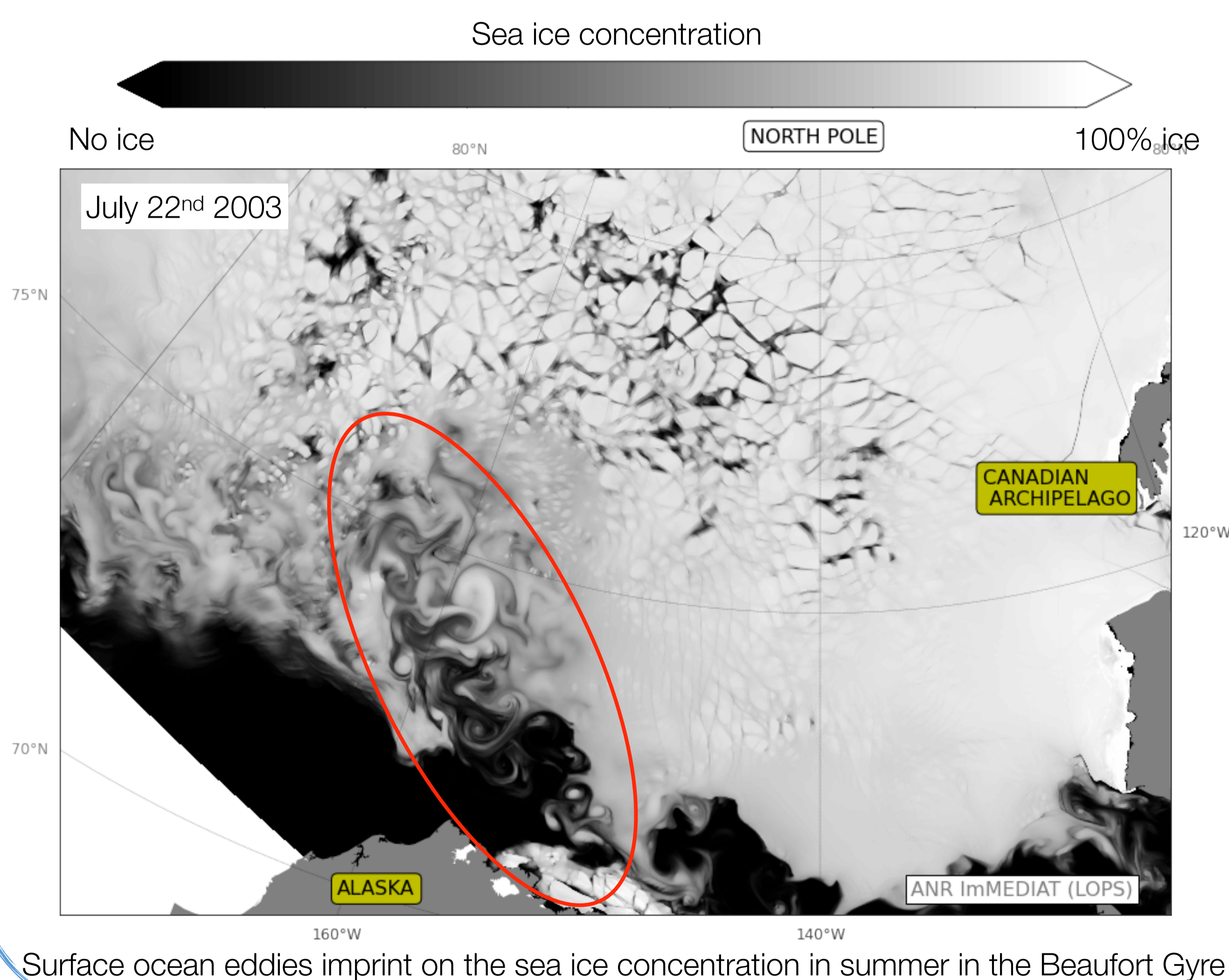
*This configuration requires massive computing resources in order to simulate a few years within an acceptable elapsed time*

## SEDNA on the TGCC's IRENE computer (ROME partition)

- # The HPC parallelism is based on a MPI horizontal domain decomposition:
  - NEMO = 16864 CPUs
  - XIOS = 544 CPUs to manage outputs
- # Elapsed time: ~12 days to simulate 1 year
- # PRACE computing resources : 35 000 000 CPU hours
- # Expected volume of data: ~ 400 TB of data for daily mean



## First SEDNA model snapshots



## Upcoming analysis

- characterise all the processes important for the interplay between the sea ice and eddies in the Arctic
- test theory related to these processes and quantify their effects on the large scale circulation and its evolution

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