



Ocean 2D eddy energy fluxes from small mesoscale processes with SWOT

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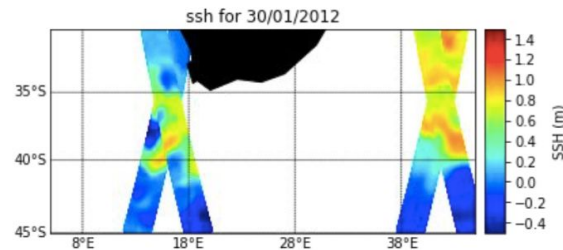
Introduction and objectives

Objectives :

- 1) Development of **2D eddy diagnostics**: model data and SWOT swaths (EKE, eddy anisotropy, vorticity, energy exchanges, strain/deformation, ...)
- 2) **Observability with SWOT**, after processing / reduction of instrumental and geophysical noise
- 3) Understand if small scale processes (15 to 150 km of wavelength) increase or compensate the **mesoscale eddy fluxes** observable nowadays (>150 km)

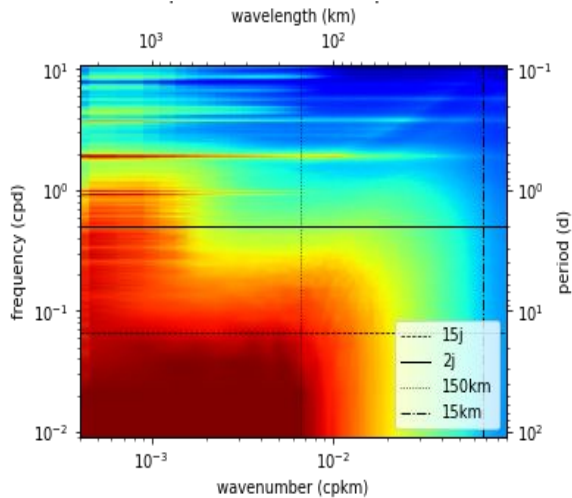
First study in the **Agulhas** current, then the full Southern Ocean with:

- SWOT **simulator** & MITgcm **model** (forced)
- Coupled model accounting for **air-sea interactions**
- SWOT **real data** and DUACS_HR data.

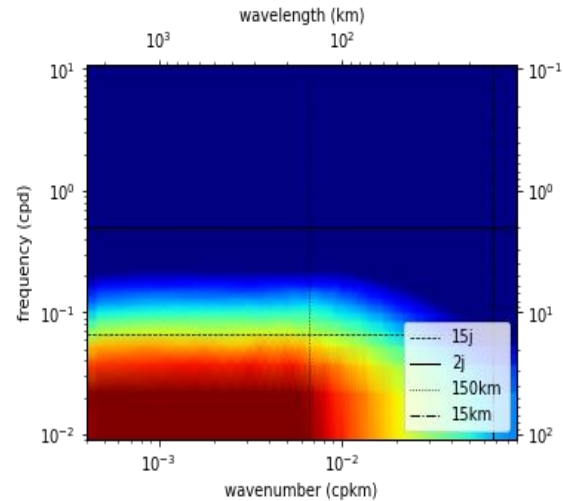


Energy spectra, MITgcm model 1/20°

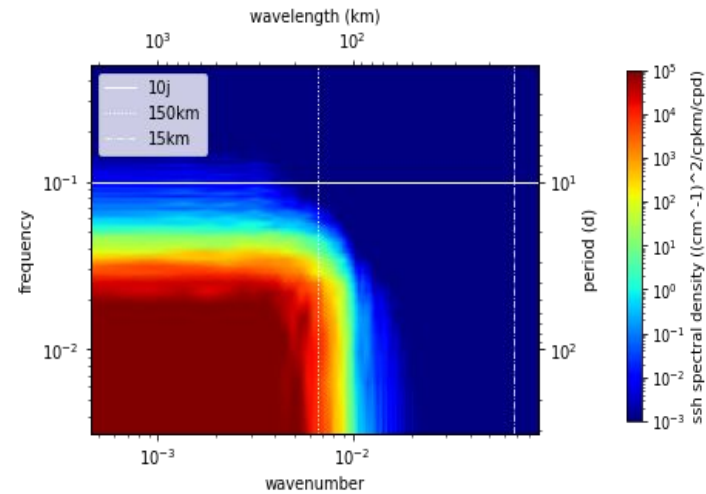
Total SSH



10-day filter applied



150 km spatial filter applied

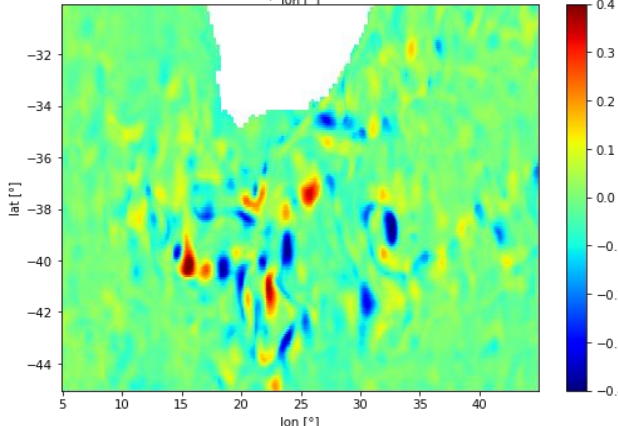
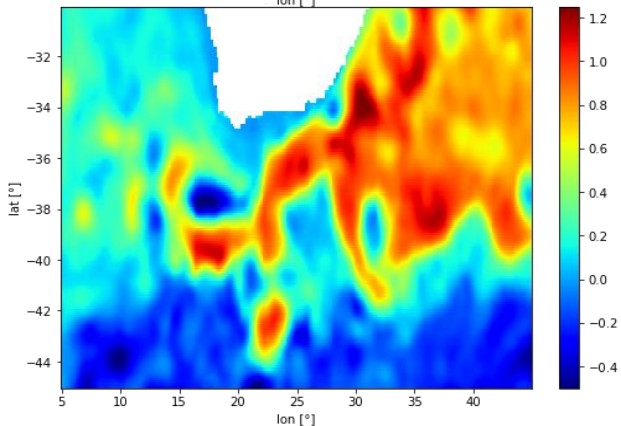
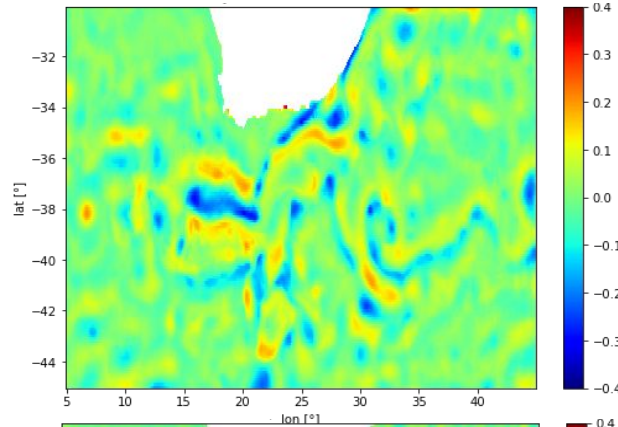
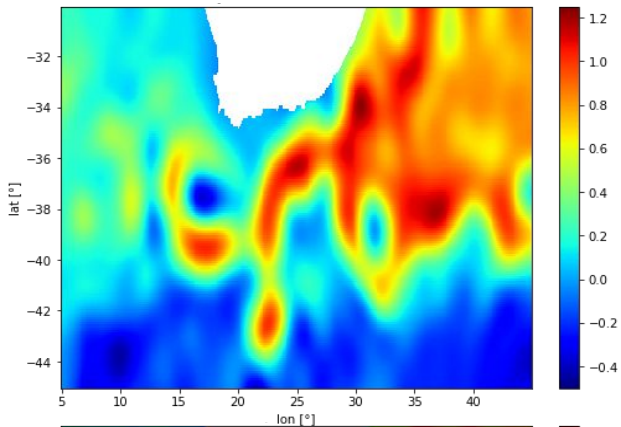


Net **cut** of the **high frequencies** both in time and space when the low-pass **filters** are applied.

Spatial filtering versus DUACS reconstruction, MITgcm 1/20°

Large scale

Small scale



Method 1
Lanczos filter (150 km, 10d)
snapshot 01/01/2012

Method 1: **elongated**
Method 2: **isotropic, isolated** structures

Method 2
DUACS reconstructed SSH
Small : Model SSH - DUACS
snapshot 01/01/2012

Eddy diagnostics, MITgcm model 1/20°

Today's scales > 150 km

New scales from SWOT < 150 km

EKE: Similar amplitude, different distribution

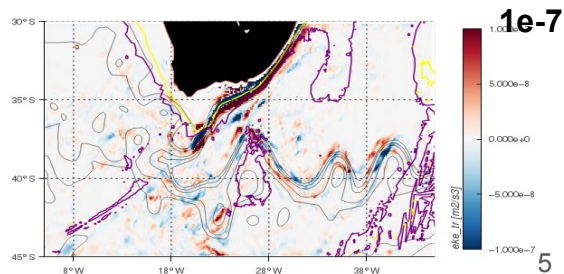
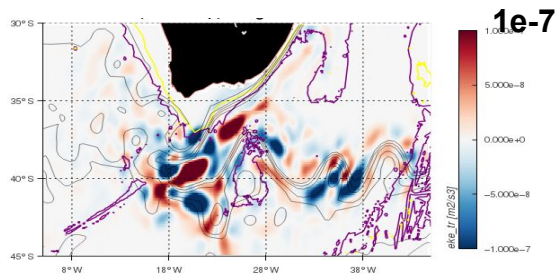
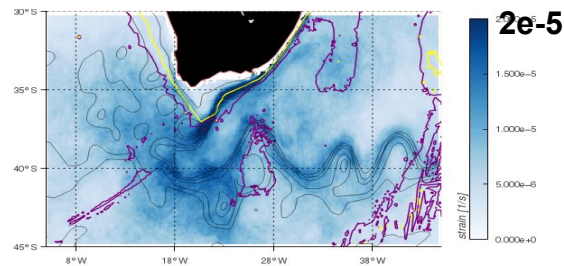
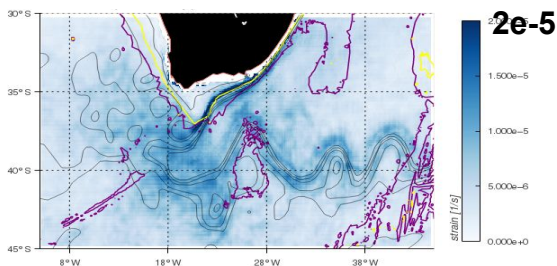
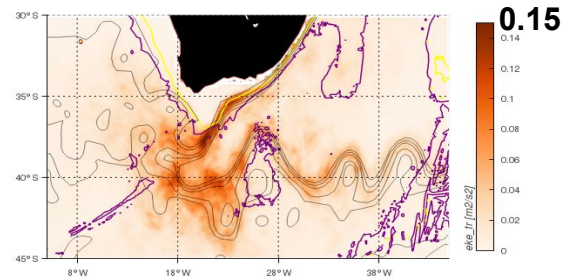
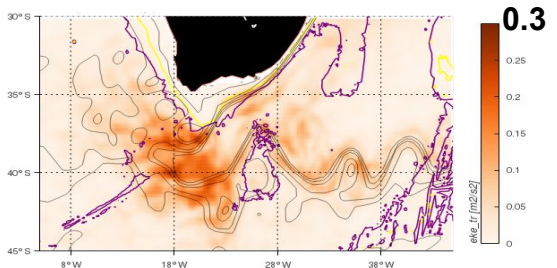
$$EKE = \frac{1}{2} (u'^2 + v'^2)$$

Strain: Fine scales 3x more energetic in boundary currents & meandering fronts

$$S_g = \sqrt{\left(\frac{\partial u_g}{\partial x} - \frac{\partial v_g}{\partial y}\right)^2 + \left(\frac{\partial v_g}{\partial x} + \frac{\partial u_g}{\partial y}\right)^2}$$

EKE transfer: Finer-scale energy transfer mainly in boundary currents

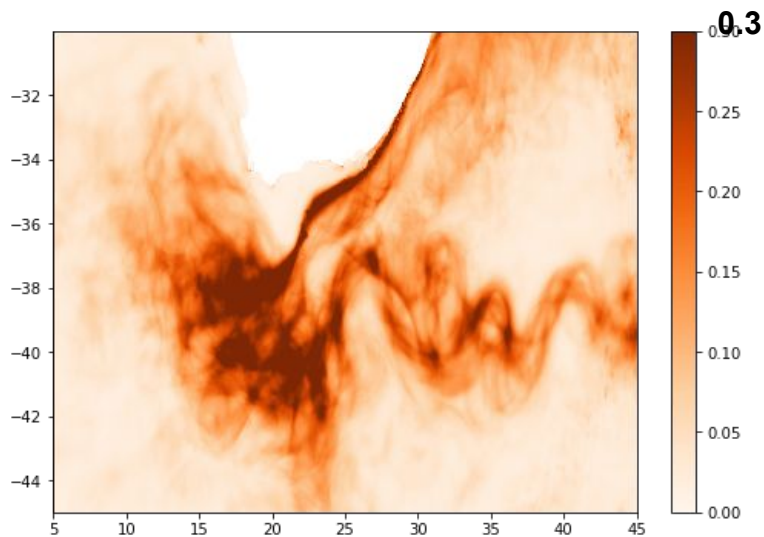
$$EKE_{tr} = \overline{u'u'} \frac{\partial \bar{u}}{\partial x} + \overline{v'u'} \frac{\partial \bar{v}}{\partial x} + \overline{u'v'} \frac{\partial \bar{u}}{\partial y} + \overline{v'v'} \frac{\partial \bar{v}}{\partial y}$$



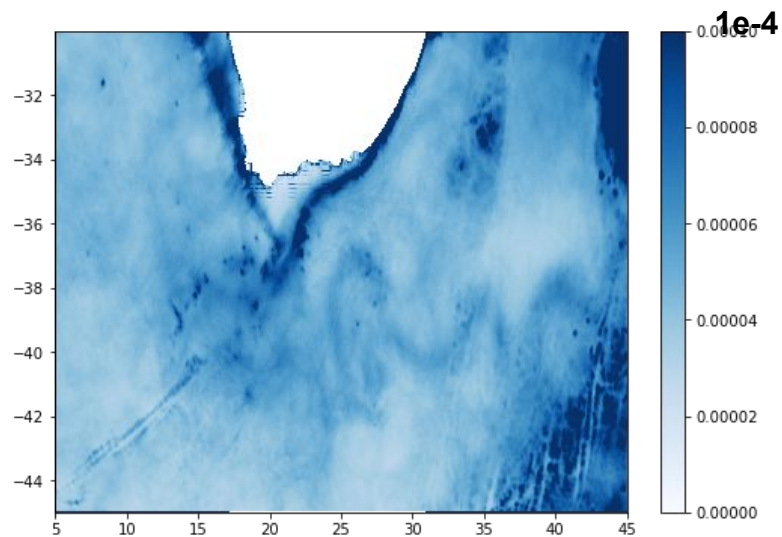
MITgcm model 1/48°

- Preliminary results
- Diagnostics on total SSH, no corrections are applied (tide, DAC)
- All frequencies represented , no filtering applied

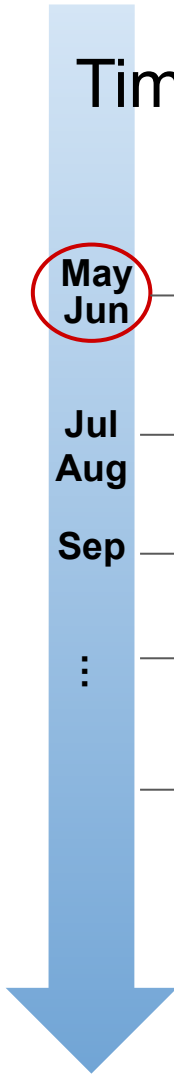
EKE



Strain rate



Timeline

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- May
Jun — Eddy diagnostics fluxes of energy between larger and smaller scales
Move to MITgcm 1/48°
 - Jul
Aug — Apply SWOT simulator to MITGCM fields
 - Standart **tide+DAC correction**
 - Introduce **waves** with WW3 model
 - Sep — Apply **Karin noise reduction** techniques
 - ⋮ — Calculate **eddy diagnostics** under the SWOT tracks
 - Start using a more realistic model, with **coupled ocean-atmosphere**



Thank you

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