Monitoring the mesoscale eddies interactions with the altimetry constellation

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Introduction

Managing interactions between mesoscale eddies (e.g. merging and splitting events) is necessary to properly understand the dynamics of these structures. The Mesoscale Eddy Trajectories Atlas – Networks is an experimental dataset that will be available soon on the AVISO+ website (www.aviso.altimetry.fr). Networks are composed of consecutive mesoscale eddies linked by interactions. Even if numerous networks only count one segment, long lived networks are composed of multiple segments experiencing interactions. We illustrate here how those interactions can be represented and investigated for a specific long lived cyclonic network off West Australia. An analysis of synthetic particles advected forward in time by the surface currents derived from the Absolute Dynamic Topography is proposed.

Data & Methods

Eddy detection :

Input maps : Daily Delayed Time Absolute Dynamic Topography from 1993 to 2022 [1] Algorithm : py-eddy-tracker [2,3,4] **Parameters : As described in [3]**

Watch the eddies!

The detected eddies are also used in META3.2 [5], available on the AVISO+ website (www.aviso.altimetry.fr).

See an illustration here : https://www.youtube.com/wat ch?v=xw-XsFqD3GU

Global Statistics

For the period 1993 – 2022 : ~2.1 networks

~2.8 million segments

~72 million detected eddies (0.5% not associated in networks)



Eddy tracking :

From one day to another, we search for overlapping contours

- Consecutive eddies with an overlap ratio *intersection / union* \geq 10% (if not, the overlap ratio *intersection / minimal area* must be \geq 99%) in a 7 days time window constitute a **network**
- Inside each network, segments are consecutive eddies linked by interactions.



Scheme 1 : Representation of a network. Points are the consecutive eddies centers. Lines represent contours at t and dashed lines contours at t+dt.. Shaded areas are the contours intersection.

Networks lasting at least 10 days :

<u>Global statistics (Figure 1) :</u> ~1.2 million networks ~1.7 million segments

~68 million detected eddies

<u>Lifetime between 10 – 30 days :</u> 56% Networks 42% Segments

Interactions:

83% Networks with no interactions ~280 000 merging events (Figure 2) ~280 000 splitting events (Figure 3) ~95% of the events occur in networks lasting more than 30 days *Figure 1 : Time spent within networks* \geq *10 days*



Figure 2 : Time spent within splitting eddies

- The segment that continues (segment 2) after a merging or a splitting event is the one with the highest overlap ratio *intersection / union*
- A lonely segment (without interactions) is a network by itself.

Coherence

Specific Network

LEIMITE.

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