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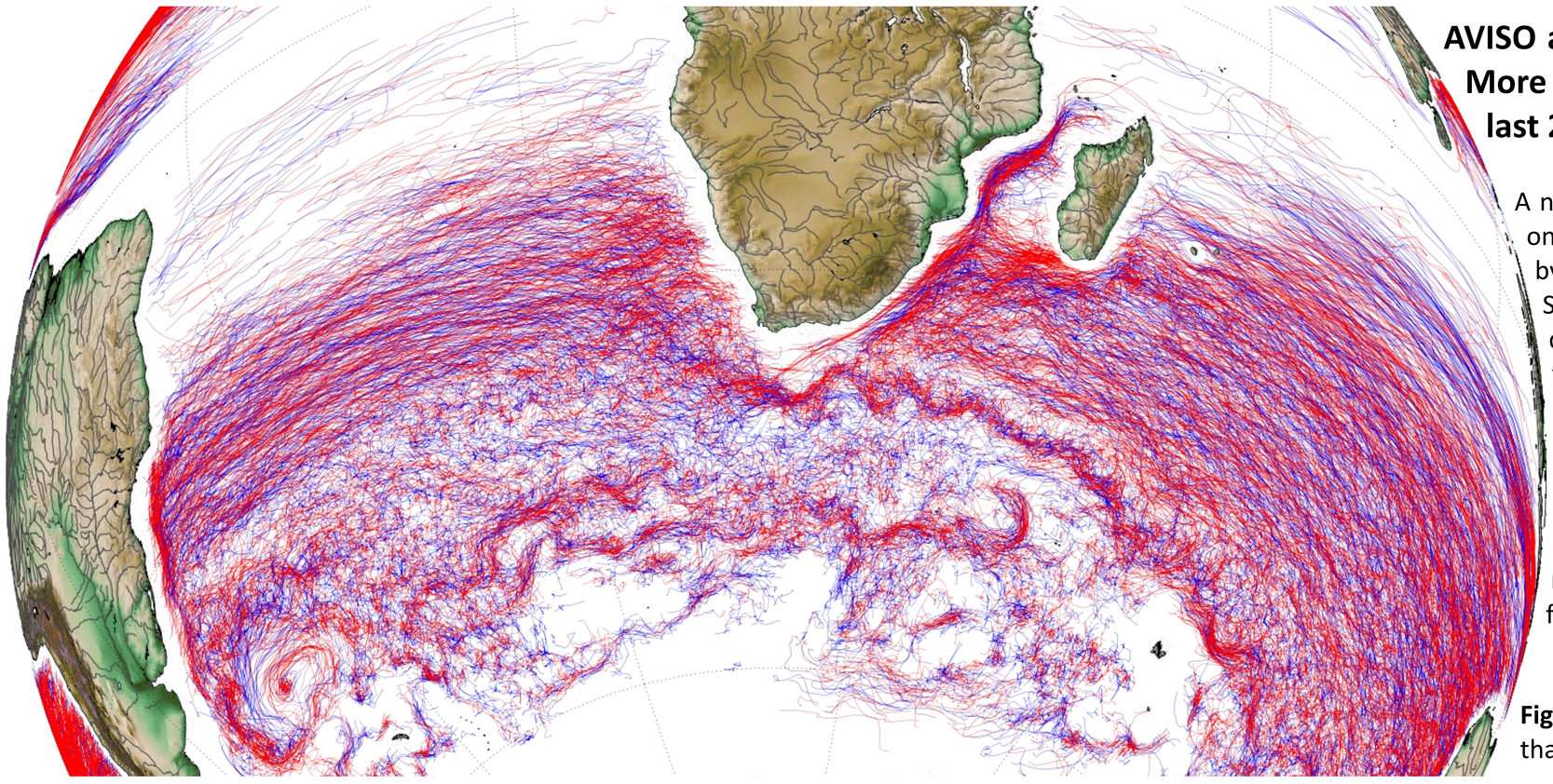
A 24-YEAR MESOSCALE EDDY TRAJECTORY ATLAS



AVISO atlas gathers 23M eddy observations in 272K tracks! More than 59K eddies are following at least 16 weeks over last 24 years (1993-2016).

A new “Mesoscale Eddy Trajectory Atlas" was released in october 2017 on the Aviso altimetry portal. This dataset was produced and validated by CLS in collaboration with D. Chelton and M. Schlax from Oregon State University. It replaces the dataset formerly produced and distributed at OSU, and is regularly updated by the SSALTO/DUACS team and distributed by AVISO+.

The current version of the eddy atlas was produced from 24 years of daily altimetry maps of SSH based on sampling by two satellites. In addition to locations of detected eddies along their trajectories, the atlas includes additional informations about the amplitude, rotational speed, radius, and eddy type (cyclonic/anticyclonic). The file format is derived from the NetCDF format formerly used by OSU.

Fig 1 : Cyclonic (red) and anticyclonic (blue) eddy trajectories longer than 16 weeks

ALGORITHM

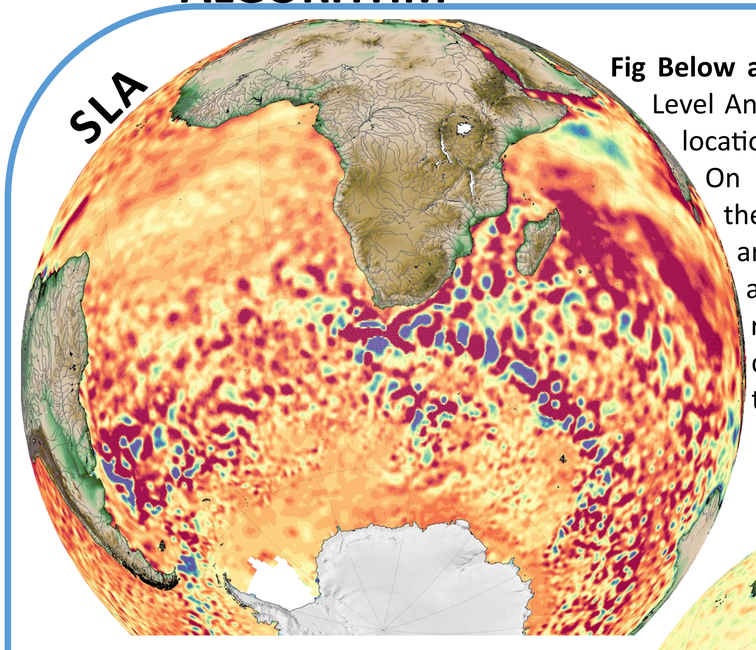


Fig Below and Right : After filtering, extrema of the Sea Level Anomaly field are detected to estimate eddy locations and properties.

On each local maximum and minimum, the algorithm searches the points around it to extend the area detected as an eddy. If the area follows some rules, an eddy is considered to be detected. Any further detection on this area is stopped.

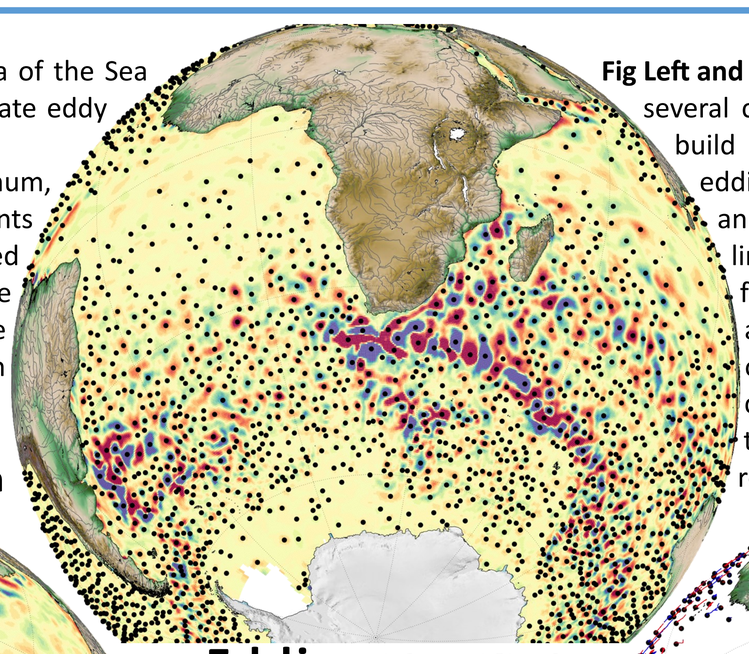


Fig Left and Below : After performing detection on several consecutive days, we apply a procedure to build the trajectories over time of the detected eddies. To search for next observation, we build an ellipse that encompasses an area to find likely linked observations. If several observations are found within this ellipse, a cost function is applied, which must be minimized to link two observations and to consider they are two different positions of the same eddy. Eddy trajectories shorter than 4 weeks are removed.

SLA Short wavelength

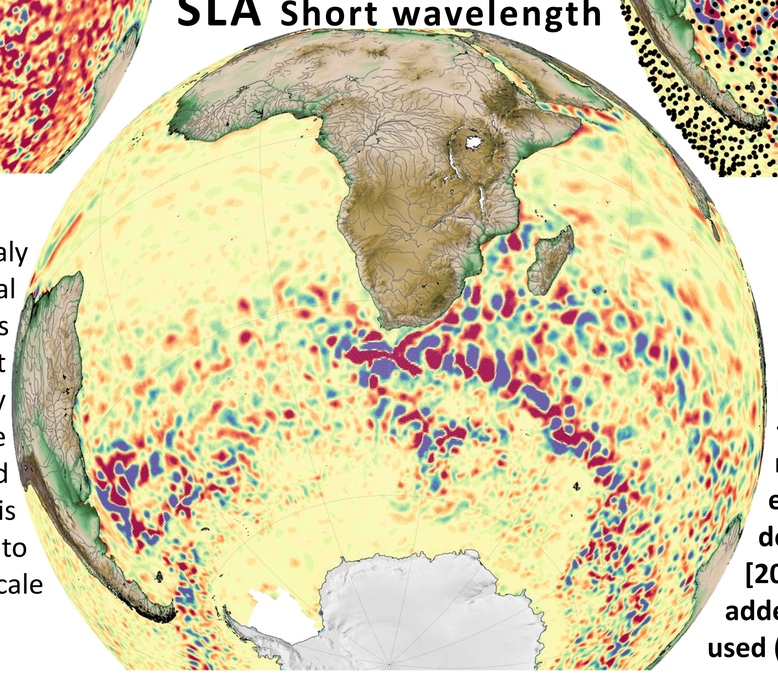
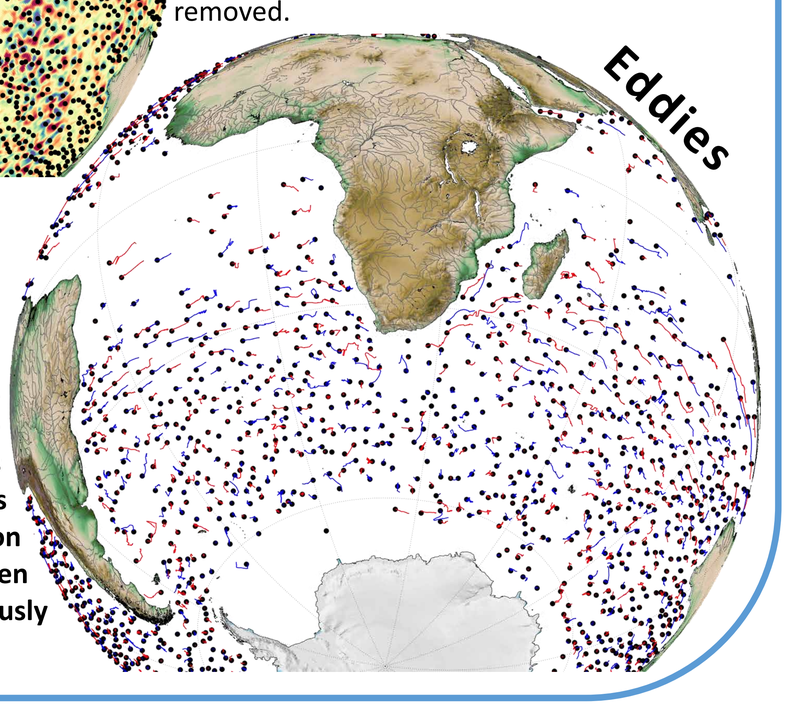


Fig Above and Right : The Sea Level Anomaly field includes a wide range of spatial features. Eddies are identified as features with diameters of 100-300 km, so the first step is to remove larger scale variability using a low pass filter. Large-scale variability is computed using a second order Lanczos smoother. The result is subtracted from the original SLA data to produce a grid which contains only mesoscale variability.

Eddies identified



Identification procedure is a 2 -dimensional version of the method presented by Williams et al. [2011], modified as described by Schlax and Chelton [2016]. Some upgrades have been added to the algorithm previously used (See below).

CHANGES

Here we describe algorithm improvements of this new version with respect to previous datasets [Chelton et al., 2016].

- In the first daily eddy atlas, tracking process sometimes linked two observations obviously unrelated in view of the distance between them, and incoherence with previous and following eddy movements. We reduced search ellipse (**Fig 2 and 3**).
- In the new eddy atlas, eddies could cross Drake Passage (**Fig 4 right**). We modified the detection process and also the tracking routine, to be able to link observations on both sides of this passage, thus allowing eddy trajectories to span between the Pacific and Atlantic.

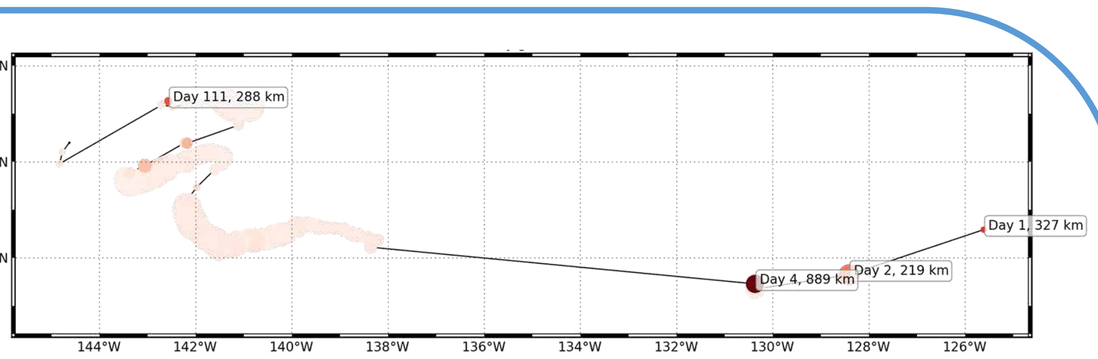


Fig 2: Jumps visible on previous dataset (ID 72724)

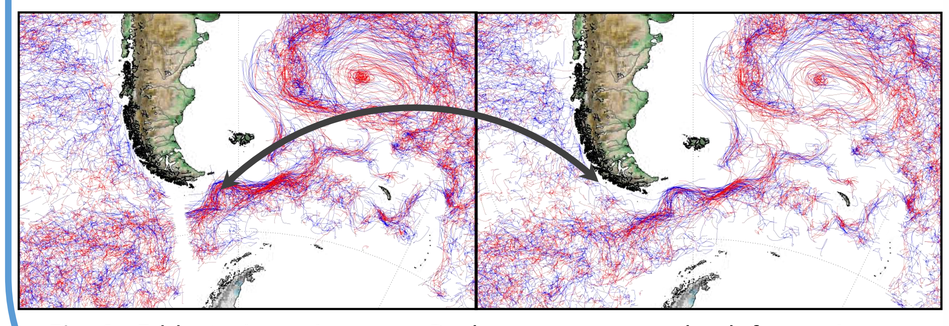


Fig 4: Eddy trajectories over Drake passage, on the left previous atlas doesn’t allow trajectory between Atlantic and Pacific. On the right new AVISO eddy atlas.

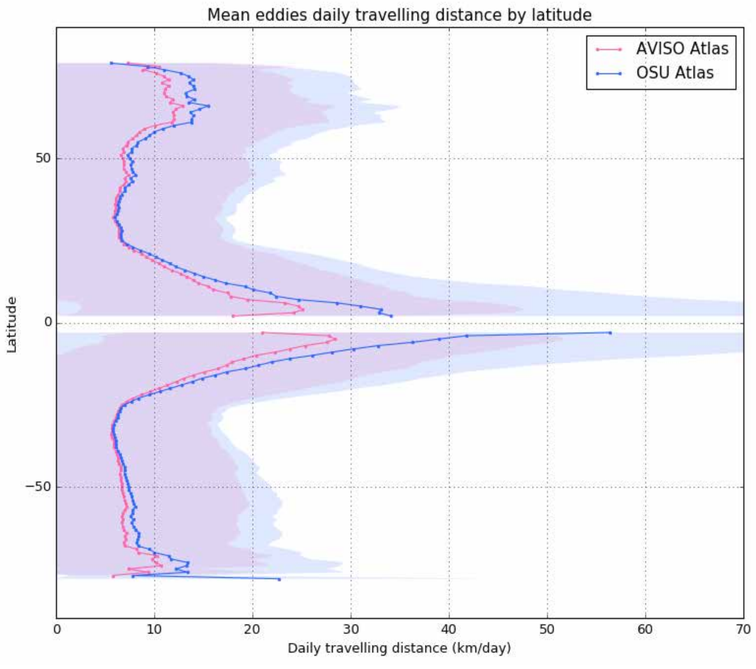


Fig 3: Mean eddy daily travel speed is reduced with new atlas (red), also standard deviation (enveloppe curve)

DATASET INFOS

Aviso eddy atlas is available on https://www.aviso.altimetry.fr. All data is stored in one file, which contains several physical field :

- Eddy radius
- Eddy amplitude
- Eddy rotation speed
- Rotation type (Cyclonic/Anticyclonic)

Other informations are also available :

- time of observation
- Coordinates
- ID of track
- Observation number(which give the number of day of tracking)

Each year, one or two updates will be performed, with a special care for eddy ID continuity. Also a validation report will be build with figures used in the first dissemination by OSU, to quantify atlas improvement. See :