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# Satellite-derived ocean current climatologies for the southern Mozambique Channel

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## Background

Existing knowledge on oceanic currents in the Mozambique Channel is based mostly on recent satellite observations and the increasing modelling efforts; therefore it lacks ground-truthing in many parts of the channel. There many and well-known reason that makes ocean observation a difficult task including the expensive costs associated with in situ observations, and the problems of contamination and limited coverage of satellites. However, in some places, such as the Mozambique Channel, the more accurate information to date is that coming from satellites.

Information on ocean currents in the southern region of the Mozambique Channel is important for navigation, port operation along the coastal zone, and fisheries. The present study seeks to describe the present-day climatologies of coastal as well as open sea currents in the southern Mozambique channel, based on multi-mission and multi-platform data collated and archived by the GlobCurrent project.

## Methods

Our approach includes data extraction from www.globcurrent.org, processing and statistical analysis. The data hosted in the GlobCurrent repository comprises Ekman, geostrophic and total current at the surface as well as at 15 metres depth. The data was extracted for the years 2002 through 2016 in the region bounded by 20º-30ºS and 30º-50ºE. The processing and analysis was conducted in python and consisted in data manipulation to extract the main modes of variability including the main characteristics of the seasonal and annual cycles.

## Results

A long-term (2002-2016) average clearly indicates the existence of a south-oriented and not-continuous current in the western reaches of the channel, with intensification towards the south, consistent with earlier reports. It is also clearly visible a region around 22.5°-25°S and 35°-39°E where the mean current undergoes an anti-cyclonic rotation, indicating the mean position of one of the anti-cyclonic mesoscale eddies. The long-term mean currents in the centre of the channels around 22°-26°S and 38°-44°E have no clear pattern as indicated by the multi-directional and weak flows as well as the rather weak standard deviation. The mean currents landward of the 500m isobaths in the Mozambican side have shown strong consistency as revealed by the extremely weak standard deviation, and the current patterns vary between a lee eddy in the Delagoa Bight (25°-26.5°S), southward flowing between 22.5°-25°S, and northward flowing between 20° and 22.5°S.

The long-term monthly or quarterly averages do not show any specific circulation pattern, except for the intensification or attenuation in the so-called "continuous" circulation. Whilst monthly and shorter-term averages taken from year-round data indicates that eddies in the southern Mozambique Channel occur in a rather random fashion, as indicated by their non-permanent position. At this temporal scale the current velocities in the vicinity of an eddy may reach 1 m/s, slightly faster than the long-term pattern indicates. Moreover, a set of cyclonic eddies present in the region south of 27°S are found propagating southwardly and westwardly, although they have been formed either outside the Mozambique Channel or in the Delagoa Bight.

## Conclusions

The analyses of short term data has clearly indicated the absence of a continuous current along the Mozambican coast and precisely above the 22.5oS, but at same time scale, a boundary current is consistent along the coast of Madagascar. At longer time scales both Mozambican and Madagascar coasts exhibit consistent currents. Therefore, we conclude that such pattern reflects the strength of the southwards flowing eddies along the African coast, whereas bellow this latitude the pattern shows the inception of the greeter Agulhas Current.

Analyses of standard deviation of the surface velocities showed that there is not much variability along the whole domain, except along the African coast and Madagascar due to the impact of the eddies along the former and the boundary current over the letter. The known pathways of the anti-cyclonic eddies from north and east, highlight the trajectory of these features and the region that both cross-over, off Delagoa Bight. The variability of surface velocities and direction allowed us to infer that the circulation in the Delagoa shows quick shifts in speed and direction probably in consistence of the complexity of the local circulation or due to variability associated with the prevalence of strong tidal currents over the coast. Therefore long term satellite data are crucial on accessing the variability along the coast. Farther south of the Bight, the relatively weak shifts in velocity indicate the importance of the boundary current over the tidal shifts.