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# THE MALVINAS / FALKLAND CURRENT OBSERVED WITH ERS 1 SCATTEROMETER AND ALTIMETER

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## ABSTRACT

**Using ERS-1 scatterometer and altimeter data, as well as TOPEX/Poseidon altimeter data, the relationship between the intensity of the Malvinas/Falkland current at -44 to -47ºS studied in relation to the intensity of the ACC (Antarctic Circumpolar Current) at Drake Passage, the intensity of local winds, and the zonally-averaged curl of the wind stress in the S. Atlantic. Preliminary conclusions: the current intensity between 44ºS - 47ºS shows the identical combination of annual and semiannual components (ratio of amplitudes; relative phases) as the local wind stress curl, with the local curl lagging the current by a few days. The ACC current intensity and the Sverdrup transports show similar but not same combinations of annual and semiannual signals as the malvinas current. the inference is that the current's intensity is driven by the ACC, which responds to the large-scale wind pattern of the southern ocean, which is also coherent with the Sverdrup transport at 40ºs. the local wind appears to be more a consequence of the (cold waters) brought by the current than its driver.**

## 1. INTRODUCTION

The Malvinas/Falkland current branches off the Antarctic Circumpolar Current at Drake passage around 57ºs, then heads north hugging the slope leading up to the argentine shelf. upon meeting the Brazil current around 40ºs, it retroflects to about 48ºs (the Falkland escarpment) then heads east. Its barotropic mode dominates both the time-averaged and time varying transports (Peterson, 1992).

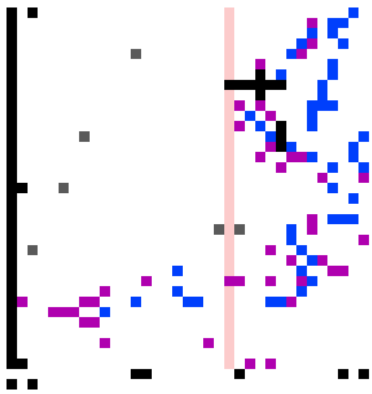

*FIGURE 1. Location of the Malvinas/Falkland current, against the steep topography.. The crosses indicate where the transport is measured with altimetry.*

The question addressed with ERS data is what is the relatonship between a) intensity of the current in the recirculating area, (40ºs to 48ºs), b) the basin-wide Sverdrup transport, c) the local winds, and d) the ACC transport.

## 2. DATA and ANALYSIS

Sea level from the ERS-1 altimeter (phase C only) and from the Topex/Poseidon altimeters were used to compute surface transports as sea level differences across the current. For the ACC transport, the data were gridded onto a 1ºx1ºx3 day grid. For the Malvinas transport, the data were used as alongtrack differences of 60 km averages.

Wind stress and stress-curl data from ERS-1 ami-scatterometer, as computed and gridded onto a 1ºx1ºx1week grids by IFREMER, are used to study the wind fields.

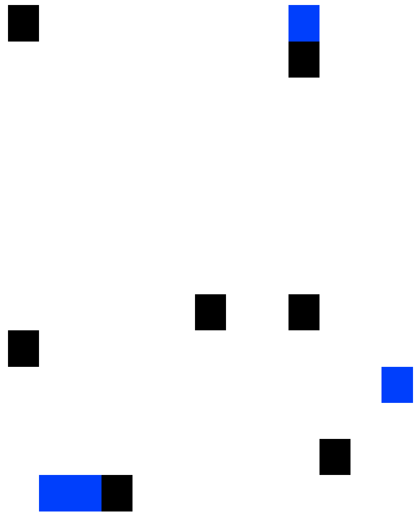

*FIGURE 2. Sea level difference at Drake passage, in mm, from altimetry gridded over 1ºx1ºx3days. Units: mm. This is a proxy for ACC transport variability; the sign is such that positive se alevel difference implies stronger transport. The upper plot is for 4 years, lower one for the same time period for which we had ERS-1 weekly gridded winds. super-imposed in blue, is the fraction with annual & semiannual periodicities. Notice that the current intensification occurs over a shorter time than its weakening.*

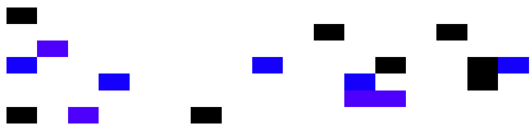

*FIGURE 3. Sea level jump over 150 km, across Malvinas current, at 47ºs, its 90 day average, and its projection onto annual and semiannual components.*

Notice that the steep rise and slow decline of the current is captured in the combination of annual and semiannual components. also notice that the behaviour is similar but not identical to the ACC asymetry between strengthening and decline. Finally, the phases are different.

*FIGURE 4. (dark) Sea level jump over 150 km, 90 day average, across malvinas current, at 44ºS and 47ºSº. Notice the strong coherence of sealevel at 44ºs and 47ºs, a property of the current, not an artifact of the data. (light) curl of wind stress averaged over lat:55.5ºS to 48.5ºS, lon: 294.5º to 301.5. (lightest): wind stress curl, zonally averaged along 40ºS. Units: sea level in dm, wind stress curl in $10^{-7}$ N/$m^3$.*

As shown in Figure 4, the the sea level differences across two points separated by more 300 km along the current axis (where it is fixed to the continental rise, with the Patagonian shelf to its west), are highly consistent and indeed measure a property of the current, its transport variability. What that figure also shows is that, whith different phase, the winds, especially the local wind, has the same general shape. To study this with simplicity, the data were projected only onto their annual and semiannual components, which were then compared (see also Figure 3 for the relationship between instantaneous samples, their 90 day averages, and their annual plus semiannual components).

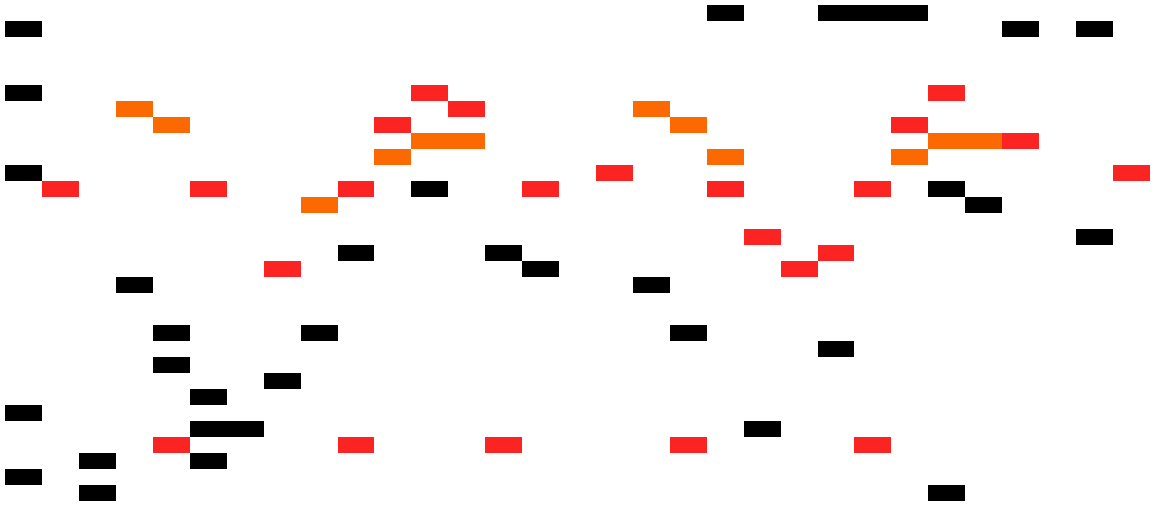

*FIGURE 5. As Fig. 4, but only the sum of annual and semiannual components (dark, sea level; light: local wind curl; lightest: zonally averaged wind stress curl).*

As shown in Fig. 5, there is strong correlation over time scales longer than six months between the shelf wind stress curl and current intensity, which was also present in the 90 day-averages. The correlation with only zonal or meridional wind components was also tested, and found to be negligible. The proportion of annual to semiannual amplitudes and the relative phases are about the same for wind and current intensity, but the local wind lags the current by a few days.

**REFERENCES.**

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