Waveguide for Rossby waves in the Antarctic Circumpolar Current based on the altimetry data

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Data

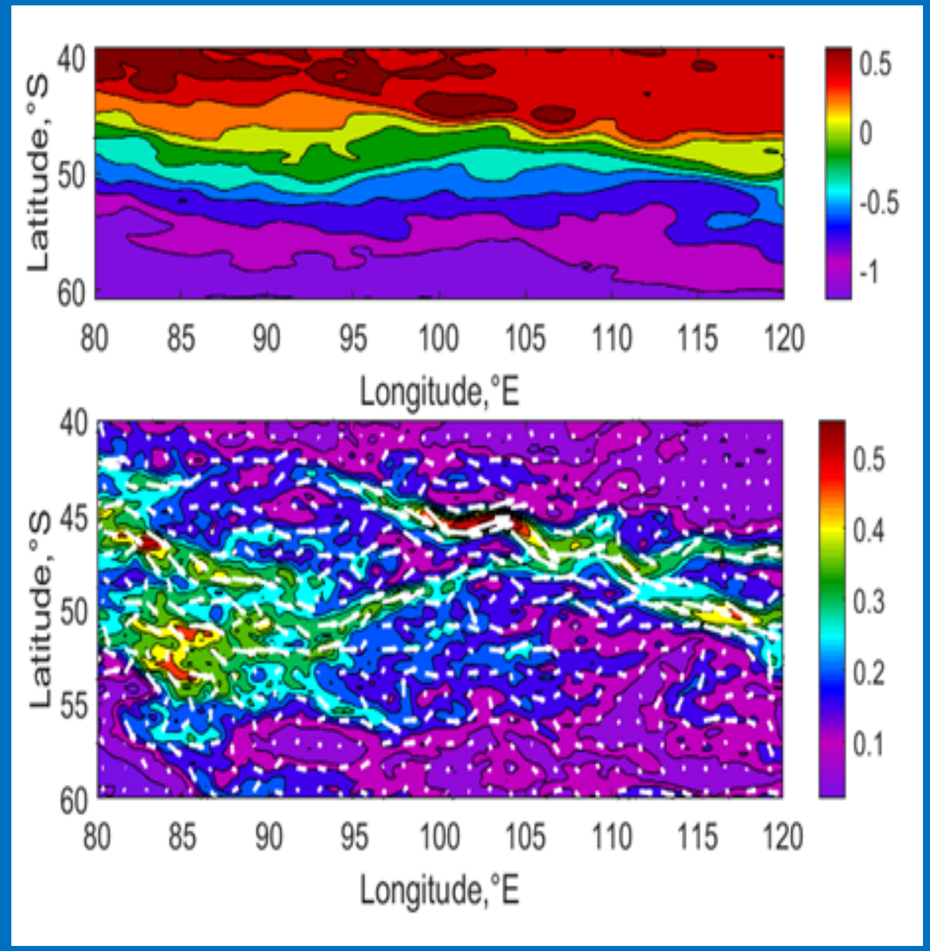
Sea Level Anomalies and geostrophic velocities

Data is presented by AVISO+ database

https://www.aviso.altimetry.fr/

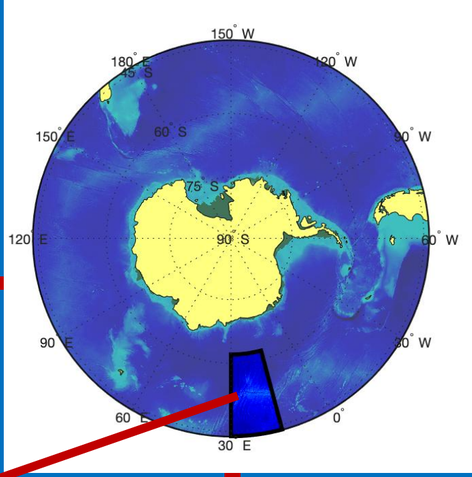
Southern Ocean Fronts

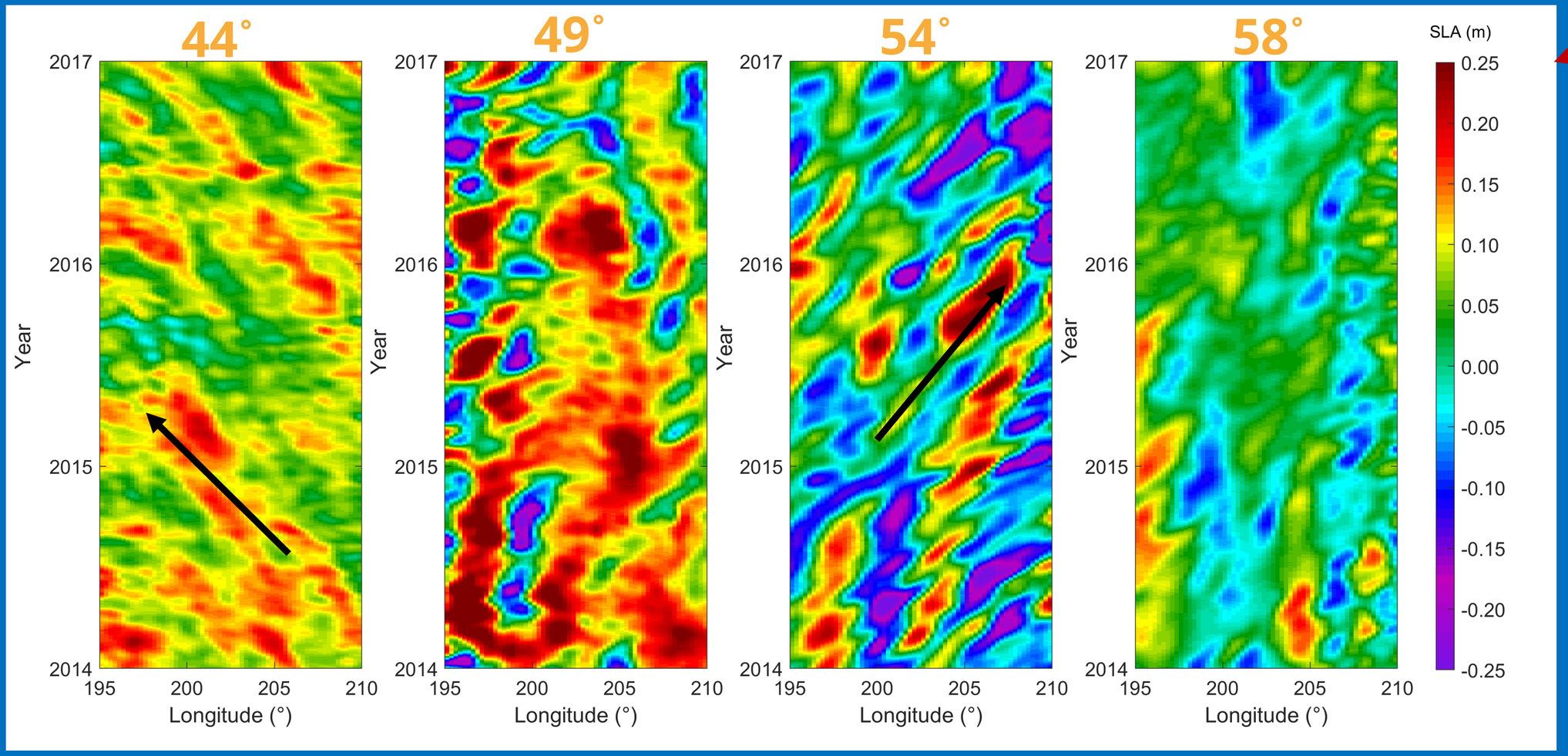
Data is presented by the Center for Topographic studies of the Ocean and Hydrosphere
http://ctoh.legos.obs-mip.fr/



(a) Sea level (m)
(b) Geostrophic currents (m/s).
Average for the period 2010-2011.

Hovmöller diagram





Velocity Comparison

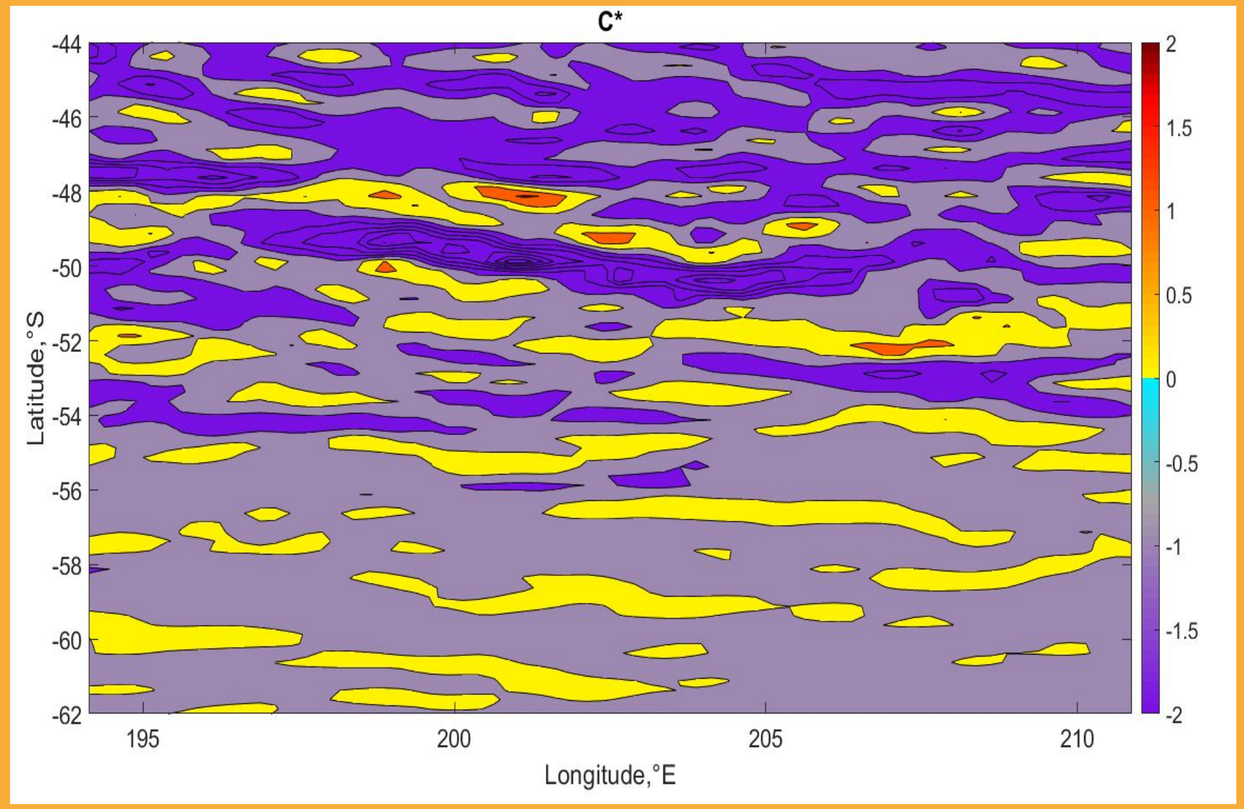
Latitude	44°	49°	54°	58°
Theoretical velocity $c = -\beta R_o^2$ [cm sec^{-1}] (linear long-wave approximation)	-1.2	-1.0	-0.4	-0.16
Empirical velocity c [cm sec^{-1}] (from Hovmöller diagram)	-2.6	1.3	4.8	2.7

Nonlinear long-wave approximation

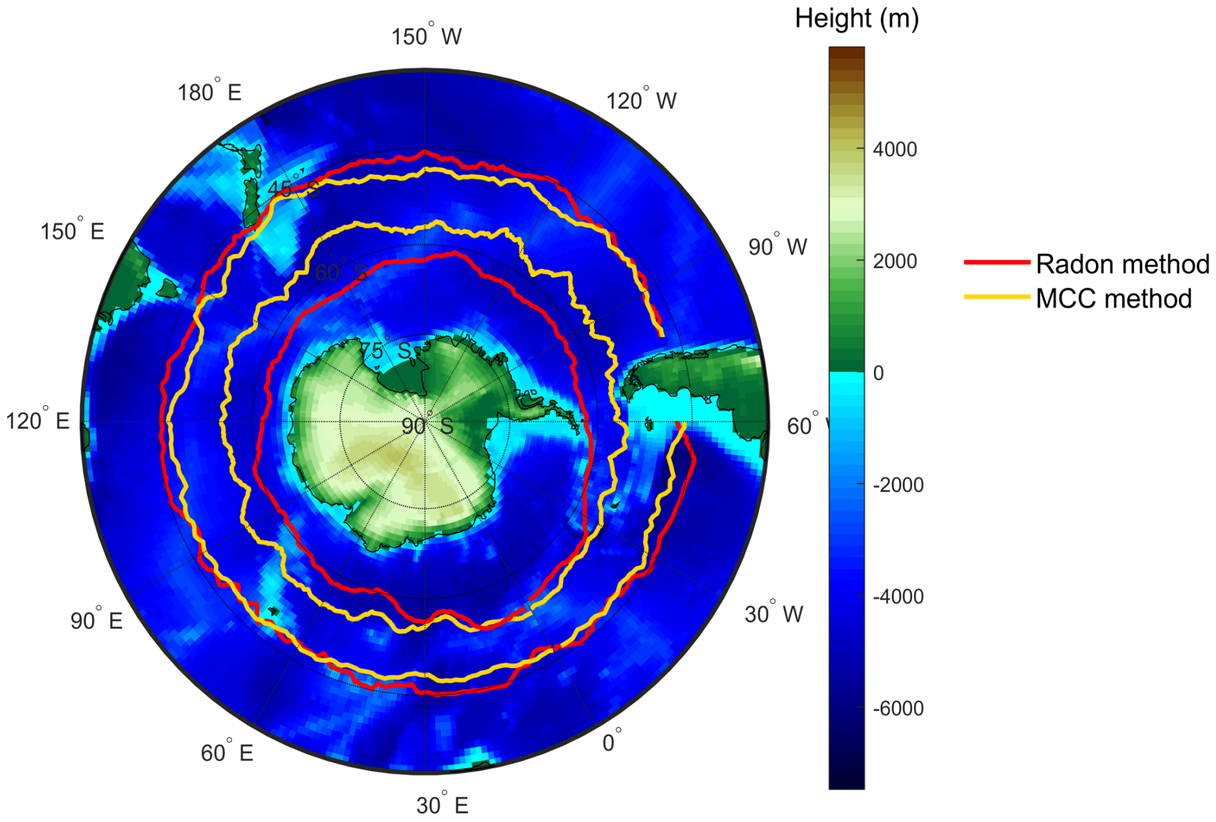
$$c^* = -\beta^* \cdot R_1^2$$

$$\beta^* = \beta - U''_{yy}$$

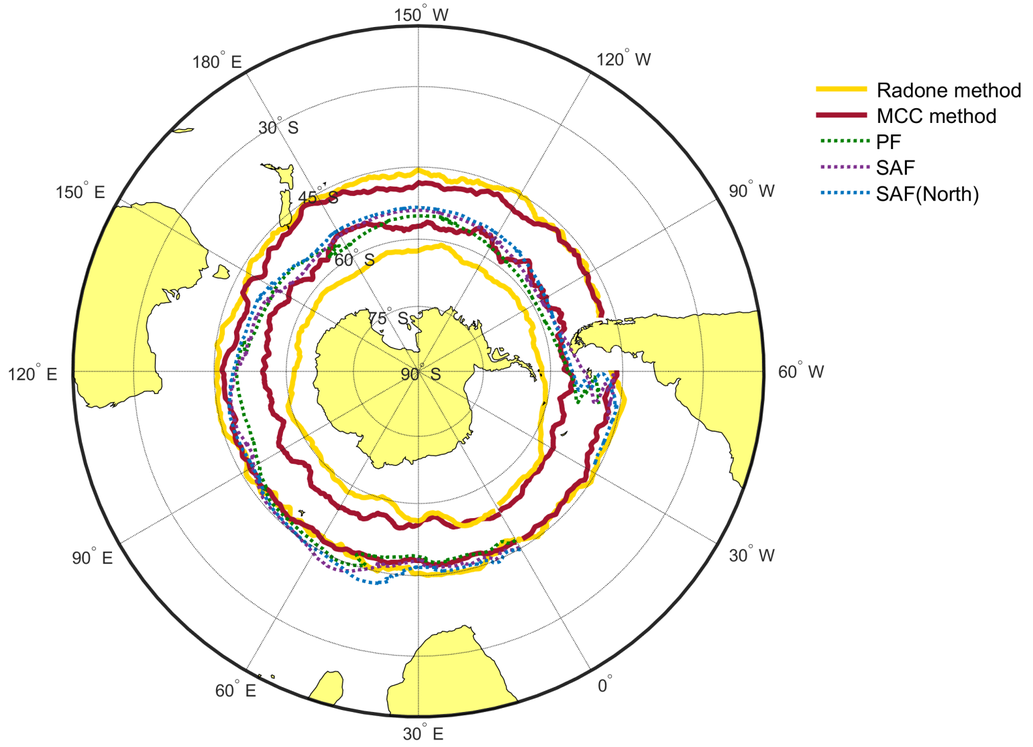
Gnevishev et al. (2019)



Waveguide boundaries



Waveguide boundaries and Southern ocean fronts



PF-Polar Front
SAF-southern branch of the Subantarctic Front
SAF (North) -northern branch of the Subantarctic Front

Conclusions

Using various methods and based on satellite altimetry data we show that ACC is a waveguide for Rossby waves
(3)

We prove that linear theory of Rossby waves doesn't work within the waveguide and we should consider nonlinear in long-wave approximation
(4,5)

We proposed the method for determining the boundaries of the waveguide in the jet stream using altimetry data
Also, we determined the geographical location of the waveguide in the ACC
(6)

The comparison of the waveguide boundaries by the Radon method and the cross-correlation method has shown that the results of these two methods are similar for study region
(6)

Thank you
for your attention!