Geophysical Research Abstracts
Vol. 13, EGU2011-13523, 2011
EGU General Assembly 2011

A new view of the Bransfield Current: a study through rotating laboratory experiments

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The Bransfield Strait is located between the South Shetland Islands and the Antarctic Peninsula and it can be considered as a transition zone. The relatively warm and fresh water in Bransfield Strait comes from the Bellinghausen Sea, flows northeastwards forming the Bransfield Current and is called as Transitional Zonal Water with Bellingshausen Sea influence (TBW). On the other hand, the water mass which has its origin at the Weddell Sea (salty and cold), named as Transitional Zonal Water with Weddell Sea influence (TWW), flows westwards. In this work, we try to simulate in laboratory the dynamical interactions between a surface light water and a deep dense water with a simplified two-layer configuration initially separated by a lock gate in a rectangular basin. However, our effort was on the quasi-steady coastal circulation of the rotating gravity current instead of the transient propagation. In order to satisfy the similarity conditions between the laboratory and Bransfield Strait, we used in-situ measurements of CIEMAR and BREDDIES surveys to fix the dimensionless parameters of the idealized laboratory model. In these experiments, to quantify the edge front geometry and the surface velocity field we used non intrusive techniques, laser induced fluorescence (LIF) and particle image velocimetry (PIV). The first results of the laboratory coastal gravity current showed that the Rossby number and the Wf/Rd, where Wf is the dimensionless width of the current and Rd is the baroclinic deformation radius, were in good agreement with the in-situ measurements of the Bransfield Current. Anyway, we need to carry out experiments with shelf slope, submarine sills and/or bottom bathymetry of the strait to have a more realistic laboratory model.