Mean sea level derived from altimetry and wind-driven numerical models in the Indian Ocean

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Wind-driven model skill in simulating sea level variations in the Indian Ocean depends on our knowledge of the mean ocean dynamic topography. This is demonstrated by running the nonlinear or linear version of a shallow-water model driven by observed winds over Geosat and TOPEX periods. Large-scale low-frequency sea level variations simulated by the nonlinear model are in good agreement with Geosat and TOPEX/Poseidon whereas this is not the case for the linear simulations. This is because the Indian Ocean dynamic topography is characterized by a steep mean gradient corresponding to the South Equatorial Current. Annual. and interannual Rossby waves propagate across the Indian Ocean twice faster whether this mean is ignored or not.

We then assimilated Geosat variations in the nonlinear shallow-water model with the objective of improving our knowledge of the mean topography. This was done by running the adjoint code of the shallow-water model over one year and choosing the yearly mean topography and the initial conditions as our optimal control . The difference between the mean topography without assimilation and the one with assimilation is the largest. in the southeastern Pacific ocean. Within our apriori error assumptions, model and data are not consistant there. This indicates that the major deficiency of the model is the lack of connection with the Pacific via the Indonesian Throughflow.

Results derived from TOPEX relative to various geoids (OSU, JGM2, JGM3, GRIM4) are then examined. They are compared with more performant simulations derived from an OGCM forced by winds and air-sea fluxes. Results indicate a net progress in the determination of the mean topography from altimetry, but a still 1 arge uncertainty relative to the oceanographic needs.

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