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Discussions

Interactive comment on "A methodology for estimating the response of the coastal ocean to meteorological forcing: A case study in the Bohai Bay" *by* Daosheng Wang et al.

Anonymous Referee #2

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Review: A methodology for estimating the response of the coastal ocean to meteorological forcing: a case study in the Bohai Bay, by D. Wang et al.

This study aims at developing a methodology to estimate the local sea level (SL) response to meteorological forcing, including the static and dynamic ocean response to varying surface atmospheric pressure (AP) and winds. The method, called IBR, is based on the inverted barometer effect and a multilinear regression (MLR) of total sea level to local or regional surface atmospheric pressure and winds at the dominant direction.

Although I appreciate that substantial work has been performed, I recommend the

paper not to be published in Ocean Science. I provide below the main underlying reasons, and will not discuss specific, more minor issues with the paper.

First, the two selected locations for which the IBR method has been developed and tested are quite peculiar, located inside the shallow, semi-enclosed Bohai Sea. Due to its shallow depth and location at mid-latitudes, the ocean dynamics should be prone to small space and time scales ocean dynamicsÂăand thus to larger deviations of the SL to meteorological forcing from the static, inverted barometer (IB) response only (e.g. Carrère and Lyard 2003). In this region, the annual variance of the IB effect is also quite pronounced (e.g. Ponte 2006) compared to other regions worldwide. Thus, the conclusions of the study are not expected to hold for other locations. A short 3-month period is analysed here. Already over this period the IBR fails at reproducing different events. The reader can wonder whether the MLR would work over longer periods, especially when the dominant wind direction changes over time, or when remote forcing, not accounted for here, might be more dominant. The main result could be that regional wind and atmospheric surface pressure forcing are more important than the local forcings in determining the local SL response to meteorological forcing. Yet, no justification is given for the selection of the regional area used to compute regional winds and atmospheric surface pressure, nor a sensitivity to the regional area provided.

The purpose of the method is not completely clear to me. Local sea level variations result from different processes, amongst which are the static dynamical response of the SL to meteorological forcing. Other processes contribute, and it is not clear how using an MLR with the total SL as the response variable and only surface wind and surface atmospheric pressure as explanatory variables would be adequate (e.g. overfitting issues, interpretation of regression coefficients in a context of co-variations between driving processes, including other processes than considered here, etc). On longer periods, notably, other explanatory variables should be used, to account for changes in SL due to e.g. the general ocean circulation. Estimating only the isostatic response of the ocean to atmospheric pressure forcing is useful if one is only interested in a

dynamical interpretation of sea level records.

In addition, the IBR does not really represent a real innovative approach. Thompson (1986) and Woodworth (1987) already used a multiple linear regression on both AP and surface winds. The added value of IBR compared to classical dynamical atmospheric corrections infered from hydrodynamic models such as MOG2D-G, which provides a process-based, physical correction for targeted processes, is not compelling. In hydrodynamic models, not only local or regional effects are accounted for, but also the high-frequency barotropic SL response to remote fast and large scale atmospheric forcing. I appreciate the simulations performed with HYCOM to compare the results of the IBR with a modelled DAC using a hydrodynamic model in a barotropic or baroclinic configuration. However, the model settings, and experiments are not presented in a convincing way. It would have been interesting to compare the MLR results to the DAC used in different altimetric products, such as that provided by MOG2D-G for the altimetric data produced by SSALTO-DUACS.

Ponte RM (2006) Low-Frequency Sea Level Variability and the Inverted Barometer Effect. Journal of Atmospheric and Oceanic Technology, 23, 619-629.

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