Interactive comment on **"Shifting momentum balance and frictional adjustment observed over the inner-shelf during a storm"** ***by*** **M. Grifoll et al.**

Response to Reviewer 1 comments.

We appreciate the support of the paper. We do believe that the momentum balance approach provides a suitable tool to characterize the changing dynamics of the inner-shelf during storm events.

This paper reports an interesting investigation of the momentum balance over a microtidal inner-shelf during a storm from extensive observational data set including currents, waves and wind.

The hypothesis and laws used to close the momentum equation are carefully presented and justified. The chosen site (including alongshore wind direction) is relevant.

The main interest of this investigation concerns the time series for an unsteady event including two wind peaks and a transient relaxation period. As expected, geostrophic equilibrium is not satisfied in transient condition when non linear effects affect bottom stress and inertial terms. Relevant adjustment times are presented on figure 6.

A first comment is concerned with the use of closure laws well established for steady conditions but that can be questionable in transient ones (especially time delay and phase shift). This point could be discussed from times series given Figures 3, 4 and 5

R1.1. We agree with the Reviewer's comments regarding the transient nature of the balance in the inner-shelf and the importance of delays and phase shifts. We have added appropriate caveats in the text regarding this point.

"Linear drag formulations are well established for steady-state conditions but might cause misrepresentations in transient conditions (such as the current storm event). We use the linear formulation as a first estimate of the size of the frictional terms, but also consider the potential effect of non-linear friction (Appendix A)."

"Inaccuracies in the observations can slightly modify the values of the linear estimates, but the current values are provided as approximations to identify the time-varying exchange between dominant terms. The underlying assumptions of linearity and steady state, while limiting for the estimation of the absolute size of the terms, are not of concern when comparing the relative importance of the forces in the momentum balance."

From this point of view, accuracy of measurements and closure laws could be pointed out.

R1.2. We have added some comments in the Discussion regarding the importance of observation accuracy to estimate balance terms.

"The N values are estimated to be 0.03 s^{-1} for the surface layer and 0.005 s^{-1} for the bottom layer. The transient nature of the storm will cause some differences in the level of stratification, especially in the surface layer, but the relative size of the terms will remain mostly unchanged."

Other comments:

Although closure of the momentum equation is used to estimate the PGFR (equation 3) a total budget could be drawn on figure 4 to comment the chosen procedure.

R1.3. We chose not to include the residual because it made the figure messy. The purpose of this figure (now Figure 5 according to the inclusion of new figures due to the reviewers comments) is to compare the momentum balance terms with the previous Figure (i.e. 50 m vs 25 m), so the residue does not provide interesting arguments.

Text is sometimes a bit long and repetitive (p 909, 910).

R1.4. The text has been shorten and clarified. It now reads: “This result is consistent with the reduced contribution of the Coriolis term to the along-shelf momentum balance and highlights the importance of bottom dissipation at depths of the order of 24 m during a storm.” and “The short frictional adjustment time is consistent with the study site being part of the inner-shelf during the storm.”

Minor comments:

verify citations : Shearman <et al> 2005 (p899) is single author in reference list Scott and Csanady <1976> missing year

Corrected

text :

- page 899 line 13 : verify the sentence "prevalent terms ..."

Corrected

- page 903 line3: Fig<3>a and d

Corrected

- page 908 line 13 : Lentz <et al > 1999

Corrected

- page 912 : Please take care of number of figures (no figure 5 in the text ?)

Figure 5 was included in the text as part of Section 4.2

Figures:

Fig 1: add the wave measurement in A3 in the legend

The sentence “A directional wave buoy was placed at A3” was added to the Fig 1 caption:

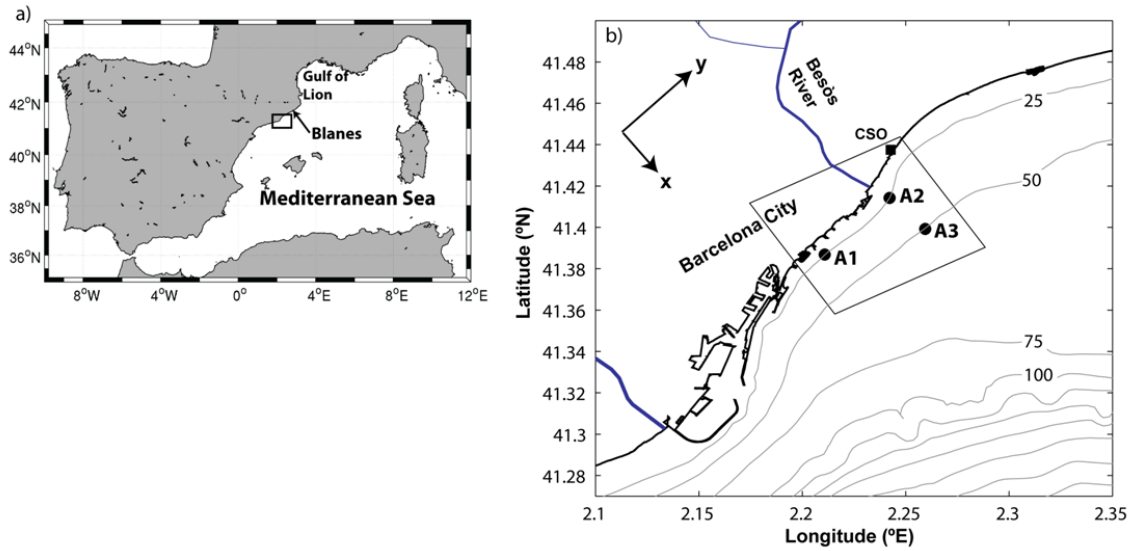

Figure 1. Map of the Western Mediterranean Sea with the study area (panel a). Panel (b) shows the bathymetry of a portion of the Catalan shelf (isobaths every 25 m) with the locations of the ADCP sensors (A1, A2 and A3). A directional wave buoy was placed at A3. The square marker shows the Coastal Station Observatory (CSO) where the wind data were recorded. Panel (b) includes the numerical model domain used to propagate the wave conditions into A2 (black rectangle); the reference system adopted for the momentum balance is also shown.

Fig 3: too small to read scales in printed version

We are hoping this figure will be included as a full-page image in the final version and the image quality seems sufficient to see the scales when printed with that size.

Fig 4: total budget is missing (sum of the 4 terms)

See comment above.