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Ocean Science Discussions

Interactive comment on "Upper layer current variability in the Central Ligurian Sea" *by* P. Picco et al.

Anonymous Referee #1

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The manuscript presents a new data set of various marine and atmospheric in-situ observations (temperature, salinity, velocity, wind) at a measurement station in the Ligurian Sea. The data set includes several interesting phenomena such as the alternative presence of WCC and ECC water at the measurement site and intrusion of Tyrrhenian Sea water. The authors use different data analysis techniques to characterize the processes at their site (EOF, power spectrum, 1D model of the surface Ekman layer). In general, the presentation is clear and convincing. However, given that the observations are only at a single point, I think that the manuscript would benefit greatly if the authors included satellite SST images (or Chl-a) at the dates where some special event occurs and interpret them together with the in-situ data because this might allow to better characterize the mescoscale variability (in terms of spatial structure) which the authors are seeing in their time series. Also the description of the Ekman layer model has

several problems as detailed below. I believe that these two major aspects need to be addressed in a major revision before this paper is suitable for publication.

Specific comments

abstract (and conclusions) mention barotropic currents but only upper 50m were sampled

page 449: 'alternative presence of WCC and ECC waters': This interpretation would greatly benefit for including a satellite SST image showing cases where WCC and ECC water is found at the measurement site

page 450: 'A relative maximum of temperature and salinity in the layer between 100 and 150 m revealed the signature of the warmer and saltier waters (13.5 C and 38.26 psu) coming from the Tyrrhenian Sea.' please add a reference here showing that the water mass with these temperatures and salinities are typical for the Tyrrhenian Sea.

page 451: 'The flow was shifted northeastern by meanderings associated to the mesoscale activity with a periodicity of about ten days': Again, showing a satellite SST image (if the site is not obscured by clouds), would be very helpful here in characterizing the mesoscale variability (cyclone, anticyclone, filament, size of the structure) seen in the velocity.

page 452: Fig. 8 is only very briefly mentioned in the text and its information is closely related to Fig 7. If the authors think that this figure is essential, they need to expand the interpretation of this figure. Otherwise, I would suggested to remove this figure from the manuscript.

figure 11: please add a color-bar to this figure

section 5: The Ekman equation in the manuscript describe the stationary solution (after infinite time), yet the manuscript mentions the time step used to integrate the equations. It is thus unclear if the time derivative was included in the momentum equation. I must assume that the time was included since the 'wind rotary spectrum was computed on

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256-h long samples'. But later the authors mentioned that inertial oscillations did not show up in their model ('Only some energy on the semidiurnal band, ascribed to the breeze regime, was detected, while the inertial frequency, which dominates in the marine currents, never appeared.'). This is very surprising. I'm wondering if the surface boundary conditions are correctly implemented. Normally the surface boundary condition equates vertical gradient of the velocity to the wind stress. Also it is unclear if the authors used only the mean wind to drive their 1D-model. There is no figure showing the model results. The output of the model should be presented in a way that it can be compared to the observations.

minor comments:

page 448: 'the estimated nominal error on the horizontal currents was 0.23 cm s$-$1': what does 'nominal' mean in this context?

page 449: 'Until late autumn, temperature and salinity time series at 35 m depth, showed variations up to 4 C and 3 psu respectively': you mean probably 0.3 psu.

page 452: 'the first mode accounts for 0.67 of the total signal, the second for 0.2 and the third only for 0.08, so that three modes are able to reconstruct 95% of the entire signal.' I suggest you to express all variances in percents.

Interactive comment on Ocean Sci. Discuss., 7, 445, 2010.