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Interactive comment on "A combined quality-control methodology in Ebro Delta (NE Spain) high frequency radar system" *by* P. Lorente et al.

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Many thanks to Dr. Jeffrey Paduan for the number of useful comments that will help to significantly improve the quality of the final version of this manuscript. In relation to the specific suggestions:

The manuscript by Lorente et al. is focused on the performance of a network of high frequency (HF) radar systems deployed along the eastern coast of Spain. Data from three radar sites for a full year in 2014 are analyzed. HF radar observations of ocean surface currents are increasingly important components of ocean observing systems. Descriptions of these observations in new regions over long time frames are of interest

both to the local scientists and marine resource managers and to other users of HF radar systems. As the data set here is extensive and the analyses and interpretations reasonable, I recommend the manuscript for publication.

Comment:

The manuscript could, of course, be improved in a few areas. Although the background sections are thorough and well cited, they also have a good deal of redundant information with the data sections. Whole paragraphs are repeated in the two sections (and in some cases again in the summary and concluding remarks section). The introduction and/or data sections should be shorted.

Answer:

Section 5 (Summary and concluding remarks) has been renamed to "Concluding remarks and future work". Accordingly, the section has been substantially shortened with the aim of avoiding any redundancy with the information already provided in previous sections. Equally, sections 1 and 3 have been thoroughly revised and compacted by deleting any repeated expression.

Comment:

In several places within the text as well as in the title, the authors suggest that the main point of the manuscript is to describe some new type of quality control for HF radar observations. I think that this is misleading as the manuscript really is a balanced look at the performance of the particular HF radar network using previously described methods. The authors highlight the variability over the 12-month record of radar-specific parameters, such as the signal-to-noise ratio (SNR) on the monopole receive antenna elements. The study does not, however, utilize these quality indices on a point-by-point basis. Neither does it show through any type of comparison that use of the SNR-based quality metrics can improve the results. Because of this, I recommend a change in the title and a diminished focus on quality control.

Answer:

With the aim of reducing the focus on quality control and placing more emphasis on the characterization of the surface circulation with HF radar data, the title has been changed to "Evaluating the surface circulation in Ebro Delta (NE Spain) with quality controlled High Frequency radar measurements". For consistency reasons and homogeneity, several sections (abstract, introduction and concluding remarks) have been modified in order to remark this alternative perspective.

Comment:

The discussion of EOF results would be strengthened if a local wind time series were added to the EOF mode time series shown in Figure 11. Is the mode-2 variability really correlated with variability of the Mistral wind?

Answer:

A new figure (Fig. 12) has been added to the manuscript (attached below) with the purpose of investigating the relative contribution of local wind as forcing mechanism. Particular emphasis has been placed to explore the relationship with the principal component of the second EOF mode of HF radar surface currents (depicted in Fig. 10-c). To this aim, an EOF analysis of hourly wind measurements provided by B1 buoy for a 6-month period (May-October 2014) is provided.

Figure 12-a shows wind principal axes as derived from hourly wind data, measured at a nominal height of 3 metres by B1 buoy, which has a wind speed and direction sensor manufactured by R. M. Young Company. Figure 12-b presents the principal components of the first EOF mode from B1 wind (red) and the second EOF mode of CODAR currents (blue), filtered with a 1-day moving mean. The amplitudes are normalized by their respective standard deviations. Equally, Figure 12-c shows the principal components of the second EOF mode from B1 wind (red) and the second EOF mode of CODAR currents (blue). As reflected from the associated correlation

coefficients (0.47 and 0.67, respectively), the degree of agreement of the principal components is significant.

Regarding the following sentence in section 4 of the manuscript: "The second EOF (Fig. 10 - c) shows a homogeneous spatial structure, perpendicular to the first mode, with a well-defined offshore-directed flow presumably driven by persistent and intense (up to 100 km/h) northwesterly winds (called 'mistral winds') channeled by the narrow Ebro Valley (Font, 1990)."

The authors firstly hypothesized the northwesterly Mistral wind to be the main forcing mechanism for the offshore-directed flow since it is very energetic and dominant during the cold season (October-May). According to the results depicted in Fig. 12, Mistral winds play a relevant, but secondary role compared to south-southwesterly winds.

Accordingly, the aforementioned sentence has been modified:

"The second EOF (Fig. 10 - c) shows a homogeneous spatial structure, perpendicular to the first mode, with a well-defined offshore-directed flow"

To provide further details about the influence of local wind forcing, the following piece of text has been added to section 4.3.2:

"In order to define the prevalent wind directions registered at B1, the major and minor variance axes have been determined (Fig. 12 - a). The results show that the main variability occurs along a direction 99° azimuth containing the 54% of the total energy. This is the EOF1 mode, largely aligned with persistent and intense northwesterly mistral winds channeled by the narrow Ebro Valley (Font, 1990). The orthogonal EOF2 is oriented 9° clockwise from north and holds the remaining 46% of the variance, capturing mainly the influence of alongshore winds.

Linear correlation coefficients have been computed between the principal components related to the two main wind EOF modes of variability and radar-derived EOF2, since the cross-shelf circulation shown in Fig. 10-c might be presumably driven by strong local winds. The high correlation between the filtered principal components can be readily seen in Fig. 12 (b-c), with a value of 0.47 (0.67) for wind-PC1 (PC2) and radar-PC2, respectively. The results underline that the surface current variability in Ebro Delta can be influenced by wind action, in accordance with Espino et al. (1998), who demonstrated such relationship when winds are strong and steady enough. The higher agreement between both wind-radar PC2 appears to be consistent with Ekman transport to the right of the wind direction. By contrast, northwesterly mistral wind events (PC1) are expected to enforce the prevalent offshore-directed circulation regime (radar EOF2) by increasing the mean speed of the flow.

Equally, the influence of local wind forcing on HF radar EOF1 mode has been assessed (but not shown), with a correlation coefficient of 0.52 (-0.28) for wind PC1 (PC2). This finding highlights the impact of mistral winds on the predominant southwestward flow, by inducing an Ekman veering."

Minor Comments:

Page 3, Line 3: "jet which" should be "jet, which"

Page 3, Line 10: "dynamic" should be "dynamics"

Page 3, Line 19: "a 13.5 MHz" should be "a network of 13.5 MHz" and Line 20: "radar able" should be "radar systems able"

Page 4, Line 11: "failure problems" should be "failures"

Page 8, Line 11: "measurements accuracy" should be "measurement accuracy"

Answer:

All the suggested minor modifications have been properly addressed in the new version of the manuscript.

Interactive comment on Ocean Sci. Discuss., 12, 1913, 2015.

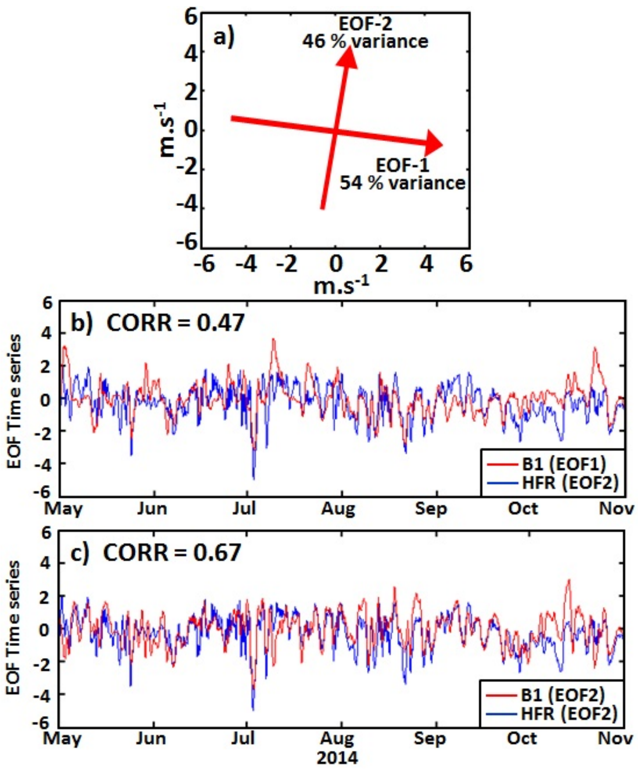

Fig. 1. (a) Main axes of variability for hourly wind data registered at B1 buoy. Principal components of the first (b) and second (c) EOF of wind (red) at B1 and the second EOF of radar currents (blue)