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Interactive comment on “Observing and modeling currents on the continental slope: assimilation of high frequency radar currents and hydrography profiles” by A. K. Sperrevik et al.

Anonymous Referee #2

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The manuscript by Sperrevik et al. deals with assimilation of HF radar surface currents within a ROMS circulation model of the coastal ocean offshore Norway, a topic of general interest to a wide community that includes oceanographers, model developers, and coastal managers. The manuscript is worth publishing, however some aspects need further analyses and investigation, and consequently discussion, before it can be accepted for publication.

One question that should be addressed for instance is the assimilation of radials (that is, the "raw" data from each radar station) instead of the "totals", that is the current velocity field. The radial-to-vector mapping procedure, presumably the standard un-weighted least-squares mapping, is prone to errors associated with unbalanced radial

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distributions, which is known to bias the current vector magnitude and direction. Using radials would also increase the spatial coverage -as GDOP (that is, the geometry of the intersecting radar beams) reduces the actual radar coverage to a smaller area. Also, it would reduce costs and timing if a rapid-deployable HF radar system is to be used.

Section 1 provides some brief description of the circulation in the area, but it mentions only a strong northward slope current and high eddy kinetic energy with significant tidal signal without providing any references nor showing results from the actual radar deployment. this is probably not the aim of the present publication but it might have provided some more information to readers not familiar with the area

Section 2 introduces data and radar errors, mstly associated with GDOP. Chapman et al (1997) is provided as a reference for this error however this formulation is valid for the zonal - meridional components of velocity for two backscatter radars only and is probably not fit to the case presented here of three SeaSonde stations. Also, some details and clarifications should be provided as for the so called "observation errors" in the data files. is the author referring to radial errors? or current errors? and how are they derived? more details are required as there is some concern and debate within the "radar community" as for how errors are computed in the data, and if those "errors" should be considered errors

Further concern are related to the choice of the drifters. at the operating frequency of 13.525MHz, the depth of the measured currents is $\sim 1\text{m}$ assuming that the $\lambda/4\pi$ approximation made in Stewart and Joy (1974) holds; so, the choice of the "iSLDMB" drifters with a drogue centered at 65 cm below the surface is consistent with the radar vertical scale. concerns arise for the choice of the "iSphere" type drifters ("spherical surface floats that are half sub- merged), for which the authors themselves state: "Previous studies have shown that the behavior of these types of surface drifters can be markedly different, mainly depending on the wind and wave conditions (Röhrs et al., 2012)". Limiting the comparison to the iSDMB would probably make more sense.

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The use of virtual drifters is probably a weak point of this work, as other comparison metrics should be used to determine assimilation performance. the presumably large data set from the radar deployment should easily allow for a determination of the variance levels, the average currents and the typical current patterns in the area, which should be compared to model results before/after data assimilation (see for instance: Oke, P. R., J. S. Allen, R. N. Miller, G. D. Egbert, and P. M. Kosro, Assimilation of surface velocity data into a primitive equation coastal ocean model, J. Geophys. Res., 107(C9), 3122, doi:10.1029/2000JC000511, 2002.; Oke, P. R., J. S. Allen, R. N. Miller, G. D. Egbert, J. A. Austin, J. A. Barth, T. J. Boyd, P. M. Kosro, and M. D. Levine, A modeling study of the three-dimensional continental shelf circulation off Oregon, 1, Model-data comparisons, J. Phys. Oceanogr., 32, 1360–1382, 2002a.)

this approach would also help identifying errors and systematic biases in the model itself, related for instance to model set-up, bathymetry (and bathymetric gradients), or model forcing.

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