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Discussions

Interactive comment on "Measurement of turbulence in the oceanic mixed layer using Synthetic Aperture Radar (SAR)" *by* S. G. George and A. R. L. Tatnall

Anonymous Referee #2

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My general impression of this paper is that it claims to address issues that it, in fact, does not. The paper's title leads one to believe that it is somehow about turbulence in the oceanic mixed layer and SAR imagery of the ocean. In fact it is about a direct numerical simulation of turbulence behind a sphere towed through wind-ruffled water and an investigation of normalized radar cross sections in the presence of a highly-idealized version of this turbulence. Even with this much more limited scope of the paper, many of the results of the paper are, in my opinion, highly suspect. Here are some of the problems I have with the paper.

1. The most obvious effect of turbulence in the wake of a ship on wind-generated

waves is its suppression of them. Yet the authors admit that they omit effects of wave dissipation due to turbulence (p. 2859). The plots in Figure 9 support this. For instance, at L-band the maximum cross section is about -9.4 dB while the minimum is about -13.5 dB. On a linear scale these are about the same distance above and below the mean value of -11 dB. These facts, though, don't keep the authors from asserting on p. 2865 that their simulated radar images "are consistent with existing SAR observations of turbulent surface wakes that display a reduction of NRCS inside the turbulent wake region. . . ".

2. It requires quite a suspension of disbelief to accept the authors' argument on p. 2858 and 2859 that turbulence can be treated as a weak interaction between wind waves and "frozen" surface velocities. The velocity scales in turbulence are very different from those in problems normally treated with this WKB approach such as surface signatures of sand waves on the bottom or internal waves.

3. If this paper were really about SAR, then some parameters of the moving platform on which the radar is mounted would be provided: range to the surface (R), platform velocity (V), etc. These are relevant because the authors state on p. 2866 that the grid resolution of their NRCS images is 15 cm. But a real SAR will misregister the location of a scatterer moving with a radial velocity v_r by an amount equal to v_rR/V. For aircraft platforms, R/V is generally about 10 while for spaceborne platforms it is generally about 100. The simulated turbulence images show maximum spanwise horizontal velocities of about 0.08 m/s. At an incidence angle of 23 degrees, this gives v_r ~0.03 m/s so the azimuthal displacement will be about 30 cm for airborne measurement and about 3 m for spaceborne. This is larger than the stated resolution so what do the calculated NRCS values have to do with SAR?

So, coming back to my original comment that the paper claims to address issues that it does not, I would recommend that the paper be rewritten to make its limitations clear. The authors should clearly state that this is only a paper about NRCS values that might be observed in the wake of a sphere moving through water under the assumptions of

no dissipation of wind waves by turbulence and frozen turbulence.

Interactive comment on Ocean Sci. Discuss., 9, 2851, 2012.