Review of "A simple method for retrieving significant wave height from Dopplerized X-band radar" by Carrasco et al., OS-2016-29.

This paper attempts to present a simple method for estimating significant wave height (H_s) from line-of-sight velocity (V_{los}) measurements using a pencil-beam, short-pulse, coherent-on-receive X-band radar oriented looking into the waves. To carry out this procedure correctly involves multiple difficulties, not the least of which is that swell and wind-waves do not usually propagate in the same direction. Nevertheless, the question being addressed here is whether one can obtain a reasonable estimate of H_s from V_{los}. Unfortunately, the paper makes a very incomplete case that this can be done.

The true relationship between the wave-height-variance spectrum, F_a, and the variance spectrum of V_{los}, F_V, is

$$\int F_V(\omega,\varphi)d\omega d\varphi = \int \omega^2 F_a(\omega,\varphi-\varphi_a)d\omega d\varphi$$

where ω is angular frequency, φ wave propagation direction relative to the wind and φ_a is the antenna look direction relative to the wind. If one assumes that F_a and F_V are very sharply peaked at a given frequency and azimuth angle, then this may be written

$$F_V = {\omega_p}^2 F_a,$$

assuming that the antenna looks into the wave propagation direction. Therefore, in the authors' notation,

$$H_s = 4\sigma_D/\omega_p.$$

There is no doubt that ω_p belongs in the equation.

The problem, I think, is that in the real world it is not easy to determine ω_p because sometimes the frequency chosen as the peak of the spectrum is that of the wind waves and sometimes that of the swell. In reality, as we see above, H_s is determined by the whole spectrum. Therefore, any simple method of determining it is bound to be approximate.

The authors' method may work better than one containing ω_p because of the difficulty of determining its value. However, their method is bound to be location-specific and the relationship will not always be $\omega_p = 1$ as the authors propose. Just think of carrying out their procedure in a wind wave tank at short fetch. (Yes, this can be done with a CW system and the antenna at a higher grazing angle.) The constant of proportionality will not be one.

The authors need to acknowledge this and show a histogram of ω_p for their entire time series. Care will have to be taken to be sure that ω_p corresponds to the type of waves carrying the most energy. The authors also need to inform the reader how the antenna was aligned to look into the waves and what was done when swell and wind waves were not aligned. Perhaps this was easy to do at the authors' site but it will not be so at all sites. Also, it would be nice to know which radar method was used to determine H_s in Figure 8