Supplemental material

An example of fitting $E(k_r, \theta)$ at a given k_r with the Gaussian distribution is shown in Figure 2(a), where θ is measured counterclockwise from the positive range-axis in the range-azimuth domain. The directional ambiguity inherent in the SAR retrievals is removed with the aid of the in-situ observed wave direction (Thomson et al., 2018).
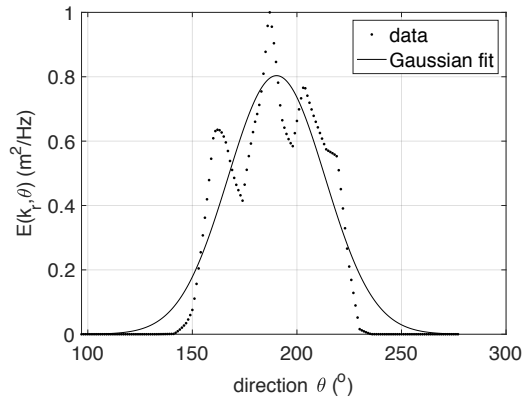

Figure S1. Demonstration of fitting the main wave direction θ_{k_r} for $k_r = 0.025$m^{-1} by a Gaussian distribution.
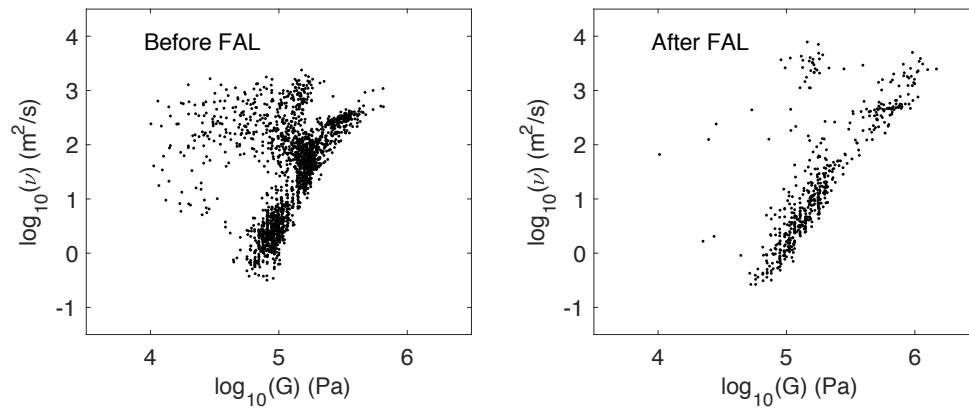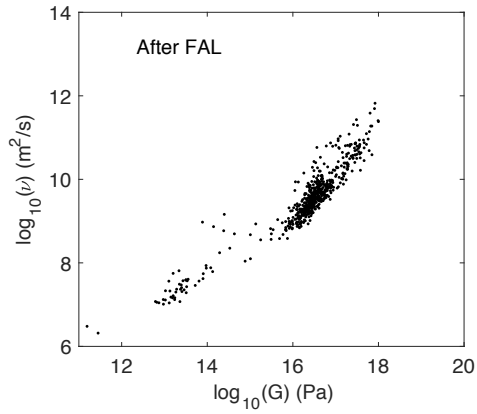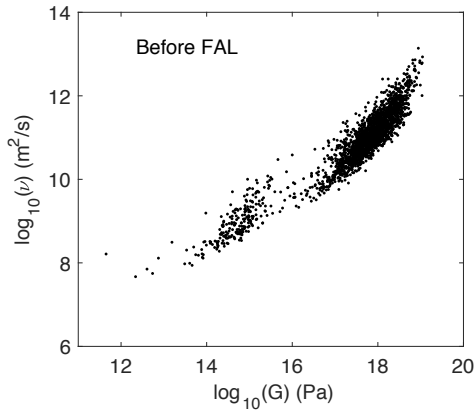

Figure S2. Scatter plots of calibrated G, ν of the WS model after filtered outliers discussed in section 4.3.

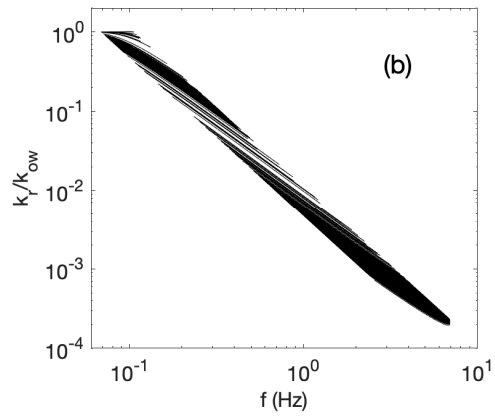**Figure S3. Scatter plots of calibrated G, ν of the FS model.**
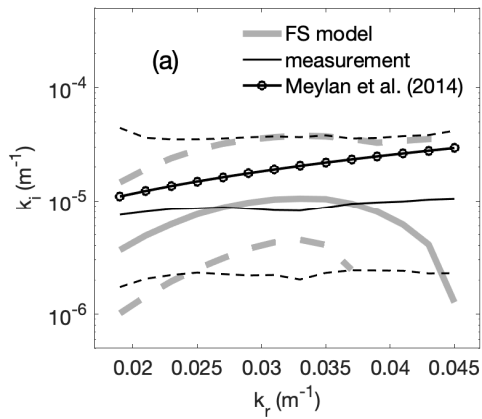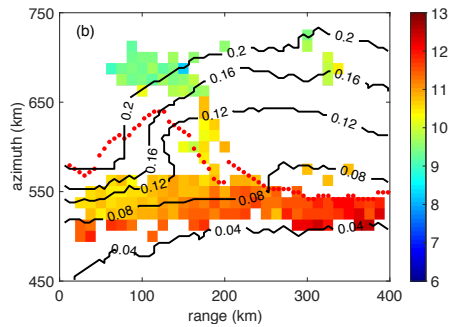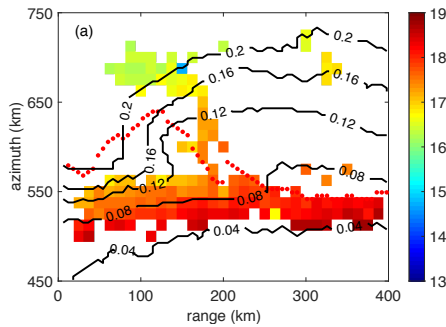

Figure S4. Similar as Figure 6 for the FS model.

Figure S5. Similar as Figure 7 for the FS model.