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Non-breaking swell dissipation from synthethic aperture radar

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Swells have the unique ability to propagate away from their generation region with very little attenuation. Only one study exists in the ocean wave literature that measures the decay rate by following a swell with in-situ measurements along its great circle route. More recently used space-borne synthetic aperture radar (SAR) to measure the attenuation. They estimated the dissipation rate from SAR with a limited number of cases: 11 storms with 22 total events. The present work extrapolates their technique to more events since ENVISAT has collected SAR data from 2002-2012. The dissipation rate is then determined in a two step process. First swell sources are identified from density maps of back-propagated waves at their group velocity along great circles. Next a "point-source" model is assumed and the waves from all directions and frequencies are propagated forward to find matching SAR observations. Relatively small directional bins are used to group observations creating transects from a given swell event. This ensemble of tracks is the basic dataset used to calculate a more statistically robust measure of the dissipation rate. Individual tracks and the swell behavior are explored through this dataset. Our results are in agreement with previous findings and it is verified that swells are very persistent with e-folding scales larger than 20,000 km and they behave nonlinearly as a function of wave frequency. The results are discussed in terms of their implications in spectral wave models as well as identify limitations of the remotely sensed wave spectra. The wind's role on the dissipation rate cannot be determined from this analysis stressing the need for concurrent wind and wave observations.