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Sea Surface Wave Observation by using CW Doppler Radar and Effect of Radar irradiation Width

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Summary: Sea surface waves had been observed remotely by using a continuous wave (CW) X-band microwave Doppler radar at off Hiratsuka of Sagami-bay. A new algorithm was applied to retrieve a sea surface elevation from the radar output Doppler signals. The sea surface waves observed by the microwave Doppler radar have been compared with the sea surface waves measured by the supersonic wave height meter. There were good correlations in both wave height and wave period between the waves observed by the microwave Doppler radar and measured by the supersonic wave height meter. The correlation of wave height was better than that of wave period. The microwave irradiation width on sea surface does a role of space filter. It seems that the filtering effect is a kind of low pass filter involving aliasing, the energy of short wavelength waves move to low wave number region. The algorithm to retrieve a sea surface elevation is described by the relation of the water surface profile and the orbital velocity of water particle on water surface that generated by water surface waves. A linear superposition method has been used to retrieve sea surface elevation. No empirical parameters are used in the algorithm. The water surface profile can be obtained from the water particle velocity on water surface by using the mathematical relation of the water surface profile and the orbital motion of water particle. Water particle motion on sea surface is affected by sea surface wind, currents, and sea surface waves. Water particle motion generated by sea surface waves can be separated by the difference of the fluctuation scale of each physical process

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