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Coastal and rain-induced wind variability depicted by scatterometers

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A detailed knowledge of local wind variability near the shore is very important since it strongly affects the weather and microclimate in coastal regions. Since coastal areas are densely populated and most activity at sea occurs near the shore, sea-surface wind field information is important for a number of applications. In the vicinity of land sea-breeze, wave fetch, katabatic and current effects are more likely than in the open ocean, thus enhancing air-sea interaction. Also very relevant for air-sea interaction are the rain-induced phenomena, such as downbursts and convergence. Relatively cold and dry air is effectively transported to the ocean surface and surface winds are enhanced.

In general, both coastal and rain-induced wind variability are poorly resolved by Numerical Weather Prediction (NWP) models. Satellite real aperture radars (i.e. scatterometers) are known to provide accurate mesoscale (25-50 km resolution) sea surface wind field information used in a wide variety of applications. Nowadays, there are two operating scatterometers in orbit, i.e. the C-band Advanced Scatterometer (ASCAT) onboard Metop-A and the Ku-band scatterometer (OSCAT) onboard Oceansat-2. The EUMETSAT Ocean and Sea Ice Satellite Application Facility (OSI SAF) delivers several ASCAT level 2 wind products with 25 km and 12.5 km Wind Vector Cell (WVC) spacing, including a pre-operational coastal wind product as well as an OSCAT level 2 wind product with 50 km spacing in development status.

Rain is known to both attenuate and scatter the microwave signal. In addition, there is a “splashing” effect. The roughness of the sea surface is increased because of splashing due to rain drops. The so-called “rain contamination” is larger for Ku-band scatterometer systems than for C-band systems. Moreover, the associated downdrafts lead to variable wind speeds and directions, further complicating the wind retrieval. The C-band ASCAT high resolution wind processing is validated under rainy conditions, using collocations with the Tropical Rainfall Measuring Mission’s (TRMM) Microwave Imager (TMI) rain data, and the tropical moored buoy wind and precipitation data. It turns out that the effect of low and moderate rain appears mainly in increasing the wind variability near the surface and, unlike for Ku-band scatterometers, the rain rate itself does not appear clearly as a limiting factor in ASCAT wind quality. Moreover, the downburst patterns as observed by ASCAT are unique and have large implications for air-sea exchange. At the conference, the main progress in scatterometer wind data processing will be shown.