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Different characteristics between wind and stress over ocean fronts revealed by scatterometer.

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Ocean-atmosphere exchange of momentum (or surface wind stress) has been directly measured only in limited regions over limited time periods. Until the launch of the scatterometer, our knowledge of stress distribution is largely derived from winds measured at ships and buoys, or from operational output of numerical weather prediction centers, through a drag coefficient. Our present parameterization of stress in terms of wind is not sufficient over the regions of ocean with strong horizontal current shear and temperature gradients. The backscatter power measured by a scatterometer is directly related to stress rather than wind. The geophysical product is called equivalent neutral wind (ENW), which, by definition, has a unique relation to stress.

The collocation of high and low magnitudes of ENW measured by QuikSCAT with sea surface temperature illustrates not only the stability dependence of turbulent mixing but also the unique stress measuring capability of the scatterometer. The observed rotation of ENW in opposition to the rotation of the surface current clearly demonstrates that the scatterometer measures stress rather than winds. The opposite sign of the stress vorticity to current vorticity implies that the atmosphere spins down the current rotation through momentum transport. Co-incident high SST and ENW enhance evaporation and latent heat flux over ocean fronts, which cools the ocean. The atmosphere is found to provide negative feedback to ocean current and temperature gradients. Distribution of ENW convergence implies ascending motion on the downwind side of local SST maxima and descending air on the upwind side, and acceleration of surface wind-stress over warm water (deceleration over cool water); the convection may escalate the contrast of ENW over warm and cool water set up by the dependence of turbulence mixing on stability; it is a positive feedback to ENW-SST relation.