The energy cascade in the atmospheric mesoscales at the bottom of the marine boundary layer: Is it upscale? Downscale? Or is nature not so simple?

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A long-standing question in atmospheric dynamics has been:
Is horizontal kinetic energy transferred to small scales through a downscale cascade as in ideal three-dimensional (3D) turbulence? Or is it transferred to large scales via a two-dimensional (2D) inverse cascade? The classic papers by Nastrom et al (1984, 1985) and more recent papers by Lindborg (1999) and Cho and Lindborg (2001) have addressed this question through an analysis of global datasets of winds near the tropopause measured by instruments carried on commercial aircraft. Here we use winds at the bottom of the marine boundary layer inferred from radar backscatter from the ocean surface measured by the Advanced Scatterometer (ASCAT) on the MetOp-A satellite and the SeaWinds scatterometer on the QuikSCAT satellite. Our results indicate that nature is not so simple.

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