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Large-eddy simulations of the Ekman boundary layer over walls with variable temperatures: the complex implications of spatially-varying static stability[1] ELIE BOU-ZEID, STIMIT SHAH, Princeton University, Department of Civil and Environmental Engineering — Understanding and parameterizing turbulent fluxes in statically-stable Ekman boundary layers (SABLs), where buoyant forces destroy turbulent kinetic energy, remains a challenging yet very important problem in geophysical fluid dynamics. The flow is further complicated when surface temperatures exhibit spatial variability leading to variation in buoyancy forces and to significant advection effects. A pertinent example is flow over polar leads and polynyas. To investigate the complex interactions of static stability and surface variability, large eddy simulations are performed over rough surface patches of different temperatures. Stable to more-stable, as well unstable-to-stable and stable-to-unstable transitions are simulated. Variability of surface temperature is shown to result in unexpected flow patterns: TKE is potentially higher under the more stable patches due to advection, and the subsidence and lofting of air over the different patches can counteract the effect of spatial TKE variability on the vertical fluxes. The TKE and flux budget development downstream of the surface temperature transition are investigates with the aim of developing models for upscaling the effect of surface heterogeneity under such conditions.

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