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Non-Boussinesq and finite depth effects in surface quasi-geostrophic dynamics RICHARD SCOTT, Northwest Research Associates — Surface quasi-geostrophic (SQG) dynamics describes the slow vortical motion of rotating, stratified fluid under the assumption that interior gradients of potential vorticity (the active scalar) vanish; it has applications in atmospheric and oceanic dynamics and provides a simple setting for the study of finite-time singularity formation. This talk will discuss two variants of standard SQG dynamics. First, we consider non-Boussinesq effects, relevant to the large-scale atmospheric situation, retaining the compressibility of the background density profile; this renders the large-scale dynamics spectrally nonlocal, with a character resembling two-dimensional barotropic vortex dynamics, while having little effect at small scales. Second, motivated by the observed jump in static stability at the tropopause, we consider the effect of blurring the distribution of surface scalar over a finite depth; this introduces a length scale below which the dynamics again becomes spectrally nonlocal and similar in character to two-dimensional barotropic vortex dynamics. In each case we consider shear instability and equilibrium energy spectra as particular examples.

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