The role of back pressure in air-sea interaction at weak SST fronts

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To explore the role of back pressure in the adjustment of the atmospheric boundary layer to SST fronts, we consider an atmospheric boundary layer capped by a sharp inversion, and forced by a prescribed, uniform tropospheric geostrophic wind and a straight sea-surface temperature (SST) front. For a weak SST front the resulting equations for the inversion height, boundary layer transport and shear are linear. The character of the solution is primarily governed by the Froude number. For Froude number greater than order one, the boundary layer response consists of standing Poincare waves, while for the Froude number less than one, the response is dominated by geostrophic spindown. In this case, the adjustment of the back pressure is a key ingredient of frontal air-sea interaction. This result is consistent with an analysis of the wind stress in the frontal regions of the western boundary current regions using a high-resolution ECMWF reanalysis product.