Wintertime Evolution of Baroclinicity and Moisture in the Western Boundary Currents

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We examine the differences in atmospheric conditions over the western boundary currents (WBC) in late autumn versus early spring. Starting with the tropospheric baroclinicity, we calculate the changes in the climatological conditions between the two seasons. The patterns that emerge help to clarify the influence of the WBC on the mean state of the atmospheric storm tracks. To establish the importance of the ocean currents, we relate the changes in baroclinicity to the wintertime evolution of (1) surface turbulent heat fluxes, (2) ocean mixed layer depths near the WBC, (3) shifts in the subtropical jet and (4) the land-sea temperature contrast. Next, we apply our autumn-versus-spring analysis to atmospheric moisture fields. Using the water vapor fields from the NASA Water Vapor Project-MEaSUREs (NVAP-M) reanalysis, we contrast the changes in atmospheric moisture content with the changes in the cloud fields in the International Satellite Cloud Climatology Project (ISCCP). For the poleward edges of the WBC regions, as compared to other regions at similar latitudes, we find unique behavior in these atmospheric moisture fields. We explain these changes based on the wintertime evolution of the surface turbulent fluxes and the storm tracks. We show that these results are helpful for both (a) understanding the air-sea interactions over the WBC, and (b) comparing the three main WBC regions.