On the Relationship of Low Clouds Variability with Lower Tropospheric Dry Static Energy Transport in Subtropical Marine Stratus and Stratocumulus Regions

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Abstract

Persistent marine stratus and stratocumulus (MSC) play important roles in earth surface radiation budget, marine boundary layer dynamics, and air-sea coupling. They are central to many questions related to climate change, and are very difficult to represent with fidelity in current climate models and weather forecast systems. The relationship of low cloud variability with lower tropospheric dry static energy transport is investigated by data analysis using ERA-40 reanalysis, EECRA ship observation, and ISCCP FD satellite observations and a simple empirical diagnostic method development over four MSC regions. It was found that in regions (such as Peruvian and Canarian) with small seasonal variations of unit area cloud radiative forcing, both seasonal, inter-annual, and geographical variation of marine low cloud variations are strongly correlated with dry static energy transport within lower troposphere. In other regions (such as California and Canarian), marine low cloud variations are closely associated with both dry static energy transport and unit area cloud radiative cooling variations on seasonal and inter-annual timescales.