

## ***Interactive comment on “Exploring the differences in cloud properties observed by the Terra and Aqua MODIS sensors” by N. Meskhidze et al.***

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Comment on "Exploring the differences in cloud properties observed by the Terra and Aqua MODIS sensors" by Meskhidze et al.

Comment by Robert Wood, University of Washington

My comment concerns the interpretation of the key result of this paper, namely how the magnitude of the morning-afternoon differences (Terra-Aqua) in cloud cover and cloud optical thickness increases with aerosol optical thickness for the Peruvian stratocumulus region. I do not dispute the result itself, but the interpretation that these findings could represent aerosol indirect effects fails to acknowledge the hypothesis that correlations between meteorology and the spatial distribution of aerosols can explain the

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results without invoking aerosol indirect or semi-direct effects.

Dry heating on the Andes cordillera generates a powerful diurnal gravity wave that results in a strong diurnal cycle of subsidence right along the coast of Chile and Peru (Garreaud and Muñoz 2004) which results in extremely powerful and persistent afternoon clearing in the coastal strip out to several hundred kilometers offshore. Examination of the MODIS aerosol product shows that this is also the region with the highest aerosol optical depth, which is not surprising given that industry in the coastal strip is a strong source of aerosol particles and aerosol precursor gases such as sulfur dioxide. Strong subsidence in the afternoon from the gravity wave response leads to particularly thin daytime clouds, and so strongly diurnally varying clouds and high aerosol optical depth are connected primarily via dynamical processes that control both the aerosol transport and the dynamical cloud forcing. The results in Figure 3 would be a direct consequence of such a covariation. Thus, there is no need to invoke aerosol indirect or semi-direct effects to explain the results. Of course, one cannot rule out a contribution from these processes, but the method used in this paper is not appropriate for isolating these effects. Similar correlations are likely to exist in most of the subtropical stratocumulus regions where pollutants decrease with distance downstream from the coastal regions.

Further, recent results from the VOCALS Regional Experiment have not found heavy loadings of black carbon in most samples taken, be they in aircraft or on the ground. It would be difficult to believe that the semi-direct effect is a strong player in this region.

Garreaud, R.D., and R. Muñoz, 2004: The Diurnal Cycle in Circulation and Cloudiness over the Subtropical Southeast Pacific: A Modeling Study. *J. Climate*, 17, 1699-1710.

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