# Biomass burning aerosol effects on cloud fraction over Australia

**Jennifer D. Small*,** Jonathan H. Jiang*, Hui Su*, and Chengxing Zhai*

*California Institute of Technology, Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, CA 91109

Understanding the complex interactions between aerosol, clouds and dynamics is an important and necessary step towards understanding the climate system and the development of accurate global and regional climate models. Here, we study the relationships between aerosols, clouds, and large scale dynamics over a north coastal Australia (NCA) region and a southeast Australia (SEA) region during the period 2002-2009. We use aerosol optical depth ($\tau_a$), fire counts, and cloud fraction ($f_c$) from Aqua-MODIS, and NCEP NCAR Reanalysis vertical velocities at 500 mb ($\omega_{500}$) as a proxy for dynamic regime.

We find that during biomass burning seasons, $f_c$ in both the NCA and SEA regions initially increases with increasing $\tau_a$, followed by a systematic decrease with higher $\tau_a$. The variation of $f_c$ with $\tau_a$ approximately resembles the aerosol microphysics-radiation-feedback (MRF) theory proposed by Koren et al., (2008). We find that $f_c$ in the NCA region is more susceptible to aerosol radiative effects, resulting in significant decreases (~30-35%) in $f_c$ at high $\tau_a$. In the SEA, the microphysical affect of aerosol on $f_c$ is more pronounced than the radiative effect, resulting in rapid increase in $f_c$ for small $\tau_a$. By conditionally sorting data by $\omega_{500}$ we are able to identify the role of dynamics in controlling the $\tau_a$ - $f_c$ relationship and the rate at which $f_c$ changes with $\tau_a$. We find that the MRF theory better represents the regions with - $\omega_{500}$ than regions with + $\omega_{500}$. This indicates that additional processes need to be taken into account in order to fully explain the observed relationships.