Creating Aerosol Types from CHemistry (CATCH) to better connect remote sensing and models

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Climate models are the primary method for assessing aerosol radiative forcing and the impact humans have on our changing environment. Models are often constrained by aerosol optical depth (AOD), a parameter easily determined by remote sensing. The AOD, however, provides no specific information on aerosol chemical composition, particle size distribution, and hygroscopicity throughout the atmospheric column, making aerosol representation challenging for models.

We have designed a new algorithm for Creating Aerosol Types from CHemistry (CATCH). The derived aerosol types - dusty mix, maritime, urban, smoke and fresh smoke - are based on High Spectral Resolution Lidar v1 (HSRL-1) retrievals during the Ship-Aircraft Bio-Optical Research (SABOR) field campaign in July/August 2014 and GEOS-Chem v9-02 model outputs of aerosol chemical composition. Results indicate CATCH-derived aerosol types compare well with HSRL-1 retrievals with an average difference in AOD of 0.08 ± 0.07. The differences in model-derived and HSRL-1 measured vertical extinction profiles during the SABOR campaign are largely attributed to free tropospheric transport of smoke aerosol. Figure 1 shows CATCH identified aerosol types over the entire GEOS-Chem model domain.

In future, the spaceborne HSRL-1 and CATCH can be used to gain insight into the chemical composition of aerosol types over different regions.

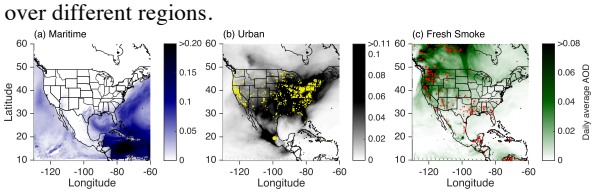

Figure 1: GEOS-Chem daily average aerosol optical depth apportioned by CATCH-derived aerosol types. Yellow circles on (b) indicate cities with a population > 100,000; red points on (c) indicate MODIS active fires with a fire radiative power > 28.3 MW