An aerosol boomerang: satellite observations and modeling of around-the-world transport of aerosols from the December 2006 Australian forest fires

Ruud Dirksen (1), Folkert Boersma (1), Jos de Laat (1), Piet Stammes (1), Guido van der Werf (2), Maria Val Martin (3), and Hennie Kelder (4)

(1) KNMI, Climate research and Seismology, Atmospheric composition research division, De Bilt, Netherlands (dirksen@knmi.nl), (2) Faculty of Earth and Life Sciences, Free University, Amsterdam, Netherlands, (3) School of Engineering and Applied Sciences, Harvard University, Cambridge, Massachusetts, USA, (4) Department of Applied Physics, Eindhoven University of Technology, Eindhoven, Netherlands

In December 2006, severe forest fires raged in southeastern Australia.

On 14 December 2006 a passing cold front in combination with the intense heat from the fires caused pyro-convective lofting and injected an intense pollution plume into the jet stream. We use Absorbing Aerosol Index (AAI) observations from the Ozone Monitoring Instrument (OMI) to track the transport of this plume, which circumnavigated the globe in 12 days. The OMI O2-O2 cloud retrieval algorithm was used to establish that in the first days after its release the plume resided near the tropopause at 200-300 hPa. The CALIOP spaceborne lidar confirmed the altitude of the plume at a later stage to be 10-15 km. Simulations with the TM4 Chemistry Transport Model (CTM) matched the AAI observations and the vertical distribution from CALIOP, provided that the emissions were injected at 250 hPa. This high injection altitude mimics the pyro-convective lofting which is typically not accounted for in CTMs.

We will show that the fate of the plume was to be scavenged: when wet deposition is incorporated in our simulations, the model reproduces the observed dilution of the aerosol plume. This exceptional event is the first ever recording of around the world long range transport of forest fire emissions in the extra-tropical Southern Hemisphere.