Atmospheric Chemistry and Physics
An Interactive Open Access Journal of the European Geosciences Union

Atmos. Chem. Phys., 4, 1311-1321, 2004
www.atmos-chem-phys.net/4/1311/2004/

Around the world in 17 days - hemispheric-scale transport of forest fire smoke from Russia in May 2003

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Abstract. In May 2003, severe forest fires in southeast Russia resulted in smoke plumes extending widely across the Northern Hemisphere. This study combines satellite data from a variety of platforms (Moderate Resolution Imaging Spectroradiometer (MODIS), Sea-viewing Wide Field-of-view Sensor (SeaWiFS), Earth Probe Total Ozone Mapping Spectrometer (TOMS) and Global Ozone Monitoring Experiment (GOME)) and vertical aerosol profiles derived with Raman lidar measurements with results from a Lagrangian particle dispersion model to understand the transport processes that led to the large haze plumes observed over North America and Europe. The satellite images provided a unique opportunity for validating model simulations of tropospheric transport on a truly hemispheric scale. Transport of the smoke occurred in two directions: Smoke travelling northwestwards towards Scandinavia was lifted over the Urals and arrived over the Norwegian Sea. Smoke travelling eastwards to the Okhotsk Sea was also lifted, it then crossed the Bering Sea to Alaska from where it proceeded to Canada and was later even observed over Scandinavia and Eastern Europe on its way back to Russia. Not many events of this kind, if any, have been observed, documented and simulated with a transport model comprehensively. The total transport time was about 17 days. We compared transport model simulations using meteorological analysis data from both the European Centre for Medium-Range Weather Forecast (ECMWF) and the National Center for Environmental Prediction (NCEP) in order to find out how well this event could be simulated using these two datasets. Although differences between the two simulations are found on small scales, both agree remarkably well with each other and with the observations on large scales. On the basis of the available observations, it cannot be decided which simulation was more realistic.

Final Revised Paper (PDF, 6268 KB) Discussion Paper (ACPD)

Citation: Damoah, R., Spichtinger, N., Forster, C., James, P., Mattis, I., Wandinger, U., Beirle, S., Wagner, T., and Stohl, A.: Around the world in 17 days - hemispheric-scale transport of forest fire smoke from Russia in May 2003, Atmos. Chem. Phys., 4, 1311-1321,

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