The 2013 Smoke Season: Elevated Ozone in Boreal Fire Plumes Observed over Central Europe

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In July 2013 very strong boreal fire plumes were observed at the northern rim of the Alps by lidar and ceilometer measurements of aerosol, ozone and water vapour for about three weeks. In addition, some of the lower-tropospheric components of these layers were analyzed at the Global Atmosphere Watch laboratory at the Schneefernerhaus high-altitude research station (2650 m a.s.l., located a few hundred metres south-west of the Zugspitze summit). In particular, these observations showed significantly enhanced black carbon. The high amount of particles confirms our previous findings that fires in the arctic regions of North America have a much stronger impact on the central European atmosphere than the multitude of fires in the United States. This has been ascribed to the prevailing anticyclonic advection pattern during the favourable periods and subsidence, in contrast to warm-conveyor-belt export, rain out and dilution for lower latitudes. A high number of the pronounced aerosol structures were correlated with elevated ozone. Chemical ozone formation in boreal fire plumes is rather limited. However, these air masses could be attributed to stratospheric air intrusions over remote high latitude regions obviously picking up the aerosol on their way across Canada. These coherent air streams lead to rather straight and rapid transport to Europe.