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The siberian pathways: experimental insights into atmospheric transport across Eurasia

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Atmospheric transport in the outflow of Europe and across Eurasia has been the subject of a few transport and chemistry-transport modelling studies. Despite their relevance to atmospheric environment issues, these studies have not been confronted to field data. Long-range transport (LRT) patterns across Siberia and how regional perturbations affect it remain virtually unexplored over Northern Asia. We address these issues using CO_2, CO, O_3 and aerosols data from 3 intensive airborne campaigns over Siberia. We analysed the data by comparing trace gases concentrations enhancements and correlations with a Lagrangian retro-transport model . We found that air from European origin is dominant in the lower 3 km of the free troposphere during the April 2006 campaign, with an average CO and O_3 concentration of 169 ppb and 50 ppb respectively, to be compare to 172 ppb CO and 58 ppb O_3 above 3 km. In contrast the European CO was more ubiquitous and mixed with Asian and North American emissions during summer and late summer. Frontal uplift of Chinese pollutant, transport of biomass burning plume and hemispheric transport are found to contribute significantly to CO_2, CO and O_3 enhancements. We also documented synoptic-scale sharp concentration gradients linked to a descent of CO-poor Arctic air beneath a biomass burning plume in a baroclinic perturbation. Additionally, a significant depletion of O_3 was observed: average free troposphere to boundary layer gradient was 31.0 ppb in summer, 18.1 ppb in late summer and 12.6 ppb in Spring. The summer/late summer gradient is attributed to continental scale O_3 deposition and probable reaction with

VOCs. This reduces the impact of O_3 production from European precursors on East Asian O_3 tropospheric burden.