How do plant emissions affect atmospheric nanoparticle formation?

MIIKKA DAL MASO[1,2], THOMAS F.MENTEL[2], ASTRID KIENDLER-SCHARR[2], EINHARDT KLEIST[2], RALF TILLMANN[2], MIKKO SIPILÄ[1], TUUKKA PETÄJÄ[1], JANI HAKALA[1], LI LIAO[1], KATRIANNE LEHTIPALO[1], MARKKU KULMALA[1] AND DOUGLAS WORSNOP[1]

[1]Department of Physics, University of Helsinki, PO Box 48, 00014, Helsinki, Finland, miikka.dal@helsinki.fi

[2] Institut für Chemie und Dynamik der Geosphäre (ICG), Forschungszentrum Jülich, 52425 Jülich, Germany

Non- and semivolatile compounds, produced by the oxidation of atmospheric trace gases that are emitted by human and biological activity, can undergo a phase transition and enter the atmospheric aerosol phase, either onto existing particles or forming new nanosized condensation nuclei. The most likely candidates of precursors of aerosol number-producing vapors are sulphur dioxide and plant-originated volatile organic compounds.

Currently, the controlling mechanism of tropospheric nanopartile formation is still an open question. Field and laboratory measurements have clearly indicated a strong correlation between observed sulphuric acid – a product of SO_2 oxidation – and nanoparticle concentrations and formation rates (eg. [1]). On the other hand, observed seasonality and comparisons with plant VOC emission strengths show that aerosol formation is also correlated with biogenic organic oxidation. Laboratory studies with real plant emissions have shown a clear dependence of aerosol formation on the VOC emission strength and also the chemical mixture ([2, 3]), thereby ruling out the possibility that nanoparticle formation by nucleation would be completely independent of organic compounds.

We investigated the formation of nanosized condensation nuclei (nano-CN) from sulphuric acid and plant emissions in the Jülich Plant Chamber setup. We performed a series of experiments using boreal forest tree emissions at levels commonly found in the boreal boundary layer.

We found that while the variation of the VOC concentration had a strong inpact on the gas phase chemistry and also the hydroxyl radical and sulphuric acid levels, the changes in particle formation rates were not explainable by sulphuric acid concentration variations alone, but the particle formation process is directly influenced by the plant emissions.

[1] Riipinen *et al*., (2007). [2] Mentel *et al*., (2009). [3] Kiendler-Scharr *et al*., (2009).

Estimating mantle temperature from a global comparison of seismic models and the petrology of mid-ocean-ridge basalts

COLLEEN A. DALTON*[1], ALLISON GALE[2] AND CHARLES H. LANGMUIR[2]

[1]Earth Sciences, Boston University, 675 Commonweath Ave., Boston, MA 02215 USA (*correspondence: dalton@bu.edu)

[2]Earth and Planetary Sciences, Harvard University, 20 Oxford St., Cambridge, MA, 02138 USA; (agale@fas.harvard.edu; langmuir@eps.harvard.edu)

Inferring mantle temperature and composition is one of the primary applications of seismic tomography. Mantle temperature and composition also strongly influence the petrology of mid-ocean-ridge basalts (MORBs) erupted on the seafloor. It is therefore reasonable to hypothesize that a relationship exists between seismological and petrological data. We have investigated whether such a relationship does exist using global seismic models and a new and expanded global compilation of MORB major-element chemistry. Petrological data obtained from PetDB form the core of our geochemical database, which is augmented by unpublished analyses and Iceland samples from GEOROC. We correct all measured values to 8% MgO and determine the mean composition for 231 individual ridge segments. We compare the petrological data (ridge depth, Na8, Fe8, etc.) with global mantle models of shear-wave speed, attenuation, and transition-zone topography. Ridge depth and wave speeds at 200-400 km depth are correlated globally, suggesting that the same factors that control ridge depth and crustal thickness also influence seismic velocity. For several ridges, anti-correlation between ridge depth and depth to the 410-km discontinuity is seen, in particular the Southwest Indian Ridge and the Mid-Atlantic Ridge. The comparisons also reveal correlation between Na8 and shear-wave speed at 200-300 km globally. Comparison of the petrological data and mantle seismic models provides an opportunity to understand the connection between temperature and composition at depth and the processes occurring at the surface.