Boreal forests, aerosols, clouds and climate – Closing the feedback loop

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It has been hypothesized that the aerosol being formed from oxidation of Volatile Organic Compounds (VOCs) emitted by vegetation is involved in an important negative feedback mechanism relevant to the resilience of the boreal forest to climate change [1, 2]. When VOC's are oxidized into Secondary Organic Aerosol (SOA) they may increase the number of Cloud Condensation Nuclei (CCN) and thereby change cloud properties, such as the albedo. This may cause a change in the surface energy balance and temperature, which in turn directly affect VOC emission whereas an indirect affect on VOC emissions is imposed by a change in vegetation productivity.

We have tested this hypothesis using a conceptual model which contains descriptions of all parts of the feedback loop in the simplest possible way, to allow for a semi-quantitative analysis of this feedback mechanism with an emphasis on the various timescales involved in this feedback.

We will present the outcomes of this model regarding the influence of this feedback loop on the surface radiation balance and the productivity of the boreal forest and discuss how this feedback may influence the resilience of the boreal forest to climate change.

[1] Kulmala *et al*. (2004) *Atmos. Chem. Phys*. **4,** 557-562.
[2] Spracklen, Bonn & Carslaw (2008) *Phil. Trans. R. Soc. A* **366**, 4613-4626.

Ethanol and water on the calcite surface observed with X-ray Photoelectron Spectroscopy (XPS)

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Calcite is present in many geological settings and is the most abundant simple salt at the Earth's surface. In environmental geochemistry, it is important to understand the surface structure of calcite and the processes that affect it under a variety of conditions, so models predicting its behaviour will be reliable. We used commercial calcite, treated to remove the agents used to ensure light, fluffy powder and examined the adsorption properties with near-surface sensitive spectroscopy (XPS). The interaction of calcite with simple organic compounds provides clues about the attachment and activity of more complex molecules such polysaccharides and proteins produced by organisms to make biominerals. Ethanol is one of the simplest alcohols, so study of its interaction and adsorption by calcite was examined to shed light on the bonding strength and character of the hydroxyl group. Results showed that initially, at room temperature, calcite remained free of ethanol but at low temperature (-130°C) ethanol adsorbed. With heating, the ethanol remained attached and did not desorb until temperatures reached -50°C. For comparison, and to test the relative strength of adsorption, we also investigated the behaviour of water vapour. We sequentially varied temperature and observed adsorption and desorption and then compared with results from experiments made during simultaneous addition of ethanol and water. Results were compared with those predicted by theoretical calculations made by molecular modelling.