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On COBACC (COntinental Biosphere-Aerosol-Cloud-Climate) feedback

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Anthropogenic emissions of GHGs have increased substantially during the past century. Elevated concentrations of CO_2 and methane are the most important forcing agents causing global warming. However, it is not straightforward to attribute or predict the climate change in detail, as the internal variability of climate is only partially understood, aerosol forcings are still highly uncertain, and there are many feedback mechanisms that are difficult to quantify. It has been recognized for decades that the biosphere plays an important role in climate. For example, Kulmala et al. (2004) suggested a negative climate feedback mechanism whereby higher temperatures and CO_2-levels boost continental biomass production, leading to increased biogenic secondary organic aerosol (BSOA) and cloud condensation nuclei (CCN) concentrations, tending to cause cooling. This COBACC (COntinental Biosphere-Aerosol-Cloud-Climate) feedback is similar to the so-called CLAW-hypothesis by Charlson et al. (1987) which connects the ocean biochemistry and climate via a negative feedback loop involving CCN production due to sulphur emissions from plankton.
The first quantification of the COBACC feedback loop (Kulmala et al. 2014) was based on continuous comprehensive observations at SMEAR II (Station for Measuring Forest Ecosystem-Atmosphere Relations) station in Hyytiälä, Finland, and showed that a 10 ppm increase in atmospheric CO_2 concentration leads to a significant (several percent) increase in both carbon sink and aerosol source. These effects operate through changes in gross primary production, volatile organic compound (VOC) emissions and secondary aerosol formation associated with atmospheric oxidation of VOCs.
Here we will describe the present knowledge from processes level understanding to whole COBACC feedback including some hints on biogenic and anthropogenic contributions to global aerosol number load.

References:
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