Session: B12 Oral presentation

Towards unravelling complex land-atmosphere processes in boreal Eurasia: the ALANIS study

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Determining the role of the Eurasian boreal region is essential in understanding the global Earth system as it represents the largest terrestrial ecosystem on Earth. In this context, boreal forests play a vital role in curbing global warming by storing in forest and peat ecosystems billions of tons of carbon formed since the Last Glacial Maximum around 20,000 years ago. Northern lakes and wetlands are important sources of carbon, partially released as methane and other trace gases to the atmosphere especially during spring and summer. Furthermore, it has been observed that boreal forests are responsible for growing emissions of natural secondary organic aerosols. This, along with increased concentrations of long-range transported anthropogenic aerosols in northern Eurasia, is expected to trigger severe impacts on climate in the near future. The size and remoteness of boreal Eurasia, however, pose a challenge to quantification of both terrestrial ecosystem processes and their feedbacks to regional and global climate. Furthermore, human activities and climate changes are thought to have altered the natural equilibrium of the whole region, thus strengthening the need for an effective mapping and monitoring of surface-atmosphere exchange interactions. In the last few years, Earth Observation (EO) data have demonstrated the potential to become a major tool for estimating key variables and characterizing main processes governing the land-atmosphere interface over the extremely wide and often unreachable northern areas of boreal Eurasia. In such context, the European Space Agency (ESA) has launched ALANIS, a novel Atmosphere-LANd Interaction Study in collaboration with iLEAPS, the land-atmosphere core project of the International Geosphere-Biosphere Programme (IGBP). The initiative is motivated, on the one hand, by the increasing need for multi-source datasets required by scientists and modelers investigating boreal ecosystems, and, on the other hand, by the growing potentialities offered for investigating northern high latitudes by existing and upcoming ESA and Third Party missions. Accordingly, the main goal of ALANIS is to advance towards the development and validation of novel EO-based multi-mission products and their integration into suitable land-atmosphere coupled models responding directly to the specific scientific requirements of the iLEAPS community. The ALANIS study encloses three different projects, each addressing a specific thematic area. In particular they aim at: improving the characterization of boreal Eurasian lake and wetland dynamics in order to reduce current uncertainties in related methane emissions, whose global warming potential is 21 times greater than that of CO2 ("ALANIS - methane"); improving the estimation of plume injection height of biomass burning events occurred in boreal Eurasia (where they can be can be injected up to lower stratosphere) and reducing current uncertainties in related greenhouse-gas and aerosol dispersion forecast ("ALANIS - smoke plumes"); discriminating natural aerosols emitted by boreal Eurasian forests from long-range transported fine anthropogenic aerosols ("ALANIS - aerosols"). ALANIS will help setting up a solid scientific basis for the development of a long-term data set of EO-based land and atmosphere products over the boreal area in support of iLEAPS. Moreover, it is expected to provide an effective Scientific Roadmap that will serve as a basis for further ESA activities with IGBP.