Geophysical Research Abstracts
Vol. 20, EGU2018-12383, 2018
EGU General Assembly 2018

Open Fires in Greenland: An Unusual Event and its Impact on the Albedo of the Greenland Ice Sheet

Nikolaos Evangeliou (1), Arve Kylling (1), Sabine Eckhardt (1), Viktor Myroniuk (2), Kerstin Stebel (1), Ronan Paugam (3), Sergiy Zibtsev (2), and Andreas Stohl (1)

(1) NILU - Norwegian Institute for Air Research, Department of Atmospheric and Climate Research (ATMOS), Kjeller, Norway (nikolaos.evangeliou@nilu.no), (2) National University of Life and Environmental Sciences of Ukraine, Kiev, Ukraine., (3) King's College London, London, United Kingdom.

Highly unusual open fires burned in Western Greenland between 31 July and 21 August 2017, after a period of warm, dry and sunny weather. The fires burned on peat lands that were made vulnerable to fires by permafrost thawing. We used several satellite data sets to estimate that the total area burned was about 2345 hectares. Based on assumptions of typical burn depths and BC emission factors for peat fires, we estimate that the fires consumed a fuel amount of about 117 kt C and produced BC emissions of about 23.5 t. We simulated atmospheric transport and deposition of BC and found that the smoke plumes were often pushed towards the Greenland Ice Sheet by westerly winds and thus a large fraction of the BC emissions (7 t or 30%) was deposited on snow or ice covered surfaces. Analysis of aerosol optical depth data from three sites in Western Greenland in August 2017 showed strong influence of forest fire plumes from Canada, but little impact of the Greenland fires. The albedo changes and instantaneous surface radiative forcing in Greenland due to the fire BC emissions showed that the maximum albedo change due to the BC deposition was about 0.006, too small to be measured by satellites or other means. The average instantaneous surface radiative forcing over Greenland at noon on 31 August was 0.03 W/m2, with locally occurring maximum values of 0.63 W/m2. The average value is at least an order of magnitude smaller than the radiative forcing due to BC from other sources. Overall, the fires burning in Greenland in summer of 2017 had little impact on BC deposition on the Greenland Ice Sheet, causing almost negligible extra radiative forcing. This was due to the – in a global context - still rather small size of the fires. However, the very large fraction of the BC emissions deposited on the Greenland Ice Sheet makes these fires very efficient climate forcers on a per unit emission basis. If the expected further warming of Greenland produces much larger fires in the future, this could indeed cause substantial albedo changes and thus lead to accelerated melting of the Greenland Ice Sheet. The fires burning in 2017 may be a harbinger of such future changes.