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including thickness, extent, drift and composition, have changed considerably. The largest changes and inter-annual variability have been observed in the summer period. The changes have already reflected on widespread interest of utilization of huge natural resources, using Northern Sea Route for a shorter navigation route between Europe and Asia and tourism in the Arctic. In this talk, I will discuss about ongoing research activities in the FMI which supports safe and efficient shipping the Arctic. A particular focus will be on new methods to monitor sea ice conditions by coastal and satellite radars as well as modelling capabilities of high resolution short term forecasting.

Arctic shipping activities and possible consequences for the regional climate

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Climate change is associated with anthropogenic emissions of long-lived greenhouse gases and short-lived climate forcers such as atmospheric particles. The particles can be transported via long-range transport from other parts of the world to the Arctic. Black carbon aerosol is known to have a significant impact on the surface albedo when deposited on snow- and ice-covered surfaces and sulfate aerosol is known to have high potential to contribute to the formation of clouds and fog and thus impact on climate. Arctic shipping is expected to become more intense because the waters have become increasingly ice-free during the summer months in the previous decades. The ships then may transit either the Northern Sea Route over the Russian Arctic from Europe or the Northwest Passage through the Canadian Arctic from the Atlantic and emit large amounts of particulate matter with significant impact on the regional climate in the Arctic.

The new Villum Research Station (VRS) at Station Nord (Northeast Greenland) was established in 2014 to monitor important climate parameters and give the possibility to detect future changes in atmospheric pollution caused the ship emissions. This presentation also gives an overview of facilities at the new station and corresponding on-going activities.

Enviro-HIRLAM black carbon modelling for Northern Europe and Arctic

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A modeling of black carbon (BC) temporal and spatial evolution in the atmosphere has very high interest in recent years. BC is considered as the second main climate stressor next to CO2. Being a product of incomplete combustion of fossil fuels, biofuels and biomass, BC absorbs heat in the atmosphere that leads to atmospheric warming and positive climate forcing. Moreover, BC particles deposited on snow surface decrease surface albedo and consequently cause melting that is considered as important process for Northern Europe and Arctic from climate point of view. In this study, the Enviro-HIRLAM (Environment - High Resolution Limited Area Model) online-coupled meteorology-chemistry model was employed to simulate BC atmospheric transport, dispersion and deposition over the Northern Hemisphere with focus on Northern Europe and Arctic. In order to predict BC transport the following major BC emission datasets have been linked to the model: ECLIPSE – anthropogenic emissions, IS4FIRES and GFAS – wildfires emissions, AU_RCP and SILAM – ship emissions. Model runs have been performed for 29 July – 13 August, 2010 and 19 – 27 January, 2010 episodes, which were characterized by unfavorable weather conditions and high air pollution concentrations. The simulated BC concentrations as well as BC deposition fluxes have been analyzed and compared with ground based observation data.