G4–O1

MOUNTAIN GLACIERS OF THE NORTHEASTERN ASIA: NEW ASSESSMENTS

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The paper compares remotely sensed glacier inventories of the Byrranga, Suntar-Khayata, and Chersky ranges (2003), Koryak Highland and Chukotka mountains (2008) obtained by Landsat, ASTER abd World View-2 imagery with data from the USSR Glacier Inventory (1945-1985). We studied changes in glacier area and morphological structure of the glaciers since the Glacier Inventory, which was mainly based on aerial photos and topographic maps. The retreated glaciers have been classified by orientation (aspect) and morphological type, and the degree of glacier reduction in these groups were studied. In total, the glacierization of Chersky Range was reduced by about 30% (1970-2003), Suntar-Khayata by 20% (1945-2003), Byrranga by 17% (1967-2003), Koryak Highland (1950-2003) – by about 60% and Meynypilginsky Range (1984-2008) by 25%. The different regional retreat rates can be explained by changes in the precipitation patterns. All these regions undergo climate warming up on now. Using DEMs and new assessments of glacier areas we compiled the maps of contemporary glacier equilibrium line altitude (ELA) for Chukotka and NE Siberia Mountains and compared with those constructed by by A.N. Krenke (1982) based on the data of the USSR Glacier Inventory. The new ELA spatial patterns differ substantially from given in (Krenke, 1982) for Chukotka and less substantial – for Suntar-Khayata Range in the NE Siberia.

G4–O2

ATMOSPHERIC TOXICS DEPOSITION TO SVALBARD: THE EMERGING PICTURE

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The analysis of organic contaminants from five different classes in ice cores drilled on Svalbard is showing widely ranging net atmospheric inputs of a variety of organic contaminants. We have analyzed 316 compounds in five groups: polychlorinated biphenyls (209); current use and legacy pesticides (64); brominated flame retardants (15); fluorinated compounds (16); halobenzenes (16). PCB total burden is <600 ng cm-2 from 1953 – 2005, dominated by congeners 66 and 70. Congener profiles are showing a shift to dominance by lower molecular mass compounds, showing a likely shift in atmospheric PCB source between 1988 and 2005. The current use and legacy pesticides show variability in numbers of compounds between east and west, with more compounds observed in the east, apparently influenced by easterly winds. The greatest burdens in any ice core are for trichlorfon (~10 000 pg cm-2 burden) and chlorpyrifos (~9 500 pg cm-2 burden).

The BFRs show few of the BDE congeners except BDE-209. Overall, BFRs are dominated by HBCD (~20 000 pg cm-2 burden in the core from 1953-2005) and BDE-209 (~6 000 pg cm-2 burden). The HBCD burden is the greatest of all 5 compound classes.

The perfluorinated compounds have the lowest burdens of all 5 groups. Perfluorononanoic acid (PFNA) has the highest burden (~30 pg cm-2) and perfluorooctanoic acid (PFOA) is second-most abundant (~18 pg cm-2).

The halobenzenes (HBs) are dominated by 1,4-dichlorobenzene (1,4-DB) (~10 800 pg cm-2), and 1,3-DB (1 500 pg cm-2). The HB record maxima are historic, from the 1970s, indicating a decline in emissions, likely from the timber industry.

G4–O3

Nitrate and sulfate anthropogenic trends in 20th century from 5 Svalbard ice cores

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Sulfate and nitrate records from 5 ice cores spread across Svalbard were intercompared and revealed strong temporal similarities with previously published global estimates the 20th century. A of anthropogenic emissions of SO_2 and NO_x during significant departure from the early century sulfate and nitrate levels was evident at all drilling sites starting from the mid-1940's. A steady increase was observed in both sulfate and nitrate profiles at most sites until the late 1960's, when the annual concentrations started to increase at a higher rate. This peak activity lasted for about a decade, and was observed to decrease steadily from the early 1980's on, when sulfate levels declined significantly and when nitrate levels finally reached sulphate levels for the first time in 20th century. The timing of these trends in Svalbard with global SO_2 and NO_x concentration profiles was best appraised when considering composite concentration profiles for Svalbard sulfate and nitrate respectively. Composite profiles were also found to provide a convenient mean for distinguishing between the most important world source regions. Based on correlation analysis, the major pollutant sources appeared to be Western Europe and North America for both sulfate and nitrate, followed by Central Europe and former USSR in generally similar proportions. Our results suggest that shifts in fossil fuel and coal combustion trends can be assessed in a first step through the ratio of pre-filtered nss-SO_4^{2-} by NO_3^- ice core concentrations.

G4–O4

RESPONSE OF GLACIER "ELA" IN SUNTAR-KHAYATA, EASTERN SIBERIA, ON CLIMATE CHANGE

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About 180 glaciers distribute in mountainous area around Suntar-Khayata region in eastern Siberia. Glaciers in this area retreat rapidly in these several ten years by global warming, and its glacier retreat is a good index of climate change. We discussed how the ELA (glacier equilibrium line altitude) response to meteorological conditions (temperature, precipitation, solar radiation, wind-speed, wind direction, drifting snow and so on) and why the glaciers distribute on mainly northward and eastward faced slopes.

Fig.1 Upper area of No.147 glacier, the longest glacier in Suntar-Khayata. Eastward slope is covered with glacier ice/snow.

G4–O5

Causes of Greenland temperature variability over the past 4000 years: Implications for North Hemispheric temperature change

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A new Greenland temperature record reconstructed from argon and nitrogen isotopes in trapped air in GISP2 ice core provides high-resolution (< 20 years) and precise annual average temperature estimates over the past 4000 years. Owing to tight age-controls and abundant paleoclimatic information from the ice core, the temperature record provides an exceptional opportunity to investigate the late Holocene climate in a multi-decadal to millennial time scale. To investigate causes of Greenland temperature variability over the past 4000 years, we calculated high latitude temperature (70-80ºN) change using a one-dimensional energy balance model with reconstructed climate forcings including orbital, solar, volcanic, and greenhouse gas forcings. Greenland temperature was calculated from the high latitude temperature considering negative Greenland temperature responses to solar variability based upon our earlier study, which significantly correlated with the ice-core-derived Greenland temperature. Therefore, the past variability of the climate forcings can explain at least 10% of multi-decadal to millennial Greenland temperature variability over the past 4000 years. A North Hemisphere (NH) average temperature trend over the past 4000 years was also inferred from the ice-core derived Greenland temperature. Lines of evidence indicate that current decadal average temperature of NH is likely warmer than anytime over the past 4000 years.