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Extracting fair-weather data from atmospheric electric-field observations at Syowa Station, Antarctica

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At Syowa Station (69.0° S, 39.6° E), located on East Ongul Island near the continent of Antarctica, atmospheric electric-field observations started in 1968 and had been carried out intermittently. An improved electric-field mill at Syowa Station had and obtained better-quality atmospheric electric-field data from February 2005 to January 2006. After a 1-year interruption, the observations resumed in January 2007.

The atmospheric electric-field data from Syowa Station are often contaminated due to local disturbances caused by near-ground meteorological phenomena. We examined correlations between the atmospheric electric field and near-ground weather from February 2005 to January 2006 and from February 2007 to January 2008, and proposed a criterion to extract "fair-weather" electric-field data based on wind speed and cloud coverage data. The diurnal variation of fair-weather data in January followed the shape of the so-called Carnegie curve. Fair-weather data obtained during a substorm showed some correspondence between the atmospheric electric field and variations in the geomagnetic field. This newly developed extraction method may enable the use of atmospheric electric-field data for studying the solar terrestrial environment.

Development of a model for ice core dating based on grain elongation

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A simple quasi-empirical model is presented to calculate the deformation rate and age scale corresponding to ice core depth, where grain size and shape are determined only by grain growth and grain deformation processes. Given the size and elongation of grains as a function of ice core depth and the accumulation rate at the ice-sheet surface, it is possible to determine the ice core age scale. The model results are in good agreement with measured values of the rate of grain deformation and the age scale for the GIPS2 ice core at depths above 700 m.

Snow accumulation, melt, mass loss, and the near-surface ice temperature structure of Irenebreen, Svalbard

I. Sobota

This study examines the mass balance, accumulation, melt, and near-surface ice thermal structure of Irenebreen, a 4.1 km2 glacier located in northwest Spitsbergen, Svalbard. Traditional glaciological mass balance measurements by stake readings and snow surveying have been conducted annually at the glacier since 2002, yielding a mean annual net mass balance of −65 cm w.e. for the period 2002–2009. In 2009, the annual mass balance of Irenebreen was −63 cm w.e. despite above-average snow accumulation in winter. The near-surface ice temperature in the accumulation area was investigated with automatic borehole thermistors. The mean annual surface ice temperatures (September–August) of the accumulation area were −3.7 ° C at 1 m depth and −3.3 ° C at 10 m depth. Irenebreen is potentially polythermal, with cold ice and a temperate surface layer during summer. This temperate surface layer is influenced by seasonal changes in temperature. In winter, the temperature of all the ice is below the melting point and temperate layers are probably present in basal sections of the glacier. This supposition is supported by the presence of icings in the forefield of Irenebreen.

Visible and near-infrared spectral survey of Martian meteorites stored at the National Institute of Polar Research

Takahiro Hiroi, Hiroshi Kaiden, Keiji Misawa, Takafumi Niihara, Hideyasu Kojima, Sho Sasaki

Martian meteorite chip samples stored at the National Institute of Polar Research (NIPR) have been studied by a visible and near-infrared (VNIR) spectrometer. Measured spots are about 3 × 2 mm in size, which are clearly marked on photographs of the meteorite chips. Rock types and approximate mineral compositions of studied meteorites have been identified or obtained through this spectral survey with no sample preparation required. This study demonstrates that this kind of spectral survey is effective in classifying and describing Marian meteorites, and that such a VNIR spectrometer on a Mars rover would be useful for identifying these kinds of unaltered Mars rocks. Further studies which utilize a smaller spot size are desired for improving the accuracy of identifying the clasts and mineral phases in the rocks.

Inferred ultrahigh-temperature metamorphism of amphibolitized olivine granulite from the Sor Rondane Mountains, East Antarctica

Nobuhiko Nakano, Yasuhito Osanai, Sotaro Baba, Tatsuro Adachi, Tomokazu Hokada, Tsuyoshi Toyoshima

This paper reports the first evidence of ultrahigh-temperature (UHT) metamorphism from the Sør Rondane Mountains, eastern Dronning Maud Land, East Antarctica, which is evident as orthopyroxene + spinel symplectite in an amphibolitized mafic

granulite. The granulite consists of olivine, orthopyroxene, clinopyroxene, pargasitic amphibole, plagioclase, and ilmenite, and it possesses a within-plate alkali basalt signature. The local bulk chemical composition of symplectite, major and trace element compositions, and thermodynamic calculations for the symplectite, suggest the presence of garnet at the high-pressure stage and that the symplectite formed from garnet, olivine, and primary orthopyroxene by decompression from more than 12 kbar at 1000 ° C. The granulite records a subsequent amphibolite-facies overprint (<700 ° C at <6 kbar) that involved the chemical re-equilibration of several phases. The obtained pressure-temperature (*P*-*T*) conditions and *P*-*T* path are different from the UHT metamorphism from the Schirmacher Hills, central Dronning Maud Land, which is considered to have occurred in a back-arc tectonic setting. The relatively high-*P* conditions and the decompression path reconstructed in the present study are similar to those reported for southern India, Sri Lanka, and part of northeastern Mozambique, possibly reflecting continental thickening and exhumation during the main collision event between East and West Gondwana.

Distribution of Calanus species off Franz Josef Land (Arctic Barents Sea)

Vladimir G. Dvoretsky

The spatial distribution of *Calanus* species was examined near Franz Josef Land archipelago in August 2006 and 2007. Surface and bottom water temperatures exceeded the average multiannual values. *Calanus* species dominated the total mesozooplankton abundance and biomass, accounting for 818 ± 178 individuals m−3 (mean ± SE) and 803 ± 163 mg wet weight (WW) m−3, respectively, in 2006. In 2007, the values were much lower (153 ± 29 individuals m−3 and 192 ± 17 mg WW m−3, respectively), reflecting the weaker influence of warm Atlantic water that year. *Calanus glacialis* dominated the *Calanus* populations, contributing 95% and 60% of the biomass in 2006 and 2007, respectively. Older copepodite stages (CIV-CV) predominated in the *C. finmarchicus* (69% and 76%, respectively) and *C. hyperboreus* populations (80% and 77%, respectively), whereas young copepodites (CI-CIII) were predominant in *C. glacialis* (45% and 59%, respectively). A clear negative relationship between the average water temperature and the total *Calanus* biomass was observed in 2006, whereas a positive correlation between these parameters was observed in 2007. The distributions of three *Calanus* species off Franz Josef Land were mainly associated with hydrological conditions and circulation patterns.

Direct PCR amplification of the 16S rRNA gene from single microbial cells isolated from an Antarctic iceberg using laser microdissection microscopy

Katsuhiko Yanagihara, Hironori Niki, Tomoya Baba

Here, we describe a technique that allows the genetic linage analysis of 16S rRNA genes in bacteria observed under a microscope. The technique includes the isolation of microbial cells using a laser microdissection microscope, lysis of the cells, and amplification of the 16S rRNA genes in the isolated cells without interference by

bacterial DNA contamination from the experimental environment or reagents. Using this technique, we successfully determined 15 16S rRNA gene sequences in cells isolated from an Antarctic iceberg. These sequences showed 94%–100% identity to their closest strains, which included bacteria that occur in aqueous, marine, and soil environments.

Survey of larval Euphausia superba lipid content along the western Antarctic Peninsula during late autumn 2006

Jennifer Putland, Tracey Sutton

A survey of larval *Euphausia superba* (furcilia stages four and six) was conducted in waters along the western Antarctic Peninsula during late autumn (May and June 2006). Larvae were collected from stations in four regions to estimate dry weight and lipid content. There were no statistically significant differences in the dry weight or lipid content among the regions sampled. The overall average (±S.D.) dry weight was 1.51 ± 0.32 mg indiv.—1 and 0.85 ± 0.12 mg indiv.—1 for F6 and F4 larvae, respectively. The average (±S.D.) lipid content was 21.6 ± 9.6 %DW and 27.9 ± 13.7 %DW for F6 and F4 larvae, respectively.

Vegetation development and carbon storage on a glacier foreland in the High Arctic, Ny-Alesund, Svalbard

Shinpei Yoshitake, Masaki Uchida, Toshiyuki Ohtsuka, Hiroshi Kanda, Hiroshi Koizumi, Takayuki NakatsuboThe distribution of organic carbon and its relationship to vegetation development were examined on a glacier foreland near Ny-Ålesund, Svalbard (79° N). In a 0.72-km2 area, we established 43 study plots on three line transects along primary succession from recently deglaciated area to old well-vegetated area. At each plot, we measured the type and percent coverage of vegetation types. The organic carbon content of vegetation, organic soil, and mineral soil samples was determined based on their organic carbon concentration and bulk density. Cluster analysis based on vegetation coverage revealed five types of ground surfaces representing variations in the amounts and allocation patterns of organic carbon. In the later stages of succession, 7%–24% and 31%–40% of organic carbon was contained in the organic and deeper soil layers, respectively. Organic carbon storage in the later stages of succession ranged from 1.1 – 7.9 kg C m—2. A larger amount of organic carbon, including ancient carbon in a raised beach deposit, was expected to be contained in much deeper soil layers. These results suggest that both vegetation development and geological history affect ecosystem carbon storage and that a non-negligible amount of organic carbon is distributed in this High Arctic glacier foreland.