Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

ACC31-01 Room:104 Time:May 23 09:00-09:15

Chemical analysis of three snow pits of inland Antarctic Expedition 2007/2008 (JASE)

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To understand the spatial-temporal variability of glaciological environment in Dronning Maud Land, a 2800 km traverse was carried out by Japanese Swedish Antarctic Expedition (JASE traverse) in austral summer 2007/2008 (Fujita et al., 2011). The route of this traverse is crossing Syowa-Dome Fuji-EPICA DML (Kohnen)-Wasa. In this expedition, 4 or 2 m deep snow pits were dug at Dome Fuji (DF) and Meeting Pint (MP) and Middle Point (Mid.P). We analyzed for water stable isotopes, major soluble ions and tritium content with 2 cm intervals. We counted summer layers of snow pits using nssSO_4^{2-}, tritium content, sodium ion, chloride ion and crust layers. Snow accumulation rates are 29.3 kg m^{-2} a^{-1} of DF, 34.8 kg m^{-2} a^{-1} of Mid.P and 0.7 kg m^{-2} a^{-1}, MP by dating of snow pits.

Comparing ion compositions between three snow pits, there is not significant difference of them. In other hands, we show negative correlation between water stable isotope and ion concentrations. These correlations are well at inland site (DF).

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

ACC31-02 Room:104 Time:May 23 09:15-09:30

Multi-millennial-scale climatic variations in Antarctica during the last eight glacial cycles

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Climatic variability on millennial timescales, characterized by abrupt temperature changes in the Northern Hemisphere and inter-hemispheric seesaw, have been well documented for the last glacial period by many paleoclimatic records. It is also evident that very large inter-hemispheric seesaw occurred during the last deglaciation. The cause for these variations is thought to be the variations of freshwater flux into North Atlantic ocean from surrounding ice sheets, which can change the strength of meridional overturning circulation and associated poleward heat transports. Therefore, millennial-scale variations in Antarctica or elsewhere may tell us about ice sheet variability in the Northern Hemisphere. However, the frequency and magnitude of such events are uncertain for older glacial periods and terminations because of the lack of suitable climatic records. Here we present a 720,000-yr ice-core isotopic record along the second Dome Fuji ice core, East Antarctica. Synchronizing and stacking this record with existing Dome C ice-core record permits robust identification of multi-millennial-scale Antarctic warming events over the last eight glacial cycles. Dust proxies in Marine Isotope Stage 16 in the Dome Fuji core (oldest glacial period in this core) show that the millennial-scale variations of dust flux are negatively correlated with Antarctic temperature for all identified events. This demonstrates that changes of aridity in the dust source region, presumably Patagonia, occurred in concert with Antarctic climate changes. A bandpass filter (3,000 - 15,000 yr periodicities) was applied to the stacked isotope record to account for loss of resolution in the old (deep) part. This allows us to identify large Antarctic warming events with a constant criteria through 800,000 years. We find a positive relationship between repetition period of multi-millennial-scale events and Antarctic temperature, with exceptions in glacial maxima. The data suggests instability of Northern Hemisphere ice sheets in intermediate glacial condition and also a role of climatic precession, presumably through Northern Hemisphere summer insolation, affecting ice sheet mass balance. Multi-millennial-scale events becomes infrequent in times of large precession variations in early parts of glacial periods, implicating long freshwater release due to strong summer insolation forcing. Very large multi-millennial-scale events are identified at glacial terminations, suggesting that the terminations in general involve abrupt and large climatic transitions which are overlaying on the slow orbital-scale variations.

Keywords: Dome Fuji ice core, Antarctica, Millennial scale climatic changes, Orbital variations, Bipolar seesaw, Glacial terminations

Japan Geoscience Union Meeting 2012
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ACC31-03 Room:104 Time:May 23 09:30-09:45

Modelling the Abrupt climate change in millennial scale and its influence upon ice sheets during the middle level glacia

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Abrupt climate change in millennial time scale such as D-O cycles and AIM recorded in ice cores occurs more frequent with high amplitude during the middle level glacial climate state than in the interglacial state or the full glacial state. The mechanism of the frequent occurrence of abrupt change through the Atlantic meridional overturning circulation is unclear and the necessity of the high frequency during the middle level glacial stated is not known. Here we use a coupled ocean atmosphere model, MIROC, to compare the detailed nature of the response to fresh water release (0 to 0.1Sv under different initial condition) of AMOC under middle level glacial state with interglacial or full glacial state. Under middle level glacial state, the AMOC is stronger at the basic state (without water release), nearly switches off with small amount of fresh water release of 0.05 Sv and induces larger cooling in the Northern hemisphere than other background climate states. The recovery of AMOC is induced from a nearly swithed off AMOC state by reducing the fresh water release to 0.01Sv or less, lead by the gradual response in the low latitude and followed by the lagged but sudden response in the convection and sea ice area in the North Atlantic. Laurentide and Fenno-Scandian Ice sheets' melt water estimated by an ice sheet model IcIES is consistent to the melt water amount needed for the AMOC change under middle glacial state, showing a possibility of favorable condition of self sustained oscillation between ice sheet and ocean meridional overturning under middle level glacial climate.

Japan Geoscience Union Meeting 2012
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ACC31-04 Room:104 Time:May 23 09:45-10:00

Variability of aerosols at NEEM, Greenland during the last glacial period

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A new deep ice core was drilled at NEEM, Greenland during the 2008-2011 field season. The bedrock was reached at 2540m depth. During 2009- 2011, CFA (Continuous Flow Analysis) was carried out. Discrete samples were collected from the CFA melt fractions, and were distributed to different laboratories. Ionic species were analyzed at National Institute of Polar Research (Japan) and Alfred Wegener Institute for Polar and Marine Research (Germany) with ion chromatographs. Here we present and compare the ion concentration data obtained by both institutes. Most of the ions show good agreement between the two institutes. Concentrations of calcium, sodium, chloride, fluoride, sulfate, potassium and magnesium, show large variations associated with Dansgaard-Oeschger (DO) events, as has been already reported for other Greenland ice cores. New ion data obtained from the NEEM deep core display large variability of oxalate and phosphate concentrations during DO events. On the other hand, nitrate, ammonium and methanesulfonate do not show such variations. The millennial scale variations of ions are thought to be caused by changes in atmospheric circulation and source strength.

Keywords: NEEM, Greenland, ice core, last glacial period, ion concentration, Dansgaard-Oeschger (DO) events

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

ACC31-05 Room:104 Time:May 23 10:00-10:15

Climate change for the past 100 ka viewed from the TOC contents of the sediment cores MD10-3304 and 3312 from Japan Sea

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Sediment cores, MD10-3304 and 3312 are collected from two sites on a mound at 896 m depth and a small ridge at 1026 m depth off Joetsu, Japan Sea during the MD179 cruise. They are composed mostly of silty clay with several maker tephra beds. Based on the relationship between the depths and ages of the identified tephra and 14C measurements, the bottom age of the cores are estimated as old as 102 ka and 125 ka respectively. Total organic carbon (TOC) and total nitrogen (TN) have been analyzed onr the cores in every 2 cm or 4 cm intervals corresponding to 50 to 100 years.

The TOC contents vary from 0.6 % to 2 %, showing quasi-periodic fluctuations, and the stratigraphic profiles of TOC contents of the MD10-3304 and 3312 cores are very similar each other. The temporal changes of TOC in both cores well correspond to the delta 18O profile of the ice core (NGRIP) from Greenland. Short warm period correlative to the Greenland Interstadial (GIS) 1 to 25 can be identified in the profiles for 100 ka (D-O cycle). General trends of both TOC curves are also similar the LR04 curve of marine delta 18O isotope. This fact suggests a strong teleconnection between North Atlantic region and Far East Asia, climate of which are controlled strongly by the same Arctic air mass. In a cold period, the strong cold air mass pushed the polar front southward, and cold air mass occupied around Japan Sea for a longer season. Cooling effect of sea surface temperature and expanded frozen season might be resulted in low biological productivity of Japan Sea TOC contents of the Japan Sea sediment is an excellent proxy of winter temperature in a middle latitude region of Far East Asia.

MD179/Japan Sea gas hydrate cruise of R/V Marion Dufresne was performed under the financial supports from MH21 project.

Keywords: paleoclimate, Japan Sea, total organic carbon, MD10-3312, Greenland ice sheet, D-O cycle

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

ACC31-06 Room:104 Time:May 23 10:45-11:00

Solar influence on Greenland temperature anomalies over the past 1000 years

KOBASHI, Takuro[1*], Kunihiko Kodera[2], Jason Box[3], Drew Shindell[4], Masakazu Yoshimori[5], Toshiyuki Nakaegawa[2], Ayako Abe-Ouchi[5], Jinro Ukita[6], Kenji Kawamura[1]

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The surface temperature of the Greenland ice sheet is among the most important climate variables for assessing how climate change may impact human societies associated with accelerating sea level rise. However, the causes of multi-decadal to centennial temperature changes in Greenland are not well understood, largely owing to short observational records. Greenland climate exhibited less warming than Northern Hemisphere (NH) average temperature during the 1960s to 1980s. Thereafter, Greenland has been warming rapidly, whereas the increase in the NH average temperature has been relatively slow. The Greenland temperature anomaly (GTA) relatively to the NH may be linked with the North Atlantic Oscillation/Arctic Oscillation (NAO/AO). Here, we show that the GTA has been caused by solar-induced NAO/AO-like patterns over the past 1000 years. Evidence indicates that the anomaly is likely linked with solar-paced changes in the Atlantic meridional overturning circulation (AMOC) and associated changes in northward oceanic heat transport.

Keywords: Greenland, Climate change, temperature, solar activity

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

ACC31-07 Room:104 Time:May 23 11:00-11:15

Sr and Nd isotopic ratio of dust in an ice core drilled on Grigoriev Ice Cap in Tien Shan Mountains

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Eolian mineral dust from vast deserts can be transported globally by wind and effect various environments on the Earth. Dust deposited on glaciers in the past can be obtained by ice core drilling. The past variations in the eolian dust can be reconstructed by particle analysis of ice cores.

Stable isotopic ratios of Sr and Nd provide a means of identifying sources of substances. The means can use for the icecore dusts because it requires low samples for analysis. These isotopic ratios of the icecore dusts may show variation of amount, provenance and pathway of the dust. In this study, we analyzed Sr and Nd isotopic ratio of the icecore dusts drilled on Grigoriev glacier in Kyrgyzstan Tien Shan Mountains.

The ice core was drilled at a snow plateau of 4660 m a.s.l. in 2007. The length is 87.48m and the age estimated 12,000 years. There were prominent dust layers in more than 80m of the ice core. The particle concentrations of the layers were approximately 10 folds of the mean concentration of the ice core. Sr and Nd isotopic ratios of the dust in several layers were lower than those of soil from the bottom of ice core. This suggests that the dust was not derived from soil around the ice cap but from Asian desert sand, which is most likely to be derived from Taklimakan Desert.

Keywords: Sr, Nd isotope ratio, Ice core, Dust provenance

Japan Geoscience Union Meeting 2012
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ACC31-08 Room:104 Time:May 23 11:15-11:30

Trace element analyses in a Gregoriev ice core in Kyrgyz Tien Shan for the period 1800-2007AD

MURAKAMI, Kosei[1*], FUJITA, Koji[1], TAKEUCHI, Nozomu[2], NAKANO, Takanori[3], Kicheol Shin[4], Vladimir B Aizen[5]

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Trace elements contained in ice cores provide various information with respect to environmental changes in the past. However, recent studies dealing such trace elements in ice cores, which were drilled in Asian regions, have been limited to decadal time scale.

In September 2007, a 87-m long ice core was drilled at the Gregoriev Ice Cap, Tien Shan Mountains, Kyrgyzstan. Age scale was given by counting the seasonal variation of pollen species validated with the 1963-tritium horizon up to depth of 67m, and by radiocarbon dating in deeper part. This core was estimated to cover over the past ten thousands years.

In this study, we analyze 53 species trace elements (e.g. Ti, Mn, Ni, Zn, Cd, Sn, Pb, REE) up to depth of 59.7m. We provide the longest continuous data with respect to trace elements in Asian ice cores.

We find that some anthropogenic elements (Ni, Cu, Zn, As, Cd, Sb, Sn, Pb) show different variation from those from the other regions in Asia whereas Ni, Cu, As Sb and Pb show similar variation. Sn concentrations increased slowly since the 1960s and decreased slowly since the 1980s. Cd concentrations exponentially increased since the second half of the 20th century presumably because of the increased fossil fuel consumption and the industrial expansion in this region. Cd concentrations gradually decreased since the 21th century because of the controlled industrial emissions in the Europe and North America. However, industrial expansion of the surrounding area (central Asia), might cause increase of Cd again.

Most of anthropogenic elements (Cu, As, Cd, Sn, Pb) show low concentration compared with the other Asian ice cores, while Antimony was contained in high concentration level (about twice) presumably because of the indigenous product in Kyrgyzstan and neighboring Kazakhstan.

Keywords: ice core, trace elements, anthropogenic elements, Grigoriev ice cap

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

ACC31-09 Room:104 Time:May 23 11:30-11:45

Verification of crystal size and water stable isotopes for climatic proxies in Belukha ice core, Siberian Altai

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The seasonal change of crystal size is utilized for deriving age scale for Belukha ice core, Siberian Altai. Consequently, the upper 154.27 m of the ice core cover the period from 1210 to 2003. Annual median of initial crystal area removed impurities effect (effective crystal area) estimated by the empirical formulas shows significant correlations with air temperature estimated Barnaul temperature. The periods of small effective crystal area agree with the periods of solar activity Minimums. The 5?year averaged oxygen isotope ratio, solar modulation, accumulation and d?excess shows significant correlations. These relationships suggest that oxygen isotope ratio in Belukha ice core represents summer precipitation changes from the Atlantic Ocean and the irradiated solar reduce precipitation. The variation of d?excess means the ratio of precipitation from western recycled water vapor.

Keywords: ice core, crystal size, water stable isotopes, d-excess

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

ACC31-10 Room:104 Time:May 23 11:45-12:00

Variation of precipitation reconstructed from Alaskan alpine ice-core

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We obtained two ice cores from Alaskan alpine glaciers. One is from Mount Wrangell at Wrangell-St. Elias range, and the other from Aurora Peak at Alaska range. Signals of water isotope of both of ice cores showed remarkable seasonal cycle. Then we could estimate annual accumulation from the seasonal cycles of water isotope. While the variation of accumulation at Mount Wrangell did not show any trend for 50-100 years, the variation of accumulation at Aurora Peak showed significant increase trend since 1970s.

Keywords: Ice core, Alaska, Alpine glacier, precipitation, water isotope

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

ACC31-P01 Room:Convention Hall Time:May 23 13:45-15:15

Variability of sea ice distribution and polar front in the Southern Ocean since the last glacial period

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The Southern Ocean has played a significant role in the global climate system during the geologic past. In order to understand the paleoceanographic variations with the polar front system and Antarctic Circumpolar Current (ACC), we conducted the paleoceanographic studies using two piston cores COR-1bPC (54 deg S) from the Conrad Rise and DCR-1PC (46 deg S) from the Del Cano Rise. Based on our paleoceanographic researches, a winter sea ice limit and the Antarctic Polar Front were migrated to the north during the last glacial period.

Keywords: Southern Ocean, sea ice, Antarctic Circumpolar Current, polar front

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

ACC31-P02 Room:Convention Hall Time:May 23 13:45-15:15

Dust-climate couplings over the past 800-kyr

SAKATA, Haruka[1*], Kaoru FUKUYAMA[1]

[1]Mie Univ.

Secular dust fluctuations have been hardly paid attention from the viewpoint of Milankovitch theory. In the present study, we address dust records from Antarctica ice core.

Dust may have passive and active effects on climate. As dust depends on the climate, dust values gradually increase or decrease under the surrounding environments such as dust origin. On the other hand, dust can force on the climate through its albedo effects. We have considered these two effects from the feature of past 800-kyr dust fluctuations.

We have analyzed each climatic cycles for small dust values (dust tend to be subject to climate) and large values (dust tend to affect climate) using spectral analysis. To examine what phenomena relates the two effects, dust fluctuations are compared with other records such as insolation, ice volume and atmospheric CO_2 records. Moreover, we researched the duration for each passive and active period of dust and the relation with temperature from the accumulation curve of dust masses.

When dust is in the subsidiary state for climate, it behaves locally on polar region, and seems to relate ice volume fluctuations, whereas as dust has predominant effects on climate, its fluctuations are global, which may relate to CO_2 fluctuations such as carbon cycle. The accumulation curve of dust masses suggests relatively long passive stage for about 60˜70-kyr, and restrained active stage for about 10˜20-kyr.

We discuss the linkages between these features of dust fluctuations and climate shift on glacial-interglacial timescales.

Keywords: Milankovitch theory, glacial-interglacial cycle, eolian dust

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(May 20-25 2012 at Makuhari, Chiba, Japan)

ACC31-P03 Room:Convention Hall Time:May 23 13:45-15:15

Formation and metamorphism of stratified firn at sites located under spatial variations of accumulation rate and wind sp

FUJITA, Shuji[1*], ENOMOTO, Hiroyuki[1], FUKUI, Kotaro[1], Yoshinori Iizuka[3], MOTOYAMA, Hideaki[1], NAKAZAWA, Fumio[1], Shin Sugiyama[3], Surdyk Sylvaine[1]

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The initial stage of postdepositional metamorphism in polar firn was investigated at sites located under spatial variations of accumulation rate and wind speed along the East Antarctic ice divide near Dome Fuji. A better understanding of this process is important for interpreting local insolation proxies used for astronomical dating of deep ice cores. Three 2-4 m deep pits were excavated and physical properties, including density, grain size D, reflectance R of near infrared light and microwave dielectric anisotropy, were investigated at high spatial resolution. We found that dielectric anisotropy ranges between 0.028 and 0.067 and that such high values occur in the surface ˜0.1 m. In addition, short scale variations of density are correlated with those of dielectric anisotropy, and inversely correlated with those of D, confirming contrasting development of initially higher density layers and initially lower density layers. Moreover, postdepositional metamorphism makes these contrasts more distinct with increasing depths. Both the contrasts and dielectric anisotropy for given values of density are higher under lower accumulation rate conditions and under less windy conditions. Insolation efficiently causes evolution of strata of firn at the ice sheet surface under such conditions. Under more windy conditions, the strata contain more wind-driven hard layers with higher density and dielectric anisotropy and thus have larger fluctuations of density and dielectric anisotropy. We suggest that the initial variability of density at the surface and the duration of exposure to diurnal and seasonal temperature gradients play sequential roles in determining the physical/mechanical properties of firn, which is retained throughout the densification process.

Keywords: Antarctica, ice sheet, firn, metamorphism, accumulation rate, wind speed

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ACC31-P04 Room:Convention Hall Time:May 23 13:45-15:15

Constructing the age of Dome Fuji ice core using a dating model

SUZUKI, Kazue[1*], KAWAMURA, Kenji[3], Frederic Parrenin[4], ABE-OUCHI, Ayako[5], SAITO, Fuyuki[6], FUJITA, Shuji[3], HIGUCHI, Tomoyuki[2]

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Past climate change is regarded as a key knowledge for predicting future climate changes. Milankovich theory has explained the climate changes from Glacial to Interglacial periods with variations of seasonal solar radiation caused by Earth's orbital parameters (eccentricity of orbit, obliquity and precession of rotation axis). Kawamura et al. (2007) indicated that Antarctic temperature rose during deglaciations following or at the same time of the solar radiation increase in Northern Hemisphere summer. In addition, the greenhouse gas, which facilitates the air temperature to rise, is thought as another important element for the past climate change.

To estimate the contribution of orbital and carbon dioxide forcings to the climate changes, especially at the start of the deglaciation, we have make construct the age of ice core and air occluded in it. The difference in age between the ice and gas at the same depth occurs in firn (consolidated snow) while they are compressed to become ice from snow. The gap between these ages was estimated to be about 5,000 years in glacial maxima, but the time lag between temperature and carbon dioxide is on the order of 0-1000 years. Therefore, we should make accurate adjustment of the age of the ice and the age of gas, in order to discuss the contributions of carbon dioxide for the temperature rising at the deglaciation.

In particular, the second Dome Fuji deep ice core needs accurate estimation of thinning function in the bottom part (within ˜500 m from the bed corresponding to 340-700 kyr ago). The thinning function, which expresses the horizontal stretching and vertical compression of an ice layer, would be changed for geothermal heat in the bottom of the ice sheet. We tried to adjust the parameters, thinning function, accumulation rate and the difference of age between the ice and the gas in the ice. In the presentation, we will present results from the adjusted ice age and gas age.

Keywords: ice core, dating, paleoclimate

Japan Geoscience Union Meeting 2012
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ACC31-P05 Room:Convention Hall Time:May 23 13:45-15:15

Numerical simulation of isotopic ratio in snow using an offline model

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Given that ice cores consist of past snowfall in a chronologic and systematic order, we can utilize stable water isotope (SWI) information in ice cores to reconstruct the past climate. Several modeling studies have tried to simulate the past SWI in precipitation preserved in ice cores (Werner and Heiman, 2002, Sjolte et al, 2011), but they are limited only on high latitude area. In such region, we do not have to consider post-depositional isotopic processes due to the extremely low temperature all over a year. However, when one wants to simulate the past SWI in ice cores in mid- and low-latitudinal areas, he has to consider the isotopic effects of the post-depositional processes because snow undergoes melt, sublimation and erosion by wind, by which SWI in snow are easily affected. Otherwise the reconstructed information of the past would be distorted and misleading.

In this study, we developed a new off-line isotopic snow-icecore model: it simulates isotopic effects due to the post-depositional processes while precipitated snow is eventually transformed into an ice core. The model is based on the snow layer submodel of Iso-MATSIRO (Yoshimura et al., 2006) with a particular purpose to simulate a vertical profile of SWI at a glacier or ice sheet. Unlimited number of snow layers with a 20mm thickness increment is incorporated, whereas the original Iso-MATSIRO snow submodel has only three layers. It also newly includes the impact of wind erosion process, including blizzard. Using this model forced with the output from IsoRSM (Yoshimura et al., 2010), i.e., an isotope enabled meso-scale climate model forced with historical meteorological reanalysis data, we simulated SWI in snow pits drilled at Belukha, Siberian Altai, and Gregoriev, Tien Shan, which are close to ice core drilling sites. The preliminary simulation period is for 1997-2007. With the new off-line model, the simulated SWI vertical profile of the snow layers shows a better correlation with the observed snow pit SWI than the simulation without the model. This study aim to simulate SWI of ice cores in mid- and /or low latitudes for more than hundred years, and it is expected to present the latest updates at the conference.

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

ACC31-P06 Room:Convention Hall Time:May 23 13:45-15:15

The variations in pollen abundance and composition in Holocene of an ice core of Kyrgyz Tienshan, Central Asia

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Various pollens are preserved in ice cores, in particlular, ice cores from mountain glaciers in low- or mid lattitude. Pollen grain concentration in ice cores can be used to distinguish annual and seasonal layers, and also are indicative to past vagitation around glaciers. In 2007, ice cores were successfully drilled on Grigoriev Ice Cap located in the Tien Shan Mountains, Kyrgyztan. The elevation of the drilling site was 4600 m a.s.l. and entire core length was 87 m. Radiocarbon dating revealed that the soil corrected from the bottom of the ice core was 12,500 cal year bp. Microscopy revealed that fourspecies of pollens were preserved in the ice core, and their abundance and composition varied in the last millenium.

Keywords: ice core, pollen, Plaeoenvironment, glacier, Holocene

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ACC31-P07 Room:Convention Hall Time:May 23 13:45-15:15

Dissolved Chemical ions in ice core drilled from Grigoriev Ice Cap in Kyrgyz Tien Shan

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Glacieres and ice sheets receive various chemical components from organic and inorganic matter supplied from surrounding atmosphere and soil, after that they change themselves conditions. Ice Cores drilled from such glacial areas have chronologically retained the snow which laid thick in the past dozens to ten thousands, and capable of holding unknown valuable paleoenvironment information. Therefore the analysis of dissolved chemical ions in ice cores drilled from all parts of the world is a convincing clue to show interpretation about a climate and environment that the earth experienced until now. Then, in this study, we intend to clarify long-term climatic and environmental variation in Tien Shan and the Central Asia based on the analysis of the dissolved main chemical ions in ice cores drilled from the cultivation area of Grigoriev Ice Cap in Tien Shan in September, 2011.

This ice core included Ca in richness through all layers. And, this core is 86.87 m in length, and maintains information until approximately 12,000 years ago. This means that the ice cap might strongly receive influence of sand (CaCO3) of huge drying area of the Central Asia, the Taklamakan from a last years of Pleistocene last glacial epoch. Moreover, as a result of having found the mean concentration of the chemical ions which dissolved in this ice core, Ca was with approximately 120 micro-Eq/kg, other (Cl, NO3, SO4, Na, NH4, K, Mg) less than 30 micro-Eq/kg. This result was similar to the chemical concentration of other glaciers, Urumqi No.1 Glacier in Tien Shan, Muztagata Glacier in Pamir and Chongce Ice Cap in Kunlun, located around the Taklamakan. This result suggest that Tian Shan is affected by the Taklamakan regardless of the west edge or the east edge and is the environment where the uniform chemical supply is accomplished.

The depth profile about dissolved chemical concentration of this ice cores showed large and small plural peaks. Especially, a peak of abnormal density (about 10-60 times of the mean) was confirmed approximately around 53.5 m in all ions. As a result of dating of this core, it was revealed that this peak was located in the layer about 1833. Because the oxygen stable isotope ratio profile of this time showed a change unlike the average year, the ice cap might experience some kind of specific snowfall events for the same period. And, as a result of having found the mean concentration of the chemical ions which dissolved in this ice core after 1990, Ca was with approximately 50 micro-Eq/kg, other (Cl, NO3, SO4, Na, NH4, K, Mg) less than 12 micro-Eq/kg. These density is approximately 40% of the mean concentration in all layers. This suggest that dissolved chemical ions in the ice cap is a tendency to decrement in late years.

Keywords: Tien Shan, Grigoriev Ice Cap, ice core, Dissolved chemical ions, oxygen stable isotope ratio, climatic and environmental variation

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

ACC31-P08 Room:Convention Hall Time:May 23 13:45-15:15

Snow algae in an ice core drilled on Grigoriev Ice cap in the Kyrgyz Tien Shen Mountains

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Snow algae are photosynthetic microorganisms and are living on the surfase of glaciers. They grow on melting surface from spring to summer and their biomass and community structure are changed with physical and chemical conditions on glaciers. Ice cores drilled from glaciers also contain snow algae that grew in the past. Studying biomass and community structure of snow algae in ice cores could reveal the temporal variation in snow algae in the past, and also environmental conditions relating propagation of snow algae. In this study, we aim to describe snow algae in an ice core of Grigoriev Ice cap located in eastern Kyrgyzstan of the central Asia.

The samples of ice core collected on the top of the glacier contained three taxa of filamentous cyanobacteria, an unicellular cyanobacterium, and two green algae. The quantitative analyses of the algae in the 25 m deep ice core samples revealed that the algal biomass showed several peaks. Based on the dating by pollen grains, the 25 m core covers 61 years. The results suggest that the snow algae did not grow every year on the top of the ice cap, and their biomass and community structure varied greatly from year to year. The peak of biomass at the depth of 20 m contained significant amounts of the filamentous cyanobacteria that was observed in the lower part of the ice cap. This suggests that the year of the peak was significantly warmer than usual and the entire surface of the ice cap melted.

Keywords: snow algae, ice core

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Variations in pollen grains in an shallow ice core drilled from Fedchanko Glacier in Pamir, Central Asia.

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Ice cores drilled from the polar or alpine glaciers contain pollen grains blown from vegetation surrounding the glaciers. Abundance and compositions of pollen grains in ice cores could be a proxy of paleoenvironment, but there are only few studies on pollen grains in ice cores. In this study, we analyzed the pollen grains in two pits and an shallow icecore drilled on Fedchanko Glacier in Pamir, Central Asia. We found seven species of pollen grains in the ice core and they could be reflective of surrounding vegetation and be used to identify annal summer layers.