Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-01 Room:301A Time:May 22 09:00-09:15

# Regional climate experiment in the central mountainous area of Japan

Yasutaka Wakazuki[1*], Masayuki Hara[2], Takeshi Yoshida[1], Chieko Suzuki[1]

[1]University of Japan, [2]Japan Agency for Marine-Earth Science and Technology

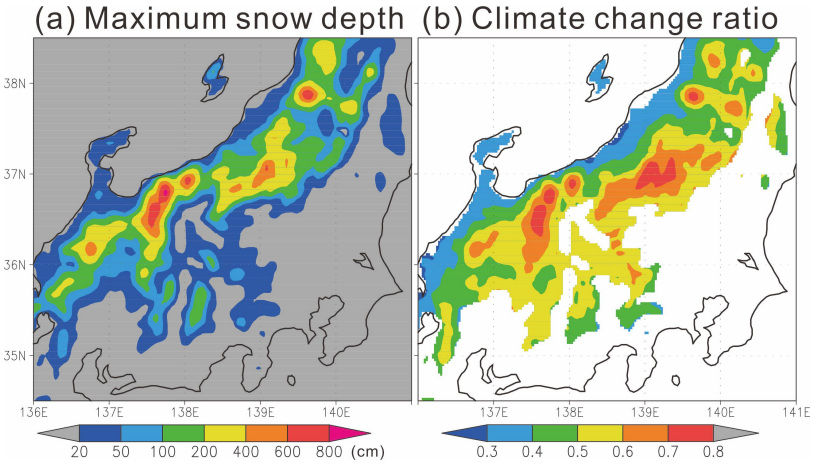
The mountainous area of the central Japan has a steep and complicated terrain. In the area, huge amount of snowfall is produced in winter season. The snow affects those of vegetation and ecosystem etc. However, the distribution of snow is too difficult to quantify because the number of observation stations is few especially in higher elevation area. The distribution data of precipitation created by radar and rain-gage data show unrealistic pattern. On the other hand, numerical simulations using cloud resolving atmospheric models are recently significantly developing, and reproducibility of simulated precipitation with small grid size become higher in recent. Therefore, it is considered that the simulated results are beneficial to understand the distribution of precipitation. We performed regional climate numerical simulation for the present and future climate with the target of mountainous area of the central Japan and Kanto region. WRF version 3.4 was used as a regional climate model (RCM). Grid sizes of simulations are 24, 6, and 2km. In the present climate simulation, an objective analysis data ERA-Interim (ANAL) was used as the lateral boundary data of RCM simulation. In the future climate simulation, mean climatological differences estimated by GCMs were added to ANAL as the lateral boundary data. This approximated method of RCM simulation is called as the pseudo-global-warming (PGW) method developed by Kimura and Kitoh (2007). In this experiment, mean climatological difference of four CMIP-3 GCMs (csiro_mk3_0, gfdl_cm2_1, miroc3_2_hires, and mri_cgcm2_3) were used. Target period of future climate is the end of 21th century. The climatological variables were calculated by 32 years run. Noah-LSM scheme including single layer snow was used as land surface model.

In the present climate simulation, snow depths in the mountainous area were validated by observation data of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and the Japan Meteorological Agency (JMA). The reproducibility of snow depths showed a large variation. However, the simulated snow depth roughly reproduced the observations. In particular, reproducibility of 2-km run was better than that of 6-km run. The characteristic of snow distribution showed realistic pattern especially for 2-km run.

In the future climate simulation, climate change of snow depth was analyzed. Figure shows (a) maximum snow depth in the present climate and (b) climatological change ratio of maximum snow depth. We found that decreases of the snow depth caused by the global warming estimated around 3 K was significant in the surrounding area of high elevation mountains. In the future climate, the frequency of snowfall (rainfall) was projected to decrease (increase) in the lower elevation area due to the global warming. Meanwhile, Changes in snowfall amount in the higher elevation area were projected to be small. In addition, the end date of snow was projected to be delayed from 10 to 35 days. In particular, the delay was significant in the higher elevation area and in the lower elevation area faced to the Sea of Japan.

This study is supported by Research Program on Climate Change Adaptation (RECCA) of the Ministry of Education,Culture,Sports,Scien
& Technology and the Tsukuba tenure track system.

Keywords: Regional climate, Mountainous area of Japan, Numerical model simulation



Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-02 Room:301A Time:May 22 09:15-09:30

# Reproducibility and Regional Characteristics in Altitudinal Dependency of Snow Depth using Regional climate model

Fumichika Uno[1*], Hiroaki Kawase[1], Noriko N. Ishizaki[1], Takao Yoshikane[1], Fujio Kimura[1], Tsutomu Iyobe[2], Katsuhisa Kawashima[2]

[1]Japan Agency for Marine-Earth Science and Technology, [2]Research Institute for Natural Hazards and Disaster Recovery, Niigata University

The reproducibility of the snow cover in the mountain areas depends on the horizontal resolution of a climate model. A high-resolution experiment can simulate detailed snow cover distributions and their characteristics (Leung and Qian 2003), i.e., the relation between the amount of snow cover and the altitude of the terrain. Then, we discussed the factors of reproducibility of snow cover distributions and the regionality of altitudinal dependency using a regional climate model with 1.5km horizontal resolution.

We used the Advanced Research Weather Research and Forecasting (WRF) modeling system Version 3.4. The initial and lateral boundary conditions are interpolated from the ERA-interim data set. We used the Noah-LSM including a one-layer snow model as a land surface model and the WSM6 including the cloud micro physics scheme with 6 class (mixing ratio of water vapor, cloud water, cloud ice, snow, rain, and graupel). We turn off the cumulus parameterization.

Snow depth tended to be underestimated by the model. The spatial distributions of snow are. however, consistent with the observations having sufficient reproducibility to the characteristics of regionality. The altitudinal dependencies with linear and nonlinear relationships are found in the windward side and the leeward side of the coastal mountainous area, respectively. This is because many snow clouds are blocked by the coastal mountain about 1,000m. The phenomena cause the difference of precipitation between windward and leeward areas. The sensitivity experiment without coastal mountain shows the nonlinear altitudinal dependency makes similar the linear dependency. As the results, a one of the major factor of regional difference in the altitudeinal dependency is geometry of terrain.

Keywords: Snow Depth, Altitudinal Dependency, Regional climate model, Dynamical Downscaling

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-03 Room:301A Time:May 22 09:30-09:45

# Effect of land surface process for simulating snow depth using WRF model over the mountainous area of central Japan

Masatoshi Kuribayashi[1*], NOH, Namjin[1], SAITOH M. Taku[1], WAKAZUKI, Yasutaka[2], TAMAGAWA, Ichiro[1], MURAOKA, Hiroyuki[1]

[1]River Basin Research Center, Gifu University, [2]Center for Research in Isotopes and Environmental Dynamics, University of Tsukuba

The mountainous area of central Japan is one of the heaviest snow areas all over the world. The accumulated snow provides water resources, and also it is one of the important factors controlling phenology of forest ecosystem. The amount of snow might be reduced under the climate changed condition. Therefore, the accurate estimation of the amount of snow and the future prediction are quite important. The most precise method to measure the snow amount is in-situ observation, but there are few observation sites in the mountainous area over central Japan because of sever environment. Though the remote sensing is useful to check the special distribution of snow depth, it is not be able to observe continuously. There are researches about the spatial distribution and the future prediction of snowpack using regional climate model WRF (e.g., Kawase et al., 2012; Hara et al., 2008). These researches adopted the Noah-LSM as land surface process scheme. On the other hand, the Noah-MP, which is the renewed version of the Noah-LSM, was added to the land surface process option from WRF version 3.4 released in April 2012. According to Niu et al. (2011), the model reproducibility about snow depth, snow density, and snow water equivalent was improved at the mountainous area of Vermont in America by adopting the Noah-MP as land surface process.

In this study, we compared the reproducibility of snowpack simulated by WRF version 3.4.1 with the Noah-LSM and the Noah-MP in the mountainous area of central Japan from September 2006 to August 2008. First, we tried to validate the modeled data at the Tokamachi site (Elev. 200 m) of Forestry and Forest Products Research Institute, because the site only opens the observation data of snow density and snow water equivalent. The simulated snow depth, snow water equivalent, and snow depth by using the Noah-MP were more consistent with these observation data than the simulated data by using the Noah-LSM. We consider that the reason of better calculation by using the Noah-MP is multi-stratified structure of snowpack. Whereas the Noah-LSM treat snowpack as a bulk layer, the Noah-MP separate snowpack up to three layers, depending on the snow depth. The multi-stratified structure of the Noah-MP would be effective to separate new snow and old snow. As a result, it could reproduce the temporal variation of snow density at the time of snow fall and snow melt. Second, we tried to validate the modeled data at the Takayama site (Elev. 1324 m) of Gifu University, where located in the middle of Mt. Norikura. The calculated time series variation of snow depth by the Noah-MP was consistent with the observed value well. Both of the calculated snow depth by the Noah-MP and the Noah-LSM were consistent with the observation until the time of maximum snow depth. But, the Noah-LSM tends to estimate too fast snow melting speed during the beginning period of snow melt. As a result, it underestimated the snow depth during the snow melting period, and it estimated the end date of snow melt about two weeks faster than observation.

Keywords: snowpack, land surface process, mountanious area of central Japan, regional climate model

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-04 Room:301A Time:May 22 09:45-10:00

# Comparison of WRF Model-simulated and MODIS-Derived snow coverage over the central mountainous area of Japan

Chieko Suzuki[1*], Yasutaka Wakazuki[1], Junpei Iizuka[2], KIMURA, Fujio[3]

[1]University of Tsukuba, [2]East Japan Railway Company, [3]Japan Agency for Marine-Earth Science and Technology

To solve the lack of meteorological observation data at high altitude area, we compared WRF model-simulated snow depth with MODIS-derived snow cover fraction around the central mountainous area of Japan. We used regional climate model WRF ver3.4 with Noah-Land Surface Model for reproductive experiments. Nested grid system were adopted. The grid intervels were 24 km, 6 km and 2 km, respectively. Time resolution was half a month depend on MODIS-derived snow cover map products.

Keywords: snow coverage, central mountainous area of Japan, numerical experiment, satellite imagery

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-05 Room:301A Time:May 22 10:00-10:15

# Year-to-year variations of snowmelt runoff in the Kurahone watershed on the Kawakami forest, University of Tsukuba

Yoshifumi Wakiyama[1*], Tsutomu Yamanaka[1]

[1]Terrestrial Environment Research Center, University of Tsukuba

Sensing the change of snowmelt runoff is one of important issues for understanding the impacts of climate change because water resources associated with winter precipitation are expected to be altered in future. Observations on small watersheds on headwaters can be useful for studying the impacts of climate change on hydrological cycle due to its exquisite sensibilities to environmental changes. Comprehensions of year-to-year variations in snowmelt runoff in headwater small watersheds can offer feasible implications for establishing countermeasures. This study presents observation results of water discharge in springtime in 1991, 1997, 1998 and 2012 on a headwater small watershed, the Kurahone watershed in Kawakami forest of University of Tsukuba. The Kurahone watershed is a forested small watershed (38.8 ha) locates on the Kawakami village, Nagano prefecture. Its altitude ranges from 1410 m to 1790 m and snow cover can be found during winter. Water discharge was observed with 90 degree V-notch weir. Meteorological data were monitored at a meteorological observation station in Kawakami forest. Precipitation data in 1991, 1997 and 1998 were estimated by regression equations obtained based on the relationship between Nobeyama AMeDAS and the station in Kawakami forest during 2002 to 2010 because of lacks of data during winter. Total specific discharge during winter and springtime seasons (December to May) in 1991, 1997, 1998 and 2012 were 470 mm, 324 mm, 661 mm and 511 mm, respectively. Total precipitation during springtime (March to May) in 1991, 1997, 1998 and 2012 were 357 mm, 265 mm, 465 mm and 342 mm, respectively. The average air temperature during winter and springtime seasons (December to May) in 1991, 1997, 1998 and 2012 were -1.9 degree C, 0.4 degree C, 1.8 degree C and -0.2 degree C. The maximum daily discharge in 1991, 1997, 1998 and 2012 were observed 25th on March, 6th on April, 15th on April and 5th on March. Integrating these results, the intensities of snowmelt were proportional to the amounts of winter precipitation and there were no clear evidence that forward shift of snowmelt was caused by increase of air temperature. Comparing of hourly discharge data, gradual increase and decrease of discharge, continuing approximately one month, were found in other years, whereas rapid increases and decreases of discharge were found in six times during March to May in 2012. These results suggest that rainfall could have controlled snowmelt runoff more strictly in 2012 than in other three years. These results suggest that changes of rainfall properties in springtime could result in changes of snowmelt runoff in headwaters in recent years.

Keywords: climate change, Kawakami forest, small forested watershed, snowmelt runoff

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-06 Room:301A Time:May 22 10:15-10:30

# Improving raster map of precipitation isotopes over the Japanese Alps region

Tsutomu Yamanaka[1*], Yuki Makino[2], Yoshifumi Wakiyama[1], Keisuke Suzuki[3]

[1]Faculty of Life and Environmental Sciences, University of Tsukuba, [2]Graduate School of Life and Environmental Sciences, University of Tsukuba, [3]Faculty of Science, Shinshu University

Isotopic compositions of precipitation are important information for tracing catchment hydrological cycle. Although recent progress in establishing isotopic monitoring network over the Japanese Alps region provides observed isotope data set, it is difficult to estimate those for non-observation sites. This study aims at creating raster map of precipitation isotope and examines optimal strategy for interpolation/extrapolation. We used precipitation isotope data obtained at 13 sites for the period from June 2010 to November 2011 for simple/multiple correlation analyses. As the results, altitude was the most important parameter with highest correlation with isotopic data. In addition, a multiple regression model (MRM) including altitude, precipitation amount, maximum snow depths, slope, slope aspect and slope curvature (but longitude for hydrogen) showed highest performance. The RMSE (root mean square error) in cross-validation for the MRM is 0.427 permil for oxygen and 2.96 permil for hydrogen; these values are about 60% of those for simple regression model and better than those for geostatistical (i.e., inverse distance weighted) model. The precipitation amount and maximum snow depth are related to the distance form water vapor source, suggesting inland effect as well as altitude effect is important in controlling spatial distribution pattern of precipitation isotope. Comparison between catchment-mean precipitation-isotope calculated from the MRM-based isotope map and river water isotope measured at 24 locations within Chikuma River and Fuji River basins clarified that the both are in generally in good agreement, while the measured river water delta values were slightly higher than the catchment-mean precipitation delta values. This is likely to be due to isotopic enrichment during soil evaporation, indicating a possibility for evaluating proportion of water that can be used neither for human activity nor ecosystems (i.e., white water). Thus, we concluded raster map of precipitation isotope based on the MRM has sufficient accuracy and useful for analyzing catchment hydrology.

Keywords: isotope, mapping, precipitation, river water, Japanese Alps region

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-07 Room:301A Time:May 22 10:30-10:45

# Depositions of the Asian dust suspended in precipitation collected on the west slope of the Mt.Tateyama and Toyama city

Hideharu Honoki[1*], WATANABE, Koichi[2]

[1]Toyama Science Museum, [2]Toyama Prefectural University

Ion constituents and suspended particles were contained in precipitation. Asian dust might be main particles of soil particles in precipitation at high mountain aria of Japan. Recent research reveals that Asian dust path through in the sky over Japan by using aircrafts and LIDER.

Ten sampling stations were set at west slope of Mt. Tateyama and one sampling station was set at Toyama city. Altitude of the highest sampling station is 2450 m. Precipitation samples of all sampling stations were collected in same sampling day.

Precipitation samples were filtered by silica fiber filter. Weight of Asian dust particles were measured after heating at temperature of 500ˆoC.

Concentration of Asian dust particles in precipitation at Toyama city and the highest altitude sampling station of Mt. Tateyama were 0.59mg/l and 0.09mg/l, respectively, from August to September in 2011. Altitude effects were observed in concentrations of Asian dust particles in precipitation. However, peek concentration of 0.82 mg/l was observed the station at altitude of 1420m. Wet deposition of Asian dust was the highest at this sampling station and deposition of Asian dust was 647.9mg/mˆ2, from August to September in2011. Asian dust might contribute to formation of soil at high mountain aria in Japan.

Keywords: kosa, Asian dust, wet deposition, altitude effect, Mt. Tateyama

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-08 Room:301A Time:May 22 11:00-11:15

# Chemical Composition on the snow surface in the Tateyama Mountains in Toyama Japan

Kozue Wakabayashi[1*], Nozomu Takeuchi[1], Shun Amemiya[1], Yukihiko Onuma[1]

[1]Graduate school of Science,Chiba University

In this study, we carried out an analysis of chemical composition, EC and pH on snow surface in Tateyama Mountains in Toyama Prefecture, Japan, and we aimed to reveal their influence of seasonal transformation change and space spatial distribution of chemical composition of snow surface in during snowmelt season, and to research examine the effects on of volcanic gas in the mountain on the chemical composition, which has become active in 2012 for snow surface.

As a result of analysis of chemical composition in tateyama, The most major chemical species most included ion was chloride ion in all measured site in snow surface from April to June. The concentration was highest at the site located near the Jigokudani fumarole. More than 90% of the chloride consisted of raichousou. non-sea salt chloride ion account for over 90%origin.

Measurement of EC was the leargest and pH was showed the snow was generally acidic (3-5) and that it was lowest at the site in near the raichousoufumarole.

Near the raichousou was nearest site of three, itThe results suggest would appeared that the high concentration of the chloride ion and the low pH of the snow were due to derived from the hydrogen chloride derived from contained volcanic gas from the fumarole,Jigokudani.

From On the surface of snow during July and to August, the most major chemica species chaged to largest number of sulfate ion was contained.

It means that snow surface at this time chemicalThe sulfate ion seems to be compositionis supplied from different origins, which that are not derived from neither sea salt and nor volcanic gas.

Origin of the sulfate ion was not clear, it might be derived from the soil surface exposed after the snow melting.

We know that concentration of chemical composition was included as much as before snowmelt in Tateyama, and major component changed from chloride ion to sulfate ion.

Especially, high concentration of chloride ion was considered the effect of volcanic gas from Jigokudani.

Chemical composition might affect the ecosystem of microorganism on the snow and ice and surrounding area.

Keywords: volcanic gas, Tateyama Mountains, snowmelt season, chemical composition, snow surface

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-09 Room:301A Time:May 22 11:15-11:30

# Geo-environmental change on Post-fire alpine slopes of Mount Shirouma-dake, northern Japanese Alps

Akihiko SASAKI[1*], Yoshihiko Kariya[2], Atsushi Ikeda[3], Keisuke Suzuki[1]

[1]IMS, Shinshu Univ., [2]Senshu Univ., [3]Tsukuba Univ.

This is the continuous study to clarify the geo-environmental changes on the post-fire alpine slopes of Mount Shirouma-dake in the Northern Japanese Alps. The fire occurred at May 9, 2009 on the alpine slopes of Mount Shirouma-dake, and the fire spread to the Pinus pumila communities and grasslands. Although the grass had a little damage by the fire, the Pinus pumila received nearly impact of the fire. In the Pinus pumila communities where the leaf burnt, forest floor is exposed and become easy to be affected by atmospheric condition such as rain, wind, snow, and etc.

First, we illustrated a map of micro-landforms, based on geomorphological fieldworks. We observed these micro-landforms repeatedly for three years after the fire. As the results of the observation, it is clear that remarkable changes of these micro-landforms have not occurred but some litter on the ground surface under the Pinus pumila communities are flushed out to surroundings. The Pinus pumila communities established on the slopes consists of angular and sub-angular gravel with openwork texture, which are covered by thin soil layer. Therefore, it is necessary to pay attention to soil erosion following the outflow of the litter.

In addition, we observe the ground temperature and soil moisture, under the fired Pinus pumila communities and the no fired Pinus pumila communities, to find influence of the fire. The ground temperature sensors were installed into at 1 cm, 10 cm, and 40 cm depth. The soil moisture sensors were installed into at 1 cm and 10 cm depth. The 1 cm depth of the soil on the post-fire slopes, the number of diurnal freeze-thaw cycles are increase, and the period of seasonal frost at 40 cm depth is extended for one month.

Keywords: Fire, Alpine zone, Pinus pumila, Slope erosion, Ground temperature variation, Shirouma-dake

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-10 Room:301A Time:May 22 11:30-11:45

# Paleoclimate for the Last Glacial-interglacial cycle based on a modern analog technique in the central Japanese

Tomohiko Kigoshi[1*], Fujio Kumon[2], Sayuri Kawai[3]

[1]Interdisciplinary Graduate School of Science and Technology, Shinshu University, [2]Department of Environmental Sciences, Faculty of Science, Shinshu University, [3]Institute of Mountain Science, Shinshu University

Among the various proxies of paleoclimate used recently in the world, the modern analog method for pollen composition is an excellent way to estimate meteorological parameters such as annual temperatures and precipitation on land area. We tried to convert the pollen data for the last several tens of thousands years in the central Japan using Polygon 1.5 software proposed by Nakagawa et al. (2002). The major data source is the pollen composition of the NJ88 core from Lake Nojiri and TKN-2004 core from Takano Formation.

The Takano Formation in Nagano City consists of Late Pleistocene lacustrine sediments. A continuous sediment core of 53.88 m length named TKN-2004 was taken at the center of Takano basin in June 2004, of which altitude is 730 m. The age of TKN-2004 core is from 160 to 37 ka, and the time resolution of pollen analysis is about 400 years for 37˜99 ka and about 1000 years for 99˜160 ka.

Lake Nojiri locates at the northernmost part of Nagano Prefecture. Its altitude is as high as 654m. A scientific drilling core named NJ88 was taken at 28 m depth off the Biwa-jima in Lake Nojiri. The upper 34 m part of the drilled core is composed homogenous silty clay with many thin layers of marker tephra, and covers the last 72 ka. The time resolution of pollen analysis is about 80 year. The pollen composition data were analyzed by Dr. Kawai, S. and Dr. Kanouchi, A. (Kumon et al., 2012: Kanauchi et al.,2009).

Total organic carbon (TOC) and total nitrogen (TN) contents were measured for both sediment cores in 30˜50 years interval (Kumon and Tawara, 2009). The TOC data can show relative warmness in detail. We estimated paleoclimate for the last 160 ka as follows stage by stage on the basis of the Polygon analysis (Nakagawa et al., 2002).

In the marine isotope stage (MIS) 6, annual temperature is about 3.7 degree, suggesting very cold climate. The coldness is also shown by the lowest content of TOC.

In MIS 5e, annual temperature becomes a little warm, about 5.7 degree on average. In spite of Last Interglacial Stage, annual temperature in MIS 5e is much lower than that in MIS 1. In MIS 5d, annual temperature is as cold as 3.7 degree on average. That of MIS 5c is 5.2 degree on average, showing a little warmer climate. The annual temperature in MIS 5b is a little low, about 4.5 degree on average. And that of MIS 5a is 6.5 degree on average, warmer than that in MIS 5c. TOC amounts vary quasi-periodically in concordance with the estimated temperatures.

In MIS 4, the annual temperature is about 3.2 degree, as cold as in MIS 6. TOC is also constantly low.

Annual temperature of MIS 3 varies from 2.7 to 12 degree, showing general coolness with many abrupt warm intervals. TOC is also slightly high with a short periodic fluctuation. Both reconstructions from Lake Nojiri and Takano Formation are very similar each other in MIS 3.

In MIS 2, the annual temperature is 3.4 degree, corresponding to the Last Glacial Maximum (LGM) the coldest climate. During 15 to 11 ka, annual temperature show a sudden increasing from 3.0 to 13 degree in MIS 1. The annual temperature drops to 9.0 degree in the latest MIS 1. TOC amounts changes correspond well with the reconstructed temperatures during MIS 2 to MIS 1.

The results reconstructed by modern analog method are generally conformable with the common knowledge. However, there are a few discrepancies. The cause seems to be due to some scarcity of modern analog data for fossil pollen composition. For example, temperature may be estimated too high in late MIS 5 and the early MIS 1 by the excess of Cryptomeria or Quercus.

Keywords: pollen compositions of a modern analog method, Polygon, TKN-2004 core, NJ 88 core, TOC content, TN content

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-11 Room:301A Time:May 22 11:45-12:00

# The distribution and carbon cycle of wood materials in the Japanese Alps region

Hideki Takamura[1*], Yoshiharu Asano[1]

[1]Faculty of Engineering, Shinshu University and Institute of Mountain Science, Shinshu University

The stock of wood in the privately owned forests in Gifu and Nagano prefecture has been increasing year by year. We have to utilize them. If enough trees grow, there will be more carbon storage, but it loses the function of carbon absorption. If we log the wood that is utilizable for the construction of houses and plant trees, we can ensure a sustainable asset for future generations. The amount of the domestic lumber used in the construction of houses is less than the amount of imported lumber used in the construction of houses. It is important to increase the supply of domestic timber in order to use more domestic timber in the construction of houses. The forest area of Gifu prefecture is the $5^{th}$ biggest in Japan and the forest area of Nagano prefecture is $3^{rd}$ biggest in Japan. However, the shipments of the lumber at lumber mills of both prefectures are lower in Japan. The reason is the size of the lumber mills in both prefectures is small. To resolve this problem, Gifu prefecture started a new project from 2011. This project aims to supply more ”A level lumber” (i.e. the lumber is not crooked and its diameter is more than 14cm) .The outline of this project is as follows. The lumber mills ship out the wood after sawing (not drying) to the factory(artificial dry center) where they season and shape the wood. The wood is dried at the artificial dry center. After the drying, the wood is shaped at the artificial dry center and is shipped out. In this paper, we researched and calculated the percentage of wood that was wasted in the forest, the lumber mill and the artificial dry center. We measured the energy used at these three locations. We also calculated $CO_2$ emissions from energy consumption at these three locations, and during the transportation of the wood. The target tree species were the Japanese cedar which grows in Gifu prefecture and the Japanese cypress which grows in Gifu prefecture. The distribution route of the Japanese cedar which is used for beams in houses is transported from the forest to lumber mill Y, and then from lumber mill Y to the artificial dry center. The distribution route of the Japanese cedar which is used for boards in houses and the Japanese cypress are transported from the forest to lumber mill Y. The Japanese cedar which is used for beams in houses is dried at the artificial dry center. The Japanese cedar which is used for boards and the Japanese cypress are dried at lumber mill Y. We calculated the difference between the amount of fixed carbon and the carbon emissions in order to calculate the carbon balance. We compared the $CO_2$ emissions of producing the local wood of $1m^3$ in Gifu prefecture and the $CO_2$ emissions of producing the local wood of $1m^3$ in Nagano prefecture. The value of the $CO_2$ emissions of producing the local wood of $1m^3$ in Nagano prefecture has already been done in previous research. We compared the carbon balance of the local wood of $1m^3$ in Gifu prefecture and the local wood of $1m^3$ in Nagano prefecture. Next, we researched the amount of cubic content of distributing the log and lumber per year at the lumber mill in Gifu prefecture by interviewing the workers. The following results were obtained. The $CO_2$ emissions at the lumber mill, the artificial dry center and the transporting of the Japanese cedar made from the new project in Gifu prefecture was less than the Japanese cedar made in Nagano Prefecture. The yield of the Japanese cypress which grows in Gifu prefecture from the forest was lower than the Japanese cypress which grows in Nagano prefecture. There was a difference between the amount of fixed carbon in the local wood in Gifu prefecture and Nagano prefecture. The electrical consumption used for distributing the volume of timber at every lumber mill was also different. The volume of the log from the forest to the lumber mill was 18%. The volume of the wood after sawing (not drying) from the lumber mill to the artificial dry center was only 5%.

Keywords: life cycle assessment, carbon balance, local wood, wooden houses, Japan Alps region

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-12 Room:301A Time:May 22 12:00-12:15

# Impact of the expanded growing period length on carbon budget in a deciduous broad-leaved forest in future climate

Taku Saitoh[1*], NAGAI, Shin[2], YOSHINO, Jun[1], SAIGUSA, Nobuko[3], TAMAGAWA, Ichiro[1], MURAOKA, Hiroyuki[1]

[1]Gifu University, [2]JAMSTEC, [3]NIES

The growing period length of plants is one of the major interests in studying the current and future carbon cycles in terrestrial ecosystems, since it would directly affect the photosynthetic CO2 uptake and respiratory CO2 release in those ecosystems. In this study, we examined the possible effects of growing period length on forest canopy and understory vegetation ecosystem CO2 budget under future climate conditions, by combining [1] canopy-phenology model based on in-situ canopy observation and its dependency on microclimate and [2] ecosystem carbon cycling model. First, by using daily canopy surface images and air temperature data at the Takayama deciduous broad-leaved forest site (TKY) from 2004 to 2009, we examined the dates of the beginning of leaf expansion, the beginning of autumn leaf color development, and the end of leaf-fall, and their relationships with air temperature. Second, we adapted these relationships between leaf phenology and air temperature to account for the seasonal variation of canopy leaf area index (LAI) under future climatic conditions by referring to the climate projection data based on A1B, A2 and B2 scenarios from CMIP3 Multi-Climate Models. Under the near future condition (2046 ? 2065) as compared to the current condition (2002 ? 2007), the beginning of leaf expansion and the end of leaf-fall were 10-13 days earlier and 7-9 days later. As a result, the potential growing period was predicted to be enhanced by 17-22 days. We also estimated the photosynthetic period of understory evergreen vegetation (i.e., from the end of snowmelt in spring to the beginning of snow cover in late autumn) under current and near future climate conditions using NCAR/LSM model. Under the near future condition (2046 ? 2065) as compared to the current condition (2002 ? 2007), the end of snowmelt in spring and beginning of snow cover in late autumn were 8-12 days earlier and 5 days later. As a result, the potential length of photosynthetic period of understory evergreen vegetation was predicted to be enhanced by 13-17 days. Then we introduced simulated phenology of canopy leaf area index into NCAR/LSM model to examine its possible effects on photosynthesis (GPP), ecosystem respiration (RE) and resulting net ecosystem CO2 budget (NEP) of overstory and understory vegetation in the near future climate. Annual total ecosystem GPP, RE and NEP was greater under the future condition than under the current condition by 9-12 %, 9-13% and 12-17%. The increased GPP, RE and NEP were almost accounted by these increased by overstory vegetation. Our analysis indicates the importance of understanding space-time distributions of canopy phenology dynamics and snow-cover and of their consideration into the mechanistic evaluation of ecosystem functions in the climate studies.

Keywords: Carbon budget, Deciduous broad-leaved forest, Future climate, Global warming, Phenology, Understory vegetation

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-13 Room:301A Time:May 22 12:15-12:30

# Mapping of forest area blown-down by the Isewan typhoon and the structure of current forests in Northern Yatsugatake

Satoshi Suzuki[1*], NISHIMURA, Naoyuki[2], SUZUKI, Jun-Ichirou[3]

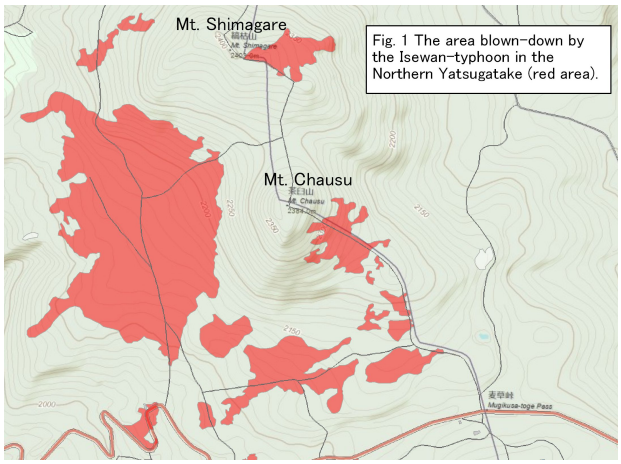
[1]The University of Tokyo Chichibu Forest, The University of Tokyo, [2]Faculty of Social and Information Studies, Gunma University, [3]Grad School of Science & Engineering, Tokyo Metropolitan University

Subalpine forests are susceptible to strong wind. Therefore, strong wind storm, such as typhoon, is an important disturbance which consequently in?uences structure, dynamics and landscape of subalpine forests in Japan. The Isewan typhoon was the one of the strongest typhoon in 20th century, and destroyed a vast area of forests of central Japan in 1959. However, there are only a few detailed data on where the forest has been disturbed by the typhoon. In this study, the area disturbed by the Isewan-typhoon was mapped for the subalpine region in Northern Yatsugatake by using air photographs. Further, biomass, productivity and forest structure derived from field survey in the disturbed area were compared with that in the undisturbed area.

Aerial photographs taken in 1962 revealed that 10% of the studied forest area was blown-down by the typhoon, especially heavily on a western slope of Mt. Shimagare and Mt. Chausu (Fig. 1). From aerial photographs taken in 1966, blown-down trees were removed from most of the disturbed area. The above ground biomass of disturbed stands was 70% smaller than that of the undisturbed stands in 2012. The recent growth in biomass in disturbed stands is twice as high as that of undisturbed stands. Although both disturbed and undisturbed stands were dominated by *Abies* species, the disturbed stands lacked *Tsuga diversifolia* and *Picea jezoensis* var. *hondoensis*, compared with the undisturbed stands.

These results indicate that a single super typhoon can destroy a large amount biomass of a subalpine forest and have a large influence on structure and dynamics of a forest even 50 years later.

Keywords: Northern Yatsugatake, Isewan typhoon, large-scale disturbance on a forest, air photograph



Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-14 Room:301A Time:May 22 12:30-12:45

# Involvment of trichome and phytochrome in local adaptation along altitudinal gradients in *Arabidopsis kamchatica*

Akira Hirao[1*], ONDA, Yoshihiko[2], SHIMIZU-INATSUGI, Rie[3], SESE, Jun[4], SHIMIZU, Kentaro K.[3], TANAKA, Kenta[1]

[1]Sugadaira Montane Research Center, Univ. Tsukuba, [2]RIKEN Biomass Engineering Program, [3]Univ. Zurich, [4]Tokyo Institute of Technology

Altitudinal gradients are among the most powerful 'natural experiments' for detecting ecological and evolutionary significance of phenotypic and genetic variation in organisms. As altitude-for-latitude model of temperature similarity show that equivalent migrations along altitude are eight hundredth of a latitudinal one, the steep environmental gradients along altitude can cause phenotypic and genetic differentiation. *Arabidopsis kamchatica* subsp. *kamchatica*, a perennial herb, occurs from 30 m to 3000m asl in and around the Japanese Alps within a limited latitudinal range. Our previous studies revealed local adaptation of the species along the wide-altitudinal gradients. Genetic variation along environmental gradients such as the altitudinal clines provides understanding to genetic basis of adaptive evolution. Here we report a screening for adaptive genetic variations in *A. kamchatica* along altitidinal gradients. Population genetic analyses suggested that *GL1* and *PHYB*, candidate trichome gene and phytochrome gene, respectively, are under diversifying selection and is associated with altitudinal adaptation.

Keywords: altitudinal gradients, adaptation, gene, trichome, phytochrome

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-15 Room:301A Time:May 22 14:15-14:30

# The effect of the warming experiment on the vegetation in the Japanese alpine-forest-limit vegetation transition zone

Tanaka KENTA[1*], KANAI, Ryuji[1], MASAKI, Daisuke[1], FURUKAWA, Keiko[2], TAKAHASHI, Kazuta[3], KAWATANI, Shohei[3], YABUTA, Taiki[2], SUZUKI, Satoshi[4], HIRAO, Akira[1], KUMATA, Yuto[3], FUNAKI, Noboru[3], OBANA, Yousuke[2], AZUMA, Shuntaro[2], MAKI, Takuto[1], NAGASAWA, Ryo[1], HOSOKAWA, Nanae[3], KANAI, Hinako[3], BANDO, Takaoki[3], FURUYA, Ryo[3], AKIMOTO, Masahiro[3], KOMATSU, Kaiho[3], KOBAYASHI, Hajime[3]

[1]Sugadaira Montane Research Center, Univ. Tsukuba, [2]Faculty of Science, Shinshu Univ., [3]Education and Research Center of Alpine Field Science, Faculty of Agriculture, Shinshu University, [4]The Univ. of Tokyo Chichibu Forest

Over the alpine forest limits, the vegetation changes drastically from the arbor zone to the shrub zone when the altitude increases by only 100 m. Ecosystem there is expected to change drastically by small temperature change and therefore is suggested to be one of most sensitive ecosystems to the global warming. We and other collaborators initiated the artificial warming experiment on the alpine forest limit in 2010 and have been monitoring biodiversity and biogeochemical cycle to reveal the impact of global warming and appeasement actions against it. Here we report the effect on the vegetation over two years.

The study site is at 2600 m altitude in the Shinsyu University Nishikoma Station in the central Japanese Alps. The site is on the steep slope (35 degree in average) and covered with shrubs under approximately 4-m tall *Betula platyphylla*, surrounded by *Abies mariesii* zone at the lower end and *Pinus pumila* zone at the upper end. We set ten open top chambers sized 105 x 105 cm width x 210 cm tall. Five of those chambers were covered with transparent panels at four sides during all seasons (all season warming treatment), and the other five were covered with panels during only summer seasons. Quadrrats sized 55 x 55 cm were set in all the chambers, as well as in five control points outside chambers, for vegetation monitoring.

The interim analysis showed that a dominant shurub species *Vaccinium ovalifolium* gained more current-year shoot growth in the warming treatments (all-season and summer-season warming, combined) than the control from 2010 autumn to 2011 autumn, whilst the difference remained small during 2011 - 2012, suggesting the effect of warming fluctuates over years. Survivorship of *Vaccinium ovalifolium* and *Cladothamnus bracteatus* (both dominant shurubs) was higher in the warming treatments from 2010 to 2012. Plant numbers of the four dominant herbs (*Rubus pedatus*, *Cornus canadensis*, *Streptopus streptopoides* and *Solidago virgaurea* subsp. *leiocarpa*) tended to decrease in the warming treatments over 2010 and 2012. These results suggest that shurubs overgrow under global warmig in the alpine forest limit, leading to decay of herbs by shading. Such vegetation change would impact the animal and microbial communities as well as the biogeochemical cycle, that we and collaborators have been monitoring and expect to report in the near future.

Keywords: Global warming, Biodiversity, Community, Ecosystem, Open Top Chamber, JALPS

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-16 Room:301A Time:May 22 14:30-14:45

# Effect of mountainous topography to genetic differentiation of two Leptocarabus beetles that inhabit different altitude

Takahiro Ogai[1*], Hirao, Akira[1], Tanaka, Kenta[1]

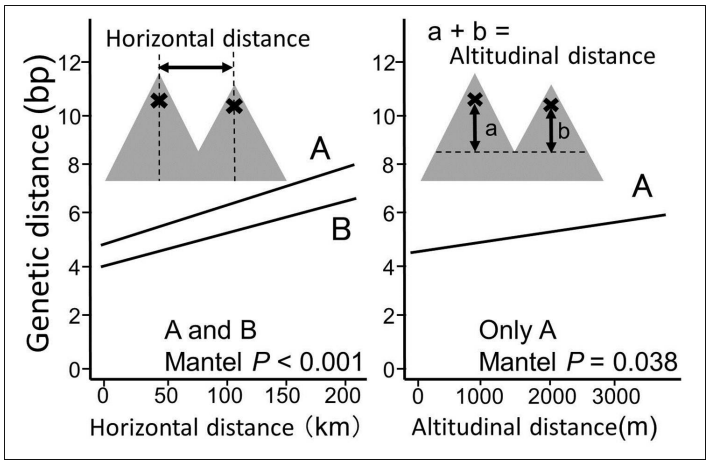
[1]Sugadaira Montane Research Centaer, University of Tsukuba

We studied genetic differentiation of two *Leptocarabus* subgenus (Carabidae; *Carabus*) that inhabits different altitude to reveal the role of mountainous topography as geographic barrier. In the Japanese Alps, *C. (L.) arboreus* and *C. (L.) procerulus* are high- and low-altitude species, respectively. The high-altitude species has seven morphological subspecies in the Japanese Alps. In this study we tested two hypotheses (1) high-altitude species is genetically more differentiated than low-altitude species and (2) geographic barrier, especially saddle altitude between mountain ranges affects genetic differentiation of high- altitude species; and examined (3) whether subspecies are supported by molecular phylogeny.

Focal species were sampled in two or more sites of each of eight mountain ranges in the entire Japanese Alps. DNA sequences of two nuclear genes (28S rDNA, and *Wingless*) were obtained for1 - 2 individuals for each species in each site (total seven subspecies, 37 individuals of high-altitude species and 36 individuals of low-altitude species). We did multiple regression analysis to reveal the effect of the pairwise the horizontal distance and the altitudinal distance on the genetic distance.

Our results showed (1) high-altitude species had more number of haplotypes and was genetically more differentiated than low-altitude species (Fig.), (2) in only high-altitude species, the pairwise genetic distance increased with the altitudinal distance (Fig.), particular when the saddle altitude was lower than 1000m, suggesting the importance of mountainous topography on the pattern of genetic differentiation and (3) approximately half of subspecies had peculiar haplotypes and morphological subspecies were supported by molecular phylogeny.

Keywords: molecular biogeography, ground-beetle, subspeciation



Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-17 Room:301A Time:May 22 14:45-15:00

# Range expansion of *Melanitis phedima* in Southern part of Nagano Prefecture

Keiko Koda[1*], Michio Ihara[2], Hiroyuki Moriya[3], Yusuke Kiryu[3], Yoshinori Tsujii[3], Hiroshi Nakamura[3]

[1]Institute of Mountain Science, Shinshu University, [2]Iida City, [3]Education and Research Center Of Alpine Field Science, Faculty of Agriculture, Shinshu University

The dark evening brown *Melanitis phedima* is a butterfly of Satyridae which inhabits Kyushu and Shikoku districts. In recent years, the distribution area of this butterfly has been expanded by the climate change. So it has been observed even in Tokai or Kanto district. This butterfly was observed in the southern part of Nagano Prefecture in 1970 and it became clear that it inhabited there from the 1990s. However, it is supposed that this butterfly cannot pass the winter in the central part of Nagano Prefecture. In this study, we investigated the distribution of this butterfly in the southern part of Nagano Prefecture and predicted the expansion range in the future based on the data stored from 1981. Moreover, this butterfly was reared in the incubators of the various temperature conditions and the total effective temperature and the developmental zero were calculated by the relation between the rearing temperature and the developmental period.

Keywords: *Melanitis phedima*, Nagano Prefecture, Range expansion

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-18 Room:301A Time:May 22 15:00-15:15

# Is the mountain ant *Myrmica kotokui* a single species?: an approach from molecular phylogeny and chemical taxonomy

Shouhei Ueda[1*], Matsuzuki, Tetsuya[2], NOZAWA, Taito[2], YAMAMOTO, Takeshi[2], ANDO, Tao[2], ITINO, Takao[1]

[1]Institute of Mountain Science, Shinshu University, [2]Department of Biology, Faculty of Science, Shinshu University

Modern molecular phylogenetic techniques have revealed that some morphological species are divided into several genetically distinct cryptic species. To evaluate the biodiversity of a taxonomic group, it is essential to identify cryptic species. In addition, biogeographical studies that determine the distributions of cryptic species are of crucial importance in conservation biology. However, recently, it has been pointed out that the molecular phylogenetic analysis alone cannot resolve the identification of cryptic species. Each gene is expected to have an independent genealogical history, and their topologies would differ from each other and from the species tree which reflects the history of speciation. Therefore, to identify the cryptic species, we should integrate many types of information, such as molecular phylogeny, chemical taxonomy and morphology. For instance, Schlick-Steiner et al. (2006) succeeded in identifying seven cryptic species in a *Tetramorium* ant species complex which are difficult to distinguish morphologically, by using mtDNA phylogeny, morphology, and cuticular hydrocarbons.

We reconstructed a molecular phylogeny of *Myrmica kotokui* specimens collected from six mountain ranges in the Japanese Alps. The phylogeny showed four highly differentiated clades and they tend to be elevationally segregated between lower and upper mountain zone (Ueda et al. 2012). However, it is not clear whether each of the DNA clades based on the molecular phylogeny represents cryptic species. Thus, we analyzed the cuticular hydrocarbons (CHCs) of the ants that were used for the molecular phylogenetic analysis, and tested whether the CHCs differ between the DNA clades. CHCs are the wax covering the surface of insects, and protect them from desiccation. In ants that have advanced chemical communication, CHCs are also used to discriminate nest-mates from non-nest-mates and conspecifics from hetero specifics. Because CHC profiles are expected to be species specific, it is useful to evaluate cryptic species in ants.

The CHC profiles of the *M. kotokui* specimens were analyzed by using gas chromatography-mass spectrometry (GC-MS). Three different types of CHC profiles (A, B and C) were observed. Comparison between the CHC types and the DNA clades showed that a CHC type (C) corresponded to the two clades living in mid and higher elevation, whilst the other two CHC types (A and B) corresponded to two clades living in lower elevation and the two types were intermixed in each clade. The results suggest that the highland type (C) is a reproductively isolated cryptic species, and that introgressive hybridization occurred between the lowland types (A and B).

Keywords: cryptic species, cuticular hydrocarbon, altitudinal gradient, introgressive hybridization, Japanese Alps

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-19 Room:301A Time:May 22 15:15-15:30

# Habitat partitioning between sympatric Japanese wood mice

Ryo Suzuki[1*], Shinsuke Sakamoto[2], Satoshi Suzuki[3]

[1]Sugadaira Montane Research Center, University of Tsukuba, [2]Divisions of Bio-Resources, Department of Biotechnology, Frontier Science Research Center, Universit, [3]The University of Tokyo Forests, Graduate School of Agricultural and Life Sciences

Habitat partitioning can maintain the coexistence of species with very similar ecological traits. We studied habitat partitioning between terrestrial and semi-arboreal congeneric rodents (Apodemus speciosus and A. argenteus) that often coexist despite asymmetry in their competitive abilities. To understand seasonal and habitat variation in their partitioning, we evaluated seasonal variation in food resources, habitat use, and habitat similarity between the species in a site comprising a mixture of grassland, pine forest, and mixed forest. Food resources were available on the ground in all vegetation types in spring and autumn, but were severe in summer. Apodemus speciosus was observed in all types of vegetation on the ground. In contrast, A. argenteus was observed on the ground and on trees in pine forest, especially areas where the understory is covered by dwarf bamboo.

Habitat similarity tests revealed that habitat partitioning between two Apodemus species may vary seasonally, and the relationship depends on habitat structure. This study suggests that the mechanism of habitat partitioning between terrestrial and semi-arboreal rodents in temperate forest is more complex than previously recognized.

This study additionally found that breeding seasons of the two species in this cold region were observed on summer from June to October, whereas breeding seasons of them are observed on spring and autumn in many temperate regions in Japan.

Keywords: coexistence mechanisms, horizontal partitioning, niche division, vertical partitioning

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-P01 Room:Convention Hall Time:May 22 18:15-19:30

# Chemical dynamics of snow layers in the Norikura Highlands

Daichi SUZUKI[1*], Hiroaki Kariyama[1], Takayuki KURAMOTO[2], Akihiko SASAKI[2], Keisuke Suzuki[1]

[1]Dept. Environ. Sci., Shinshu University, [2]IMS, Shinshu University

Precipitation includes various chemical substances. Chemical substances within precipitation were preserved in the snowpack during winter. These substances flushed out during the snowmelt season. It exerts great impact on the environment. Therefore, it is very important to examine its deposit and melt. In this study, we aim to clarify the chemical dynamics of snow layers during winter in the Norikura Highlands, Japanese Alps.

We conducted the regularly snow pit study during winter in the Norikura Highlands. The snow pits were dug through flat and open space. We observed the profile of the snow pit to make clear snow conditions, which are snow stratigraphy, snow temperature, and snow density. Then, we collected the snow samples. The snow samples were melted in the clean room. The pH and electric conductivity were measured after filtration. Concentrations of major ions were measured by ion chromatographs. The total ion leads in the snowpack were decreased in snowmelt season.

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-P02 Room:Convention Hall Time:May 22 18:15-19:30

# The chemical characteristics of spring water in Kamikochi at the Japanese Alps

Takayuki KURAMOTO[1*], Akihiko SASAKI[1], Keisuke Suzuki[1]

[1]IMS, Shinshu University

There are much spring waters in the Azusa River which flows through Kamikochi. These spring waters form the branch of the Azusa River. Spring water shows the characteristics reflecting an underground water flow. Therefore, in order to understand the water cycle of Kamikochi, it is important to understand the formation mechanism of spring water. The purpose of this study is to clarify the characteristics of spring water which forms the branch of Azusa River in Kamikochi. We set up the thermometer in five places of a basin for the measuring of spring and river water temperature. The water samples were collected in water temperature measuring site and Azusa River from July 2011. The pH, electric conductivity, major ions, and stable isotope of water were analyzed with the pH meter, conductivity meter, ion chromatographs, and isotope mass spectrometer, respectively. In addition, $HCO_3^-$ concentration was measured using the sulfuric acid titration method. At many observation points, the temperatures of spring water showed seasonal change. However, only one site did not have change of water temperature through a whole year.

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-P03 Room:Convention Hall Time:May 22 18:15-19:30

# Snow Depth Measurement using GPS on Karasawa Cirque, Japanese Northern Alps

Akihiko SASAKI[1*], Katsuhiko ASAHI[1], Keisuke Suzuki[1]

[1]IMS, Shinshu Univ.

In the mountainous area, snow depth is known to increases so as to become of high altitudes. However, the snow depth distribution are hardly measured in the high mountain. It is significant to clarify the snow depth distribution based on actual measurement of snow depth in order to calculate the water equivalent of snow in its hydrographic basin. The measurement using GPS is attracted to attentions because the method of the GPS measurement is simple and high resolution. Especially, the Kinematic GPS measurement using two GPS receivers make possible to the measurement a wide area in a short time. We aim to measure the snow depth based on the Kinematic GPS measurement in Karasawa Cirque where is one of the biggest cirque in Japan,during snowmelt season in 2012.

Keywords: GPS, Kinematic Survey, Snow depth, Karasawa Cirque

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-P04 Room:Convention Hall Time:May 22 18:15-19:30

# Perennial snow patch distribution in Japanese Alps Region by aerial photograph interpretation

Katsuhiko ASAHI[1*], Keisuke Suzuki[1]

[1]Institute of Mountain Science, Shinshu University

Variations in glaciers are visible indicators of climate change, especially in mountain region. In Japan, snow patch can be an alternate indicator since glaciers, long years, were not recognized in the Japanese Alps. One characteristic of the Japanese Alps is their extensive distribution of perennial snow patch. A snow patch inventory for this mountain is urgently required, not only for monitoring snow patch variations but also to evaluate water reservoir in the region. Limited number of studies has attempted to complete snow patch atlas in Japan. As a step in this direction, the authors have produced a snow patch inventory of 1976/77. This study addresses the results of snow patch mapping. The status of snow patch distribution may indicate snowfall character in winter and also future possibilities of snow patch change.

The work of compiling a perennial snow patch inventory for the Japanese Alps initially involved preparing a detailed map using aerial photographs. First, vertical aerial photographs at scales of about 1:16 000 were interpreted for the entire study area using a stereoscope. The photographs were taken by the Geographical Survey of Japan in fall seasons of 1966 and 1967. In addition, aerial photographs taken by the Forest Agency of Japan in 2009/2010 and 1968/1969 were applied. Then the compilation of these perennial snow patch maps may identify snow patch variations during the past 43 years. The planimetric outline of each perennial snow patch of fall was carefully delimited and drawn on 1:25 000 scale topographical maps. Interpretation of stereopairs of aerial photographs was employed to determine the exact three-dimensional position of snow patch with reference to the surrounding topography. Moreover, stereo interpretation was used to discriminate snow patch from other associated assemblages around a snow patch could be misconstrued to be snow patch forms. Debris flow, landslide portion, and gully erosion can be clearly clarified, while an orthoimagery cannot discriminate them from small-sized snow patch. Once satellite images were applied for the compilation of inventories, the spatial resolution of the imagery limited the accuracy of mapping. However, when stereopair of aerial photographs are used, mapping resolution depend not on the scale of the aerial photographs but on the scale of the base map. This study used 1: 25 000 scale topographical maps. 1 mm at this scale corresponds 25 m of actual distance on the ground; hence this is regard as the limit of resolution for the snow patch map produced by this study.

Snow patch maps from around the study area illustrate successful aerial photograph interpretation in the Northern Japanese Alps and Mt. Norikura. Even very tiny snow masses, smaller than 0.005 ha, were identified. Then manual delineation from aerial photograph interpretation is reliable method of producing complete, accurate perennial snow patch maps. The inventory of 1976/77 thus compiled reveals 226 perennial snow patches with a total surface area of 244.41 ha (2.44 $km^2$). Major distribution concentrated in Mts. Tsurugi and Tateyama, whereas highest mountains, the Yari-hotaka Mountains, the southern part of the Northern Japanese Alps have quite limited number of snow patches. In addition, almost of all snow patches distribute the eastern flank of the mountains, in contrast, rare snow patches at the western flank of the mountains. The biggest snow patch appeared at Tsurugi-sawa valley with the area of 14.94 ha and length of 1410 m. Basically Mt. Tsurugi has 62 perennial snow patches with the total surface area of 90.69 ha. Distribution changes of these perennial snow patches during the past 34 years are not so remarkable. However minor change in the size and distribution are significant.

Keywords: Snow patch, Japanese Alps Region, aerial photograph

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-P05 Room:Convention Hall Time:May 22 18:15-19:30

# Impacts of forest harvesting on micro-climate and sediment transport in a mountain area

Fumitoshi Imaizumi[1*], Ryoko Nishii[2], KENICHI UENO[2], Kousei Kurobe[3]

[1]Faculty of Agriculture, Shizuoka University, [2]Faculty o Life and Environmental Sciences, University of Tsukuba, [3]Graduate School of Life and Environmental Sciences, Universtiy of Tsukuba

Most of knowledge on the sediment transport in forests has been obtained by many field studies conducted in low mountain areas. In contrast, only few studies on the sediment transport have been conducted in deep mountain areas, because of the difficulties in monitoring. Mountain areas can be characterized as colder climate as well as steeper topography. Effect of these characteristics on types and timing of sediment transport is not sufficiently clarified. Therefore, we have conducted field observations on the sediment transport and the micro-climate in Ikawa University Forest, Akaishi Mountain Range, central Japan. We also harvested part of trees in our study site and observed changes in the sediment transport and the micro-climate to discuss impact of forest harvesting on them. The study site is located in 38-year-old hinoki (Chamaecyparis obtusa) artificial forest. In June 2011, six sediment traps were set up to investigate spatial distribution of sediment transport in the forest. We collected and weighed sediment captured by traps once in a month. We also monitored micro-climate (e.g., temperature, amount of radiation, soil moisture) near sediment traps. Clear cutting of trees was conducted around three sediment traps from March 2012 to September 2012. Our observation results show that the sediment transport rate is largely different among sediment traps. Spatial variability of slope morphology and grain size may result in wide range of the sediment transport rate. In autumn (non-freezing season), sediment transport rate was high in the periods with larger rainfall events (i.e., daily rainfall $>$ 50 mm). Sediment transport was also observed in the winter when freeze-thawing occurs. Daily variation of the ground temperature and amount of soil moisture became larger after clear cutting of trees. However, the sediment transport rate did not change clearly (or decreased) by the cutting. By field surveys, we found that sediment coming from upper slopes was captured by leaves and brunches of harvested trees left on the ground surface. Thus, sediment transport rate is influenced by combination of various factors (i.e., changes in micro-climate and covering of ground surface) resulting from clear cutting of trees.

Keywords: forest harvesting, sediment trasport, micro-climate, mountain area

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-P06 Room:Convention Hall Time:May 22 18:15-19:30

# Carbon cycling in an old-growth beech-oak forest of cool-temperate region, Mt. Hakusan

Toshiyuki Ohtsuka[1*], Vilanee Suchewaboripont[1], Yasuo Iimura[1], Ma Qian[1], Shinpei YOSHITAKE[1], Akira Komiyama[2]

[1]River Basin Research Center, Gifu University, [2]Faculty of Applied Biology, Gifu University

Old-growth temperate deciduous forests were grown in a middle slope (840-1600 m) of Mt Hakusan, Gifu, central Japan. Mt Hakusan has erupted in the middle of 16 century, and no human disturbance occurred in these areas up to the middle of 20 century. The carbon balance of a forest varies dramatically at different successional stages. In general, a forest stand is expected to be a C source for several years at the beginning of secondary succession. Even-aged forests, such as coppiced forests or plantations, reach the peak of net ecosystem production (NEP) in a middle age (ca. 40-50 years) after disturbance in turn NEP declines as forest mature and finally reach to GPP/RE ratio = 1 (NEP=0). In contrast, old-growth natural forests with gap dynamics might have different pattern compared to even-aged mature forests. However, few studies of carbon cycling were conducted in old-growth forests especially in Japan. We set up a 1 ha permanent quadrat in an beech-oak old growth forest on Mt. Hakusan (1330 m) in 2011 to study carbon cycling and to estimate biometric-based NEP. Here, we introduced the preliminary study of soil respiration measurement and biometric-based annual NPP in the old growth beech-oak forest during 2012.

Above-ground net stand increment of the old-growth forest was 3.3 t $ha^{-1}$ $yr^{-1}$, and annual biomass increment is 3.1 t $ha^{-1}$ $yr^{-1}$ with a few dead trees during 2012 (dry weight basis). Annual fine litter that produced during 2012 was 4.0 t $ha^{-1}$ $yr^{-1}$, and thus annual aboveground NPP was estimated as 7.3 t $ha^{-1}$ $yr^{-1}$. Aboveground biomass in the old-growth forest was extremely large (479 t $ha^{-1}$), and beech and oak contributed more than 95% biomass almost equally (beech: 236 t $ha^{-1}$, oak: 220 t $ha^{-1}$) in 2011. However, annual total beech growth (2.3 t $ha^{-1}$ $yr^{-1}$) contributed 70% to the total annual stand increment of 2012 in the forest against to total oak growth (0.6 t $ha^{-1}$ $yr^{-1}$) contributed 18%. Aboveground NPP in the old-growth forest fell with in the data of Japanese cool-temperate deciduous forest stands (8.74 $^{+}_{-}$ 3.47 t $ha^{-1}$ $yr^{-1}$), and thus, growth of beech is rather high even in old-aged (may be more than 400 yrs) with large biomass.

Moreover, daily soil respiration (RS) was measured using soda lime method: 100- closed chambers (23.5 cm in diameter, ca. 16 cm in height) were used in each 10 by 10 m subquadrat in every month during growing season (June to November) in 2012. Daily soil respiration was exponentially correlated with soil temperature at 1 cm depth, and the Q10 value was 1.67. Annual RS was calculated based on the soil temperature monitoring in the field. Total annual RS (only in growing season) was 3.19 tC $ha^{-1}$ $yr^{-1}$, which was rather small compared to the other temperate forests (ranged from 4.5 to 9.1 tC $ha^{-1}$ $yr^{-1}$). These data (high NPP and low RS) suggested that rather large C sinks in the beech-oak old-growth forest under study although we need to separate RS to autotrophic and heterotrophic respiration to estimate biometric-based NEP.

Keywords: Mt. Hakusan, Caron cycling, Net ecosystem production, Net primary production, Soil respiration, Beech forest

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-P07 Room:Convention Hall Time:May 22 18:15-19:30

# Comparison of quantity and quality of soil organic carbon between matured and gap areas in an old-growth beech forest

Yasuo Iimura[1*], Mitsuru Hirota[2], Hideyuki Ida[3], Toshiyuki Ohtsuka[1]

[1]River Basin Research Center, Gifu University, [2]The Graduate School of Life and Environmental Science, University of Tsukuba, [3]Institute of Nature Education in Shiga Heights, Faculty of Education, Shinshu University

We performed this study to further understand the effect of canopy gap stands on surface soil carbon dynamics in cool-temperate deciduous broad-leaved old-growth forests. We investigated the annual aboveground litter production, soil organic matter content, and soil humic acids (soil organic matter) quality in several matured (n=7) and gap (n=3) areas (each area was 20 m times 20 m) in a Japanese old-growth beech forest. The annual fine litter (foliage) production from 2005 to 2011 in the matured area was totally higher than that in the gap area; however, those of annual coarse litter production were not so different. The gravimetric soil carbon content in the matured area was significantly higher than that in the gap. In addition, the C:N ratios in the matured area were significantly higher than those in the gap. The estimated compositions of carbonyl C and aromatic C and those of O-alkyl C and alkyl C in total C of soil humic acids in the matured area were higher and lower, respectively, dependent on higher A600/C values, than their respective compositions in the gap area. Furthermore, the ratio of alkyl C to O-alkyl C in the matured area was significantly lower than those of the gap. Our data strongly suggests that, compared to the closed canopy stands, canopy gap stands in this study site can be a carbon source, which is particularly dependent on labile carbon dynamics.

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-P08 Room:Convention Hall Time:May 22 18:15-19:30

# Influence of soil formation on spreading process of Abies mariesii : Case study in the Hachimantai area

Asaka Konno[1*]

[1]Miyagi University of Education, MA

Coniferous forest composed of Abies mariesii and Abies veitchii commonly covers subalpine zone of Tohoku and Japanese Alps, although its extent and maturity vary even in adjacent areas corresponding to some local factors such as landform and snow cover. In case of Hachimantai, Abies mariesii forest is well distributed in its northern part in contrast with the southern part where the coniferous forest is scanty. This study investigate the spreading processes of Abies mariesii forest in Hachimantai in terms of soil formation.

The results suggest that the matured Abies forest widely covers the areas in which black soils are well developed. The Abies forest on places where black soils are less developed is scattered or immatured. The past palynological studies also support this correspondence. It is estimated that spreading processes of Abies forest is closely related to soil development.

Keywords: Abies mariesii, Soil formation, Pseudo-Alpine Zone, Vegetation changes

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-P09 Room:Convention Hall Time:May 22 18:15-19:30

# Repeated migration of *Dasiphora fruticosa* during the Pleistocene revealed by comparison between Japan and Tibetan

Ayako Shimono[1*]

[1]Gene Research Center, University of Tsukuba

Alpine plants would experience several cycles of range contractions and expansions in response to the Pleistocene climate fluctuations. Such range and demographic changes affects the geographical patterns of genetic variation within and among populations. Such genetic variation indicates where species survived and how species colonized their present-day distribution using the molecular approaches

*Dasiphora fruticosa* L. (Rosaceae), an alpine shrub, is widely distributed in Northern hemisphere. In this study, phylogeographic analysis was conducted using samples from Qinghai-Tibetan Plateau and Japanese archipelago to reveal that the Japanese populations have been migrated to Japan in several times.

Leaf materials of *D. fruticosa* were collected from 23 populations from inner to northeast across the Qinghai-Tibetan Plateau and five populations from Japan. The sequence variation and geographical distribution of the chloroplast *matK* region were analyzed. 33 and 23 haplotypes were detected from the Qinghai-Tibetan plateau and Japan, respectively.

Two Japanese haplotypes were closely related to haplotypes detected in the inner plateau. These were belonging to different clades. One clade indicated deep divergence and included relatively ancestral haplotypes. The other clade included relatively derived haplotypes. These results suggested that *D. fruticosa* has been migrated to Japanese Archipelago at least two times. Although just one of the two clades was detected in central Japan, two clades were detected in Northern Japan.

The population of Hokkaido mountain showed high levels of genetic diversity and had unique haplotypes that were restricted to this area. The Hokkaido mountain maintains longer history of *D. fruticosa* and/or enough population size avoiding bottleneck from past to present than other regions.

Keywords: alpine plant, genetic diversity, phylogeography, refugia

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-P10 Room:Convention Hall Time:May 22 18:15-19:30

# Open field warming experiments for forest carbon cycling in Takayama, Japan

Hiroyuki Muraoka[1*], NamJin Noh[1], Taku M. Saitoh[1], Masatoshi Kuribayashi[1], Hikibi M. Noda[2], Shin Nagai[3]

[1]Gifu University, [2]University of Tsukuba, [3]JAMSTEC

Experimental evaluation of the effects of rising temperature on carbon cycling processes in forest ecosystems is one of the central interests in ecosystem science under climate change. We have established open field warming experiments in a cool-temperate deciduous broadleaf forest in Takayama site, central Japan, to investigate the responses of foliage photosynthesis in a canopy tree (*Quercus crispula*) and soil carbon dynamics to artificial warming treatment. Warming treatment for canopy tree (+5degreeC) was made by installing an Open-Top Canopy Chamber (OTCC) to three branches at the top of tree crown by an aid of canopy-access tower (18m height), and for soil (+3degreeC) it was made by installing heating cables to a depth of 3-5cm. Air temperature in the OTCC and soil temperature in the warming plots are monitored by temperature probes, respectively.

We monitored foliage phenology by automated digital camera system, and leaf-level ecophysiological characteristics by periodical measurements of chlorophyll content (biochemical assay and SPAD meter), photosynthetic and respiratory CO2 gas exchange (LI-6400, Li-Cor, Inc.) and leaf mass per area. Rising air temperature of the branches resulted in earlier leaf expansion (ca 5 days) and delayed leaf senescence (ca 5 days), and about 10% higher photosynthetic capacity in early summer, while leaf morphological characteristics were not influenced by the temperature treatments.

We examined the diurnal and seasonal patterns of soil respiration in warmed and control plots by using automatic measurement system (LI-8100, Li-Cor, Inc.) and portable non-dispersive infrared gas CO2 sensors (GMP343, Vaisala CARBOCAP, Finland). Soil warming treatment decreased soil moisture by about 6.4% and enhanced annual soil respiration by about 10% during growing season without snow cover. Temperature sensitivity (Q10) was different between control (3.06) and warmed (2.75) plots. The diurnal and seasonal variations in soil respiration might reflect the changes in physiological activities of plant roots and microbial organisms with increasing temperature.

Keywords: carbon cycle, global warming, forest ecosystem, photosynthesis, soil respiration

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-P11 Room:Convention Hall Time:May 22 18:15-19:30

# Monitoring leaf-out day of forests in Gifu, Japan using Terra/MODIS data

Yoshio Awaya[1*], Izumi Nagatani[2]

[1]River Basin Research Center, Gifu University, [2]Nippon Hakuyo Electronics, ltd.

Carbon dioxide concentration in the atmosphere would accelerate global warming. Therefore climate change would have strong effects on terrestrial ecosystems, and analyzing the impacts on terrestrial ecosystems is required. Growth stages of vegetation are controlled by air temperature in the humid temperate zone. The seasons from spring to autumn under high air temperature are growth period by photosynthesis. Winter under cold air temperature is dormant season. Global warming would make the growth period longer. If photosynthesis becomes possible through a year due to air temperature rise, deciduous trees are left out of their own habitat. Monitoring phenology would be important to evaluate effects by global warming. However, observing phenology is difficult in large forests on the ground.

MODIS sensors on Terra and Aqua satellites observe the same point on the earth every day, although their ground resolution is coarse. MODISs observe red and near infrared bands, which are effective for vegetation analysis, with 250m resolution, and their reflectance images after atmospheric and geometric corrections are open to public. Even MODISs observe the same point every day, MODISs cannot observe the ground quite often due to cloud over Japan in the humid temperate with frequent cloud covers. Therefore cloud free images are produces by mosaicking 8 days' or 32 days' images, and phenology is analyzed by curve fittings using the normalized difference vegetation index (NDVI) images with smoothing. The smoothing and curve fittings would reduce accuracy of analysis, since they change seasonal trends of NDVI slightly.

We produced a leaf-out day analysis method using a linear regression model which showed a trend of NDVI change at each pixel. We applied the linear model to daily MODIS NDVI of each year in the leafing period and estimated leaf-out days over forests in Gifu prefecture. The process is as follows. 1) Moving averages of NDVI during 3 days in some years and their moving median during 7 days were computed on each pixel according to the day of year (DOY) from the New Year's day. 2) A linear regression line was estimated selecting DOY as an independent and NDVI as the dependent variables in each pixel during the leafing period. 3) A threshold value at the time of leafing start was determined by searching NDVI after dropping leaves in autumn. 4) The leaf-out date was estimated using the linear regression line and the threshold value in each pixel using daily NDVI data.

Advantages of this method are as follows. 1) Leaf-out day can be determined daily basis in each pixel. 2) Since any smoothing and curve fittings are not applied, the method analyzes NDVI change trends in detail. 3) Mixed pixels with different forest types can be analyzed by the same method. Although the method is not suffered by noises by clouds, noises of increasing NDVI by atmospheric correction errors reduce accuracy.

The method estimated leaf-out days quite accurately in deciduous forests with great seasonal NDVI changes in snowy areas. On the other hand, leaf-out day was not estimated in evergreen forest, since coefficients of determination were not high enough in the regression analysis due to small seasonal changes and the linear equations were not reliable. Inter-annual changes in pixels of evergreen forests where leaf-out day was estimated appeared greater than those in deciduous forests. It suggested that additive noises on NDVI reduced accuracy. Accurate leaf-out day estimation was also difficult in mixed pixels with urban areas, farm lands and forests. We concluded that mapping of inter-annual changes of leaf-out days was possible in deciduous forest, however, effects of global warming were not validated yet due to the short period of MODIS images available.

This research was executed in the research project " Development of mitigation and adaptation techniques to global warming in the sectors of agriculture, forestry, and fisheries" by MAFFIN.

Keywords: phenology, leaf-out day, MODIS, NDVI

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-P12 Room:Convention Hall Time:May 22 18:15-19:30

# Successional changes in vegetation and soil microbial community in a volcanic desert on Mount Fuji, Japan

Shinpei YOSHITAKE[1*], FUJIYOSHI, Masaaki[2], WATANABE, Kenichi[3], MASUZAWA, Takehiro[4], NAKATSUBO, Takayuki[5], KOIZUMI, Hiroshi[6]

[1]Gifu Univ., [2]Tokai Univ., [3]NIPR, [4]Shizuoka Univ., [5]Hiroshima Univ., [6]Waseda Univ.

Lava flows and ash deposits from volcanic eruptions create virgin land surfaces on which ecosystem development processes such as plant colonization and soil formation begin. Such areas affected by volcanic activity are referred to as ”volcanic deserts”. Volcanic deserts are nutrient-poor ecosystems, and therefore the soil microorganisms function as drivers of carbon and nutrient cycles and soil formation through their role in the decomposition of soil organic matter, and their roles as sources of, and sinks for, labile carbon and nutrients are of great importance. This suggests that successional changes in the microbial community will greatly affect soil C and N pools and cycling in volcanic deserts.

In subalpine volcanic deserts such as those in Japan, we can find isolated island-like plant communities at different developmental stages. The presence of these island-like communities at different successional stages in a small area with the same altitudinal location and initial conditions therefore provides a good opportunity to investigate successional changes in the plant community, soil characteristics, and soil microbial community after a volcanic eruption. However, there is little information about the relationships between the shifts in microbial properties and the development of island-like communities.

In this study, to study the relationship between vegetation development and changes in the soil microbial community during primary succession in a volcanic desert, we examined successional changes in microbial respiration, biomass, and community structure in a volcanic desert on Mount Fuji, Japan.

The study was conducted on the southeastern slope of Mount Fuji between 1500 and 1550 m above sea level. Soil samples were collected from six successional stages, including isolated island-like plant communities. We measured microbial respiration in our laboratory and performed community-level physiological profile (CLPP) analysis, phospholipid fatty acid (PLFA) analysis, and denaturing gradient gel electrophoresis (DGGE) analysis of 16S rDNA amplified by polymerase chain reaction (PCR) to determine the microbial community composition from functional, taxonomic, and genetic perspectives, respectively. Combining these methods should provide a better understanding of soil microbial communities from multiple (functional, taxonomic, and genetic) perspectives.

Microbial biomass (total PLFA content) increased during plant succession and was positively correlated with soil properties including soil water and soil organic matter (SOM) contents. The microbial respiration rate per unit biomass decreased during succession. Nonmetric multidimensional scaling based on the PLFA, DGGE, and CLPP analyses showed a substantial shift in microbial community structure as a result of initial colonization by the pioneer herb *Polygonum cuspidatum* and subsequent colonization by *Larix kaempferi* into central areas of island-like communities. These shifts in microbial community structure probably reflect differences in SOM quality.

Microbial succession in the volcanic desert of Mt. Fuji was initially strongly affected by colonization of the pioneer herbaceous plant (*P. cuspidatum*) associated with substantial changes in the soil environment. Subsequent changes in vegetation, including the invasion of shrubs such as *L. kaempferi*, also affected the microbial community structure.

Keywords: Island-like plant community, Microbial biomass, Microbial community structure, Primary succession, Volcanic desert

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


ACG35-P13 Room:Convention Hall Time:May 22 18:15-19:30

# Vertical distribution and Seasonal change of Shilphidae community in the Central Alps

Hiroshi Nakamura[1*], Kenji Tsujii[1], Takahumi Kurosaki[1], Yosuke Nakayama[1], Keiko Koda[2]

[1]Education and Research Center Of Alpine Field Science, Faculty of Agriculture, Shinshu University, [2]Institute of Mountain Science, Shinshu University

The burying beetle is an insect belonging to Coleoptera (Silphidae). It eats the dead body of animals. Since the body length of the burying beetle is comparatively large and the species identification is easy, it is suitable as a bio-indicator. In recent years, change of biota has broken out on the earth by global warming.

It is possible to monitor global warming using the burying beetles. In this study, the seasonal change and the vertical distribution of the community structure of the burying beetles were investigated in the Central Alps of Nagano Prefecture, and the results were reported.

Keywords: Shilphidae, Vertical distribution, Seasonal change, Nagano Prefecture