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Localization of VLF ionospheric exit point by comparison of multipoint ground-based observation with full-wave analysis

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In order to estimate the dynamic structure of the VLF ionospheric exit point, we conducted multipoint ground-based observation of the natural VLF emissions at three unmanned sites: West Ongul (69° 01´ S, 39° 30´ E), Skallen (69° 40´ S, 39° 24´ E), and H100 (69° 18´ S, 41° 19´E) around Japanese Syowa station, Antarctica, during a whole year of 2006. In this observation, we developed three sets of unmanned autonomous observation systems for natural VLF emissions. Each observation system consists of two crossed vertical loop antennas to pick-up North-South (NS) and East-West (EW) magnetic components, a multi-channel analyzer, and a data logger. The intensity and polarization of NS and EW magnetic components are obtained in 4 spaced frequency (0.5, 1.0, 2.0, and 6.0 kHz) channels by the multi-channel analyzer.

The VLF emissions observed at the three sites exhibit an interesting difference in the wave intensity as well as the polarization that allows important information about the locations of their ionospheric exit point to be determined. Firstly, to find the distinct exit point, we have theoretically calculated the spatial distributions of the wave intensity and the polarization on the Earth for VLF whistler mode waves coming down from the magnetized ionosphere, by using the full-wave analysis. Then, we have compared the calculated results with the observed data, to evaluate the possible locations of the ionospheric exit point for the auroral hiss events.

As an example, the direction of the estimated ionospheric exit point for the auroral hiss event at 31 March 2006 was found to be consistent with a bright aurora region. However, in this case, the estimated ionospheric exit point was located a few hundred kilometers equatorward of the associated aurora. This would suggest that the ray paths for the auroral hiss could be different from the directions of the geomagnetic field lines for auroral precipitation.

A Method for the Analysis of Ultra-trace Levels of Semi-volatile and Non-volatile Organic Compounds in Snow and Application to a Greenland Snow Pit

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A method was developed to quantify a suite of organic compounds from snow melt water samples present at trace level concentrations, using a dichloromethane liquid–liquid extraction and GC–MS. Samples from a 3–m snow pit sampled in 2005 from Summit, Greenland were analyzed using the method developed, and a profile of organics over the past 4 years was compiled. Supporting data including the concentrations of total organic carbon (TOC), low molecular weight acids, and trace elements were determined using well established methods. The results show that low molecular weight acids contribute a significant percentage, up to 20%, of the measured TOC. Hopanes were measured quantitatively for the first time in Greenland snow. Hopanes, as well as PAHs, are at very low concentrations and contribute 0.0002–0.004% to TOC. Alkanes and alkanoic acids were also quantified, and contribute less than 1% and up to 7%, respectively to TOC. No apparent seasonal pattern was found for specific classes of organic compounds in the snow pit. The lack of seasonal pattern may be due to post–depositional processing.

Interpretation of the GRACE Mass Trend in Enderby Land, Antarctica

Keiko Yamamoto; Yoichi Fukuda; Koichiro Doi; Hideaki Motoyama
Monthly gravity solutions of the Gravity Recovery and Climate Experiment (GRACE) reveal three areas in Antarctica with striking interannual mass trends. The positive mass trend in Enderby Land, East Antarctica, is poorly understood because of uncertainties in the surface ice–sheet mass balance, post–glacial rebound (PGR), and processing of GRACE data. In this study, we compare the GRACE mass trends with values estimated from in situ snow–stake measurements, and Ice Cloud and land Elevation Satellite (ICESat) data. The mass trends estimated from ICESat data show a strong correlation with GRACE mass trends. In contrast, the snow–stake data show discrepancies with temporal variations in GRACE mass, especially in 2006. The discrepancies are probably associated with basal ice–sheet outflow, which is difficult to observe using snow stakes. We conclude that the bulk of the GRACE mass trend can be explained by snow accumulation and basal ice–sheet outflow.

Soil organic carbon pools in alpine to nival zones along an altitudinal gradient (4400–5300 m) on the Tibetan Plateau

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To accurately estimate soil organic carbon (SOC) storage in upper alpine to nival zones on the Tibetan Plateau, we inventoried SOC pools in 0–0.3 m profiles along an altitudinal gradient (4400–5300 m asl). We also studied vegetation properties and decomposition activity along the gradient to provide insight into the mechanisms of

SOC storage. The vegetation cover and belowground root biomass showed a gradual increased with altitude, reaching a peak in the upper alpine zone at 4800–4950 m before decreasing in the nival zone at 5200–5300 m.
Decomposition activity was invariant along the altitudinal gradient except in the nival zone. SOC pools at lower sites were relatively small (2.6 kg C m^{-2} at 4400 m), but increased sharply with altitude, reaching a peak in the upper alpine zone (4950 m; 13.7 kg C m^{-2}) before decreasing (1.0 kg C m^{-2} at 5300 m) with altitude in the nival zone. SOC pool varied greatly within individual alpine meadows by a factor of five or more, as did bulk density, partly due to the effect of grazing. Inventory data for both carbon density and bulk density along altitudinal gradients in alpine ecosystems are of crucial importance in estimating global tundra SOC storage.

Discovery of an ice cave in the Yatude Valley, Langhovde, Dronning Maud Land, East Antarctica

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A circular hole was discovered on the downstream side of a glacier dam in the Yatude Valley, Langhovde, East Antarctica, during the 2005–2006 austral summer. The opening of this hole is the first opportunity enabling us to observe the interior of the dam. The opening led to a large cave in the dam, raising the possibility of meltwater drainage through the dam. The Yatude Valley is an approximately U-shaped fluvial valley. The valley floor has been incised to form a box-shaped inner valley that contains fluvial terraces and large boulders upon the valley floor. The origin of these features can be explained by a large amount of running water; however, we consider it unlikely that a regular current has flowed through this site for a long period. Instead, it is more likely that large quantities of lake water have been periodically discharged due to collapse of the glacier dam or spilling out through a tunnel channel within the cave. The discovered hole and the ice cave are key features in understanding the historical development of the Yatude Valley in relation to the melting history of the Antarctic ice sheet.