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Meteorological influences of SST anomaly over the East Asian marginal sea on subpolar and polar regions: A case of an extratropical cyclone on 5–8 November 2006

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The eddy-resolving Japan Sea (East Sea) data assimilation affects the mid-level troposphere via vertical wind in the early stage of an explosively developing extratropical cyclone on 5–8 November 2006, and its influence further propagates toward the subpolar and polar regions. Two types of atmospheric responses (convective and gravity-wave patterns) to a sea surface temperature (SST) difference resulting from the ocean data assimilation are found in the early stage of the cyclone development over the western and central Japan Sea. A gravity-wave (convective) pattern appears when the near-surface atmosphere is stable (unstable). The atmospheric signals induced by the SST anomaly resulting from assimilation of the ocean circulation model are subject to advection and can deform with time owing to nonlinearity and instability. The differences in atmospheric and surface temperatures are widely and rapidly spread over the polar region by strong synoptic-scale cyclonic advection. On the other hand, the SST effects on vertical flow and precipitation are limited to narrow areas around the northern Japan Sea and the Pacific cold front in the fully developed stage. Such a developing cyclone is potentially important as a transporter of the meteorological influence over the Japan Sea toward the polar region.

Very-low-frequency electromagnetic (VLF-EM) measurements in the Schirmacheroasen area, East Antarctica

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To assess the feasibility of the very-low-frequency electromagnetic (VLF-EM) method in the Schirmacheroasen area of East Antarctica, and to investigate its response, VLF-EM measurements were performed along four traverses. The preliminary results reveal the locations of geological boundaries and shear zones/faults, which may indicate that VLF anomalies are due to shear zones or alteration zones located along contacts between different rock types. The strength

of the VLF anomaly decreases over the polar ice cap. The inphase component of the VLF anomaly, when processed and interpreted with an analytic signal approach, yields a depth range of 15–30 m, whereas Fraser and Hjelt filter analyses yield a depth range of 25–60 m. The VLF–EM responses along all four traverses, along with their interpretations, are presented here as a case study.

Validation of global ocean tide models using the Superconducting gravimeter data at Syowa Station, Antarctica, and *in-situ* tide gauge and bottom-pressure observations

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We performed a validation study of six ocean tide models (CSR4.0, GOT99.2b, NAO.99b, FES2004, TPXO7.1, and TPXO7.2) using superconducting gravity data recorded at Syowa Station. From comparison with the observed loading effects, the most optimum ocean tide model was found to be TPXO7.2, which had a combined root-mean-square (RMS) misfit of 0.194 μGal for the eight major (four diurnal and four semidiurnal) waves. The next best ocean tide model was NAO.99b, with a combined misfit of 0.277 μGal. To determine the effect of inclusion of regional tide gauge and bottom-pressure data around Syowa Station, we estimated the combined RMS error for all eight waves; incorporation of these regional data into the TPXO7.2 model resulted in a 5% reduction in the misfit. Our phase lag anomalies indicate that the scatter of the out-phase component was greater than that of the in-phase component in the final residuals; this tendency was especially clear for O1, K1 and M2 waves. Improvement of the phase differences was the key to determine the optimum ocean tide model.

Community structure of culturable bacteria on surface of Gulkana Glacier, Alaska

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Viable bacterial communities on the surface of Gulkana Glacier (Alaska) were investigated using a cultivation method. Viable bacteria were isolated using R2A, diluted-R2A (DR2A), LB, diluted-LB (DLB), and xylose agar at 4, 15 and 25 °C. The highest number of colony-forming units (CFU) was observed on DR2A agar plates at 4 °C, ranging from 10^4–10^5 CFU mL^{-1}. A collection of 234 morphologically distinct isolates was obtained in total. The glacial snow and ice sample was dominated by *Betaproteobacteria* (97 isolates) and *Gammaproteobacteria* (87 isolates). The bacterial communities were examined by amplifying 16S rRNA genes from the isolates, and 34 phylotypes with >99% similarities were obtained. Of these phylotypes, 26 (76.5%) were similar to those phylotypes found in bacteria that were previously recorded from cold environments. Five of the phylotypes appeared in the clone library of a previous independent cultivation study, corresponding with 6.5% in the

clone library. Our results suggest that cold environments harbor common phylotypes of culturable bacteria, which could possibly lead to a better understanding of bacterial diversity on glaciers in combination with molecular studies

Early 20th century warming in the Arctic: A review

Takashi Yamanouchi

From the 1920s to the 1940s, the Artic experienced significant warming that is comparable to the recent 30-year warming. The former warming was concentrated mostly in high latitudes, in contrast to the recent 30-year warming, which has occurred in all latitudes. Several explanations have been proposed; however, one of these proposed explanations, single external forcing, which could once explain the global average, failed to explain the early 20th century scenario. A second possible explanation was internal atmospheric variability with low frequency. Another candidate for the explanation was still forcing by black carbon deposited on snow and ice surfaces. The answer is most likely to be a combination of intrinsic internal natural climate variability and positive feedbacks that amplified the radiative and atmospheric forcing. We must continue our study by discovering historical data, analyzing ice cores, reanalyzing the Arctic system together with long-term reanalysis dating back to the 1880s, and also determine the contributions of each factor.