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Evaluation of stratospheric ozone, temperature, and aerosol profiles from the LOANA lidar in Antarctica

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We present an evaluation of observations from the Lidar Ozone and Aerosol for NDACC in Antarctica (LOANA) at the Dumont d'Urville station, Antarctica. This instrument is part of the Network for the Detection of Atmospheric Composition Change (NDACC), and ensures continuity with lidar measurements made since 1989 with the previous instrument at this site. This study is based on the dataset from 2008 to 2009, and comparisons are made with observations from balloon soundings, and from three satellite experiments: Aura/MLS, TIMED/SABER, and CALIOP/CALIPSO. The lidar ozone data are in very good agreement with the balloon sounding data (ECC sensor), revealing a bias of less than 3% between 17 and 34 km. For temperature, the lidar shows a low bias of −3 K at 20 km when compared with Aura/MLS. Between 30 and 50 km, the bias is less than 2 K. We also present our initial results showing diurnal variations in temperature. The amplitude of these diurnal cycles is on the order of 1 K and is unlikely to account for the temperature biases between LOANA and the reference instruments. Comparisons of total attenuated backscatter reveal good qualitative agreement between LOANA and CALIOP, with differences of less than 30% in the derived optical depth.

A new approach to quantifying soil temperature responses to changing air temperature and snow cover

Michael C. Mackiewicz

Seasonal snow cover provides an effective insulating barrier, separating shallow soil (0.25 m) from direct localized meteorological conditions. The effectiveness of this barrier is evident in a lag in the soil temperature response to changing air temperature. The causal relationship between air and soil temperatures is largely because of the presence or absence of snow cover, and is frequently characterized using linear regression analysis. However, the magnitude of the dampening effect of snow cover on the temperature response in shallow soils is obscured in linear

regressions. In this study the author used multiple linear regression (MLR) with dummy predictor variables to quantify the degree of dampening between air and shallow soil temperatures in the presence and absence of snow cover at four Greenland sites. The dummy variables defining snow cover conditions were z = 0 for the absence of snow and z = 1 for the presence of snow cover. The MLR was reduced to two simple linear equations that were analyzed relative to z = 0 and z = 1 to enable validation of the selected equations. Compared with ordinary linear regression of the datasets, the MLR analysis yielded stronger coefficients of multiple determination and less variation in the estimated regression variables.

Surface temperature inversion in the palsa and pounu fields of northern Finland

Hiroshi Tabuchi, Matti Seppälä

A very large surface inversion, which would not have been detected at the official recording height of 2 m above the mire surface, was recorded at the snow surface of an earth hummock in Lapland. The maximum inversion was 35 ° C, and the monthly temperature departure was 7.8 ° C in December 1992. The characteristics of the surface inversion are compared with conditions during another winter when no long inversion periods occurred. The presence of this surface inversion may explain the formation of new permafrost in pounus, even when official records showed no unusually low temperatures.

Diverse mineralogical and oxygen isotopic signatures recorded in CV3 carbonaceous chondrites

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We describe the petrography and mineralogy of six CV3 carbonaceous chondrites. LAP02206, LAP02228, LAP04843, and GRA06101 are classified as oxidized Allende-like chondrites (CV3oxA). RBT04143 and QUE97186 are classified as members of the reduced subtype (CV3red). Chondrules in the CV3oxA chondrites show extensive Fe-Mg zoning. Fe-rich olivine in the rims of the CV3oxA chondrules are 16O-poor relative to Mg-rich olivine in the cores, suggesting that in addition to Fe and Mg, oxygen was exchanged between chondrules and matrix during weak thermal metamorphism. The CV3red chondrites appear to have formed through various processes. QUE97186 shows chondrule flattening with a preferred orientation, which is interpreted to have resulted from shock impact at a pressure of ~20 GPa. The post-shock residual heat (~1000 ° C) is likely to be responsible for the restricted Fe/Mg ratios of matrix olivine. Based on the degree of Fe-Mg homogenization of matrix olivines, we estimate the spatial scale of the shock-heated region to be ~1 m. RBT04143 is a breccia containing many clasts of two types of lithologies: reduced-type material and very weakly altered material.

Seasonal mortality rates of Oithona similis (Cyclopoida) in a large Arctic fjord

Vladimir G. Dvoretsky

Instantaneous mortality rates of the common planktonic copepod Oithona similis were investigated for the first time in Kola Bay, a region of the Barents Sea that is influenced by freshwater discharge. The rates were estimated in different seasons (December, May, September 2005 and July 2006). A vertical life table approach (VLT) was used to assess mortality. The total abundance of O. similis (copepodites IV and V, and adults) was highest in autumn and lowest in winter. The maximum mortality of O. similis for the stage pair copepodite IV–copepodite V (0.005 ± 0.001 day^<-1>) occurred in December 2005, while the highest mortality rates for the pairs copepodite VM–adult male (0.453 ± 0.026 day^<-1>) and copepodite VF–adult female (0.228 ± 0.006 day^<-1>) occurred in summer 2006. Simple regression analyses showed that the total abundance of each stage and the mortality rates were positively significantly correlated with water temperature. The mortality rates for the stage pairs copepodite VM–adult male and copepodite VF–adult female were positively significantly correlated with chlorophyll a concentration. The abundance and mortality rate of O. similis in each season was determined by life cycle factors, and possibly by the dynamics of its food resources and potential predators.