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Upper Atmospheric Soundings in Ice Base Cape Baranova during the YOPP Special Observing Period

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Abstract: Twice daily upper atmospheric sounding observation was conducted at research station Ice Base Cape Baranova during the Year of Polar Prediction (YOPP) Special Observing Periods (SOPs) of 2018 as a part of Polar Prediction Project (PPP)[1]. This station is noteworthy as it is one of the representative observation stations within the Arctic Sea. During the two SOPs, a total of 286 soundings were made (113 in late winter and 173 in summer). Data is formatted into a NOAA NCEI compliant NetCDF format in accordance to the YOPP data portal guidelines.

1. Background & Summary

High quality upper atmospheric radiosonde data in the Arctic with sufficient time resolution is crucial in assuring the quality of numerical weather predictions[2, 3]. In such remote area such as the Arctic, it is important to assess the significance of individual observation station for its accuracy and representation within the region. To this end, an intensive observation period of twice daily atmospheric sounding in Ice Base Cape Baranova were conducted during the YOPP SOPs. In this paper, we summarize the observation data acquired during the two SOPs.

It is also noteworthy that the observation made in Ice Base Cape Baranova is not submitted to the Global Telecommunications System (GTS) maintained by the World Meteorological Organization (WMO), therefore it is not assimilated into major numerical weather prediction products or analysis datasets. This gives the observation data detailed in this paper a unique advantage of validating other data especially when compared to a nearby station such as Cape Fedorova located 185km south of Ice Base Cape Baranova which regularly submits its data to the GTS.

2. Location (or Observation)

Ice Base Cape Baranova research station (WMO station number 20094) is located in the Bolshevik Island of the Severnaya Zemlya archipelago (79˚18'N, 101˚48'E) north of the Taymyr Peninsula (Figure 1). It is facing a narrow strait separating the island with the October Revolution islands in the north. The station is situated in a shore where the height is 30m above mean sea level.

The station was founded in 1986 by the Arctic and Antarctic Research Institute (AARI) of Roshydroment and was closed in 1991 due to lack of funding. In 2013, the station was reopened as a research station conducting routine atmospheric, hydrologic and radiation observations by the AARI[4].

3. Methods

Ice Base Cape Baranova conducts routine upper atmospheric observations at 00Z (UTC) which is 7 A.M. local Krasnoyarsk Time (KRAT). With the support of National Institute of Polar Research, additional observation at 12Z (UTC) or 7 P.M. local time was conducted during the YOPP SOPs, one in late winter of February-March 2018 (SOP1) and another during the summer period of July-September 2018 (SOP2). Finnish VAISALA DigiCora III MW31 system and RS-92-SGP sounds were used for the observation.

SOP1 consists of 59 days in which 113 soundings were made (51 during February and 62 during March) with a total of 5 missing observations. SOP2 consists of 92 days in which 173 soundings were made (57, 61, 55 soundings for July, Aug, September, respectively) with 11 missing observations. Most sounding reaches the middle troposphere with 103 soundings reaching 10hPa in SOP1 and 169 soundings for SOP2 (Figure2).

4. Data Records

Original sounding data is provided from the AARI website in a text format[5]. In accordance to the YOPP data portal guidelines, we converted the sounding data into a NetCDF format using the NOAA National Centers for Environmental Information (NCEI) NetCDF Template Version 2[6].

We use the “profile” feature type with orthogonal CDL (network Common Data form Language) to describe the sounding data. The data has two dimensions, “nzMax” and “profile” which corresponds to maximum number of height data within the datafile and number of observations. Height, air temperature, dew point depression, wind velocity and direction are contained within the datafile (Figure3).

Data is separated in months with the following filename.

A20094_2018_02.nc

A20094_2018_03.nc

A20094_2018_07.nc

A20094_2018_08.nc

A20094_2018_09.nc

5. Technical Validation

RS-92-SGP is a GPS radiosonde observing pressure, temperature, wind velocity and direction (PTU) with high accuracy. The capacitive wire temperature sensor has a measurement range of +60˚C to -90˚C with an accuracy of 0.2˚C up to 100hPa and 0.3 ˚C up to 20hPa. Humidity is observed using a thin-film capacitor and heated twin sensor with accuracy of 2% relative humidity upon calibration. Pressure is observed with a silicon sensor with an accuracy of 0.4hPa within 1080-100hPa and 0.3hPa within 100-3hPa.

6. Figures

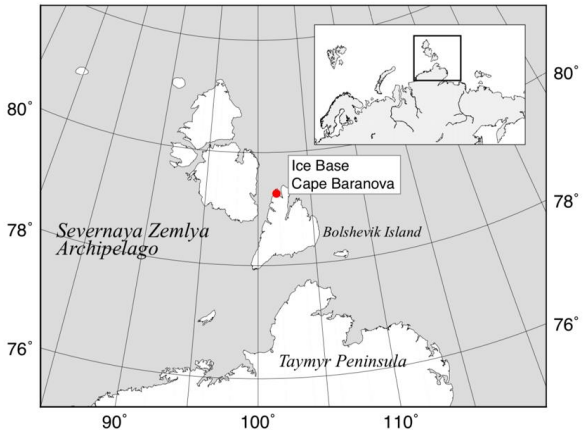

Fig. 1. Map of the location of research station Ice Base Cape Baranova.

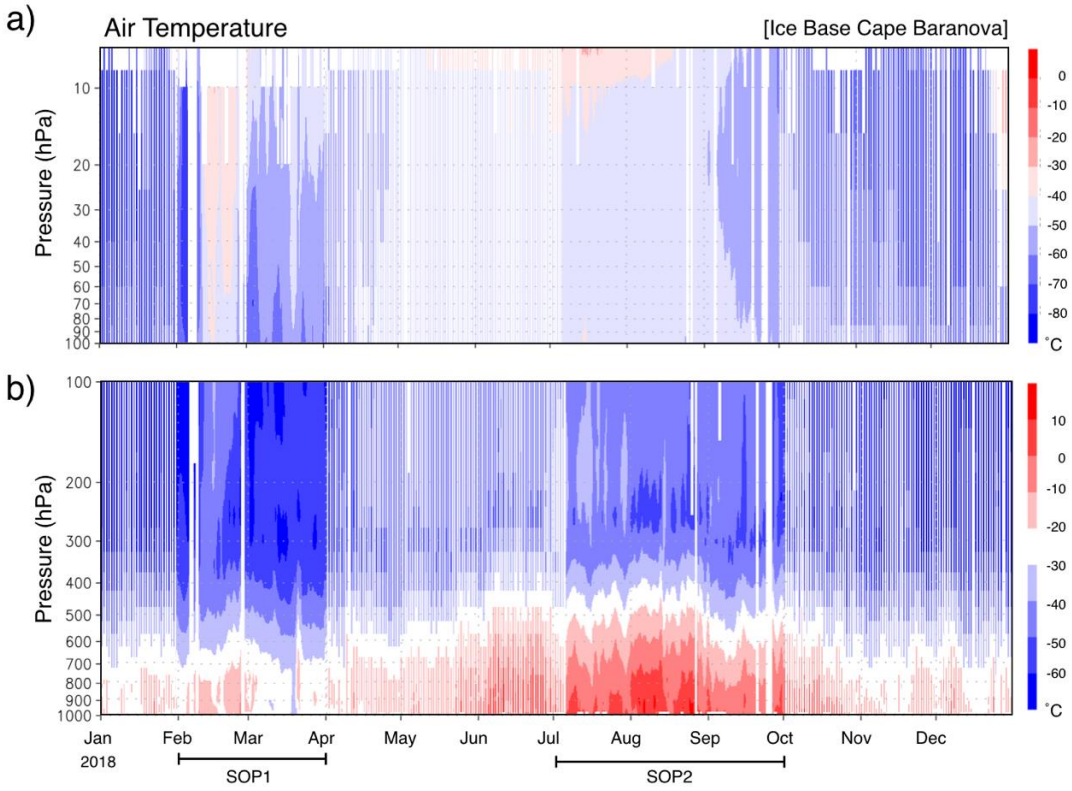

Fig. 2. Time-height section of air temperature observed at Ice Base Cape Baranova for the year 2018. Two YOPP special observing period is denoted within the figure one lasting from February to end of March (SOP1) and another starting from July and ending in September (SOP2). Upper panel shows the upper stratosphere and the lower panel shows the troposphere and lower stratosphere.

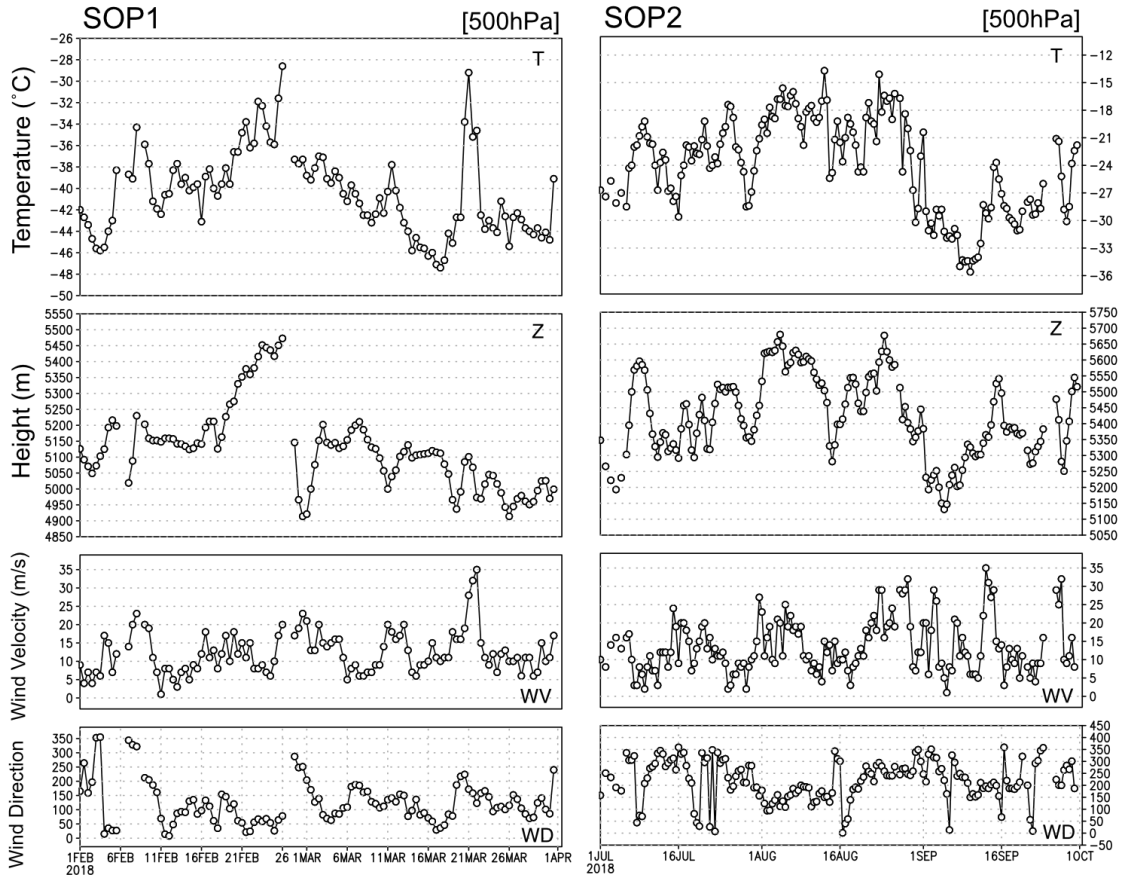

Fig. 3. Timeseries of 500hPa air temperature (upper panel), height (middle panel), wind velocity and direction (two lower panels) for SOP1 and SOP2.

Author contributions

Jun Inoue coordinated the contribution of NIPR to the YOPP SOP and observation conducted at Ice Base Cape Baranova. Masatake Hori created the NetCDF dataset based on the raw sounding data provided by the AARI. Manuscript and figures were also created by Masatake Hori.

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Data Citations

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