# Supporting Information for "Observational uncertainty of Arctic sea-ice concentration significantly affects seasonal climate forecasts"

Felix Bunzel,[1] Dirk Notz,[1] Johanna Baehr,[2] Wolfgang A. Müller[1], and Kristina Fröhlich[3]

Corresponding author: F. Bunzel, Max Planck Institute for Meteorology, Bundesstraße 53, Hamburg, Germany. (felix.bunzel@mpimet.mpg.de)

[1]Max Planck Institute for Meteorology, Hamburg, Germany.

[2]Institute of Oceanography, Center for Earth System Research and Sustainability, Universität Hamburg, Hamburg, Germany.

[3]Deutscher Wetterdienst, Offenbach, Germany.

**Contents of this file**

1. Figures S1 to S4

**Introduction** Anomaly correlation coefficients (ACCs) for September and December-January-February (DJF)-mean 2-meter air temperature are shown (Fig. S1) in order to supplement Figure 4 to allow for a more complete view on the skill of May and November hindcasts.

Moreover, the difference in Arctic sea-ice volume between Bootstrap (BT) and NASA-Team (NT) ice-concentration assimilation runs is shown (Fig. S2), together with ice-thickness difference maps (Fig. S3) for the Arctic sea-ice maximum (March) and minimum (September). Since in each gridbox the sea-ice thickness is nudged proportionally to ice-concentration updates, the surplus of sea-ice area in BT compared to NT data manifests also in a surplus of ice thickness and volume in the BT assimilation run.

Additionally, the ensemble spread for Arctic sea-ice area for BT and NT hindcasts is presented (Fig. S4) in order to supplement that the reliability of NT initialization is low, when hindcasts are initialized on 1 May.

## References

Goddard, L., A. Kumar, A. Solomon, D. Smith, G. Boer, P. Gonzalez, V. Kharin, W. Merryfield, C. Deser, S.J. Mason, et al. (2013), A verification framework for interannual-to-decadal predictions experiments, *Clim. Dyn.*, *40*(1-2), 245–272.

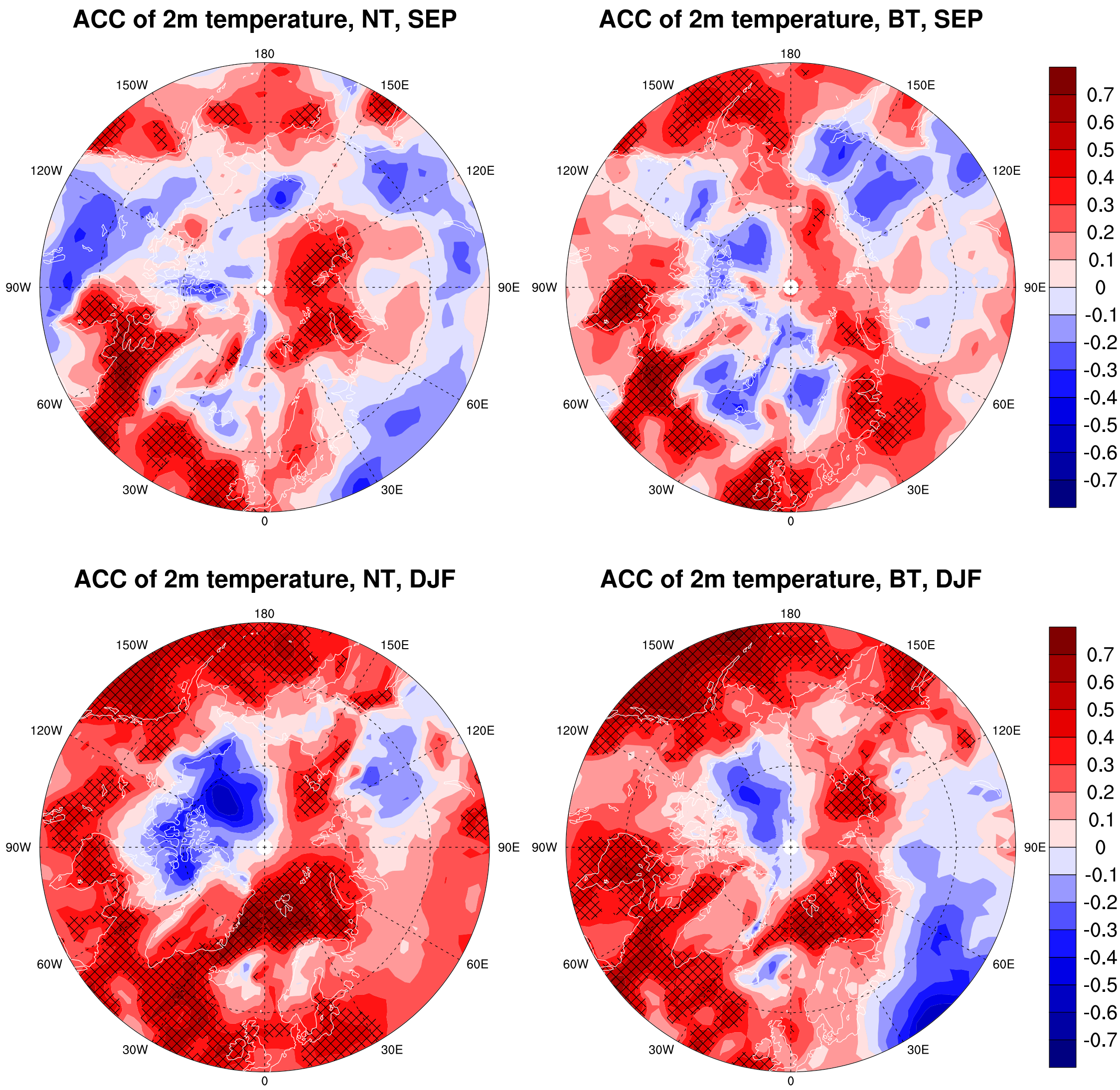


**Figure S1.** The anomaly correlation coefficient (ACC) between predicted 2-meter temperature and ERA-Interim reanalyses is shown. Climatology and linear trend were removed from original fields to obtain anomalies. ACCs are presented for September (top, hindcasts started on 1 May) and DJF (bottom, hindcasts started on 1 November) 2-meter temperature derived from hindcasts initialized with NASA-Team (NT, left) and Bootstrap (BT, right) sea ice. The black lattice pattern indicates significant differences at the 95%-level obtained from a distribution of 1000 re-sampled 10-member ensemble means [*Goddard et al.*, 2013].

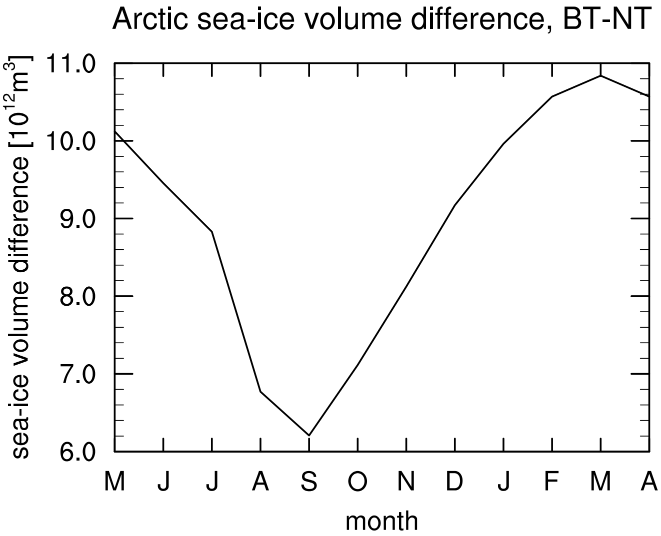


**Figure S2.** Climatological mean sea-ice volume difference between Bootstrap (BT) and NASA-Team (NT) ice-concentration assimilation runs is shown.

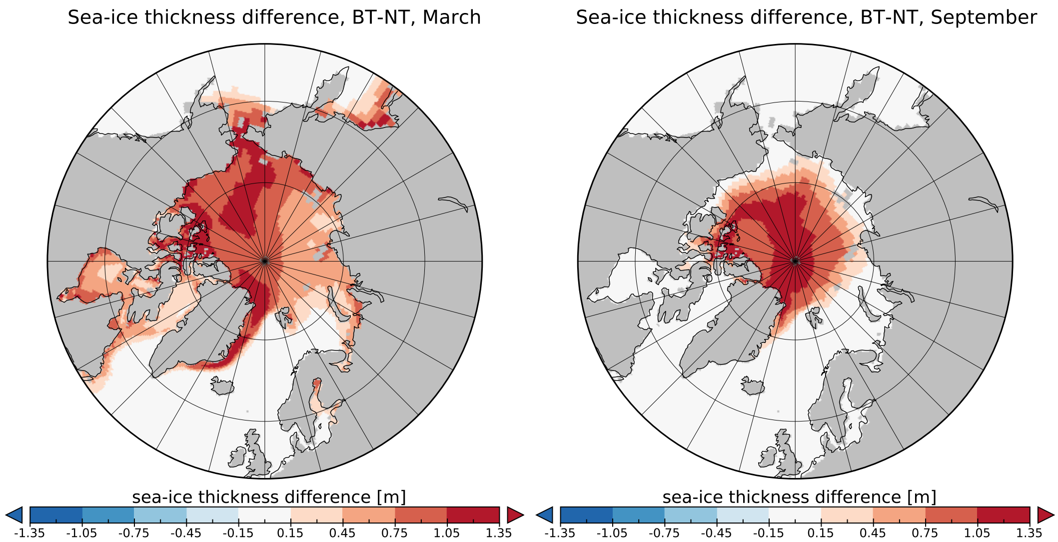


**Figure S3.** Sea-ice thickness difference between Bootstrap (BT) and NASA-Team (NT) assimilation runs averaged over 1981-2011 is shown for March (left) and September (right).

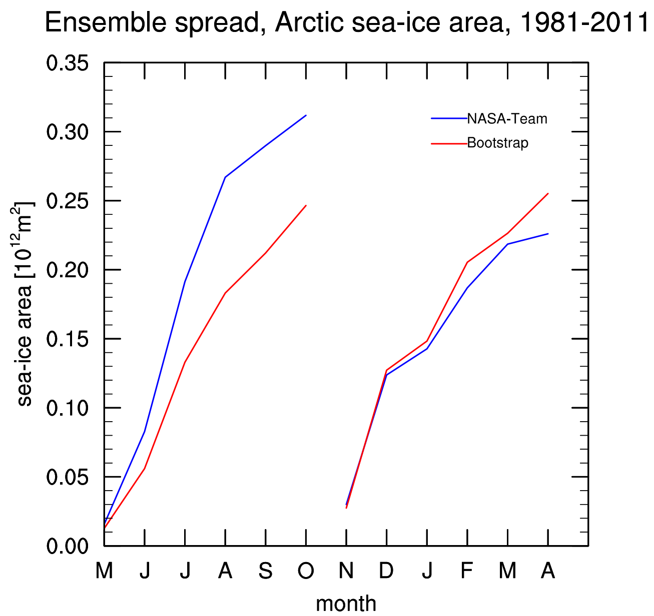


**Figure S4.** The Arctic sea-ice area ensemble spread averaged over 1981-2011 is shown for Bootstrap (BT) and NASA-Team (NT) hindcasts initialized on 1 May and 1 November.