

A Comparison of ERA Interim Reanalysis Data With Meteorological Observations From The Central Arctic

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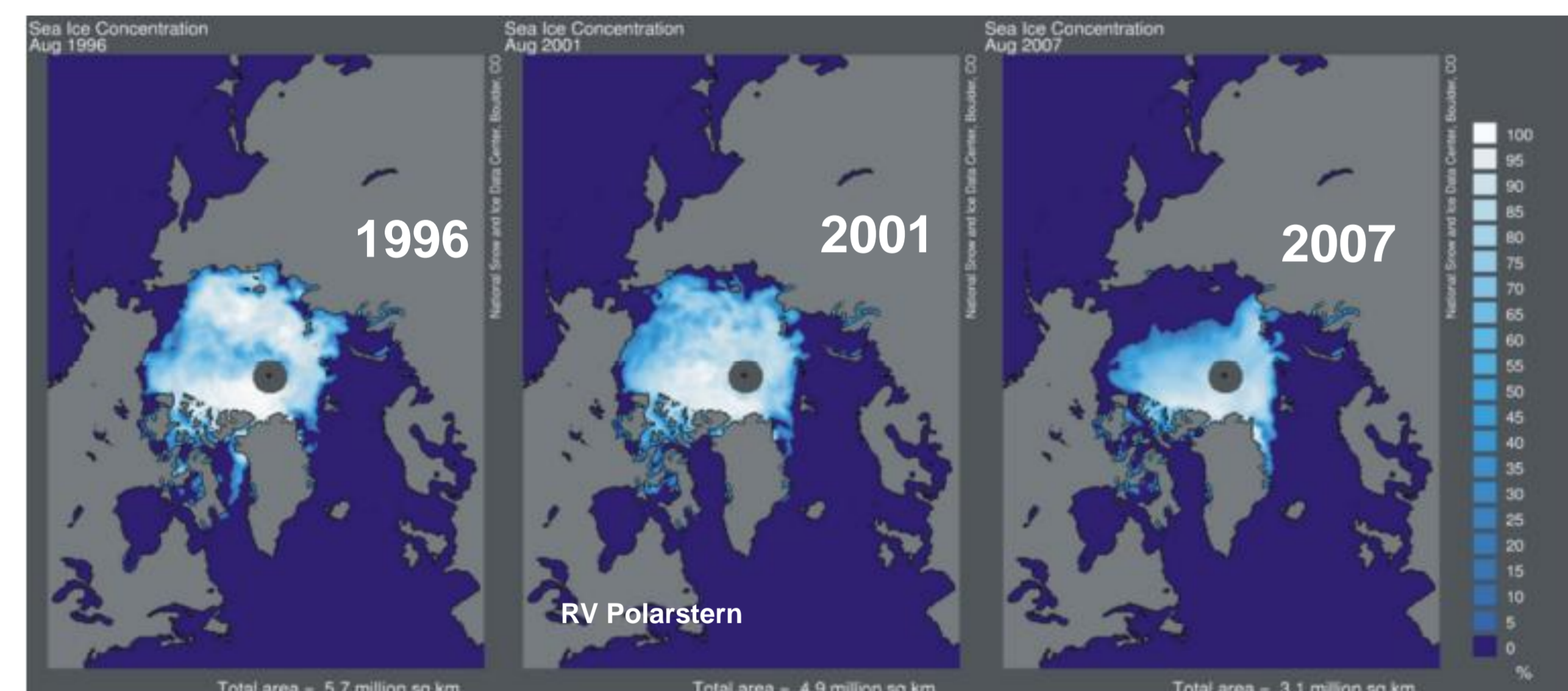
Introduction

The analysis of polar climate change on the basis of observations and the validation of weather and climate prediction in polar regions are challenging due to the lack of observations. In the inner arctic regions, in-situ observations are available only from buoys, ship cruises, and aircraft campaigns with large temporal differences and spatial separations.

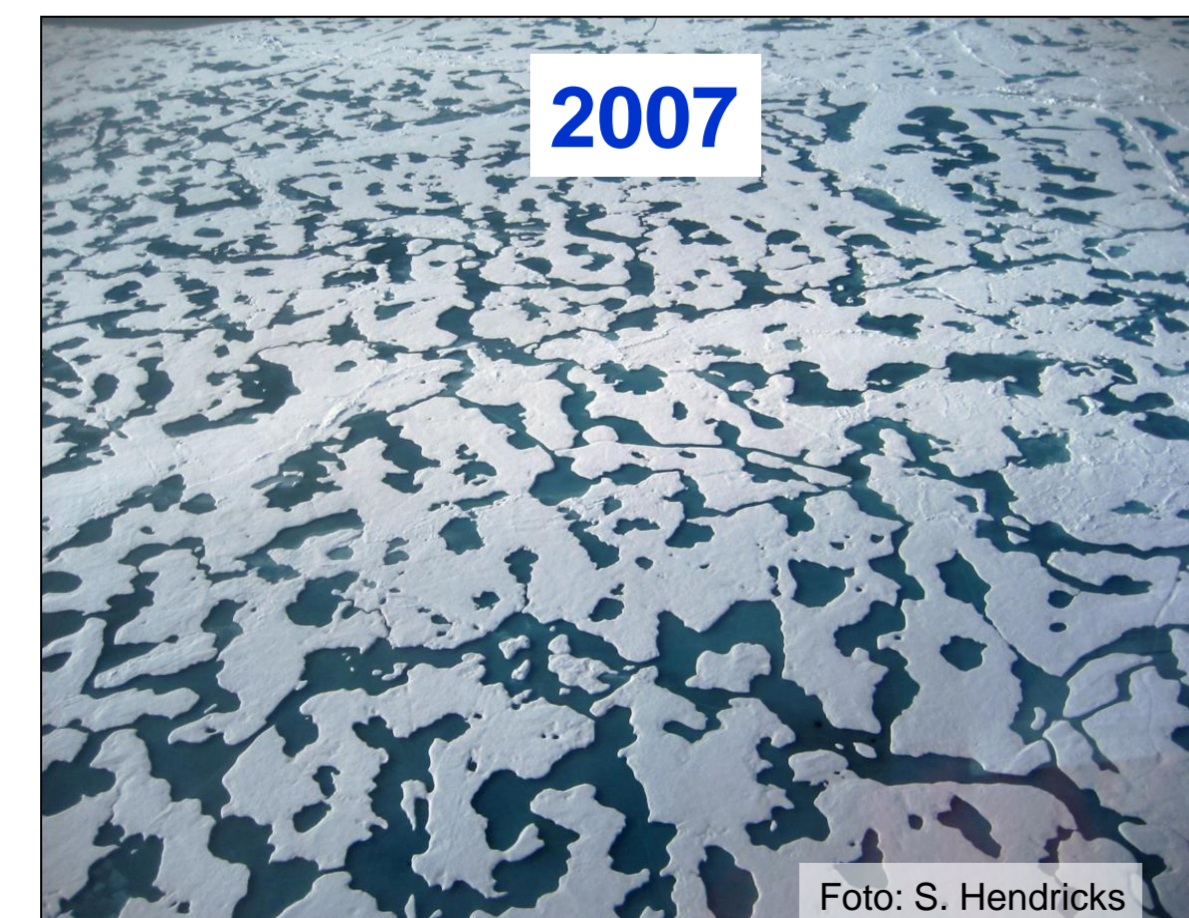
Main Goal

Comparison of results from ERA-Interim reanalyses with near-surface meteorological observations and rawinsonde soundings from Arctic cruises with the German icebreaker RV Polarstern.

We consider the years 1996, 2001, and 2007. Ice cover between these years differs considerably, especially between the years 1996 and 2007 (figure from NSIDC, <http://nsidc.org/>)

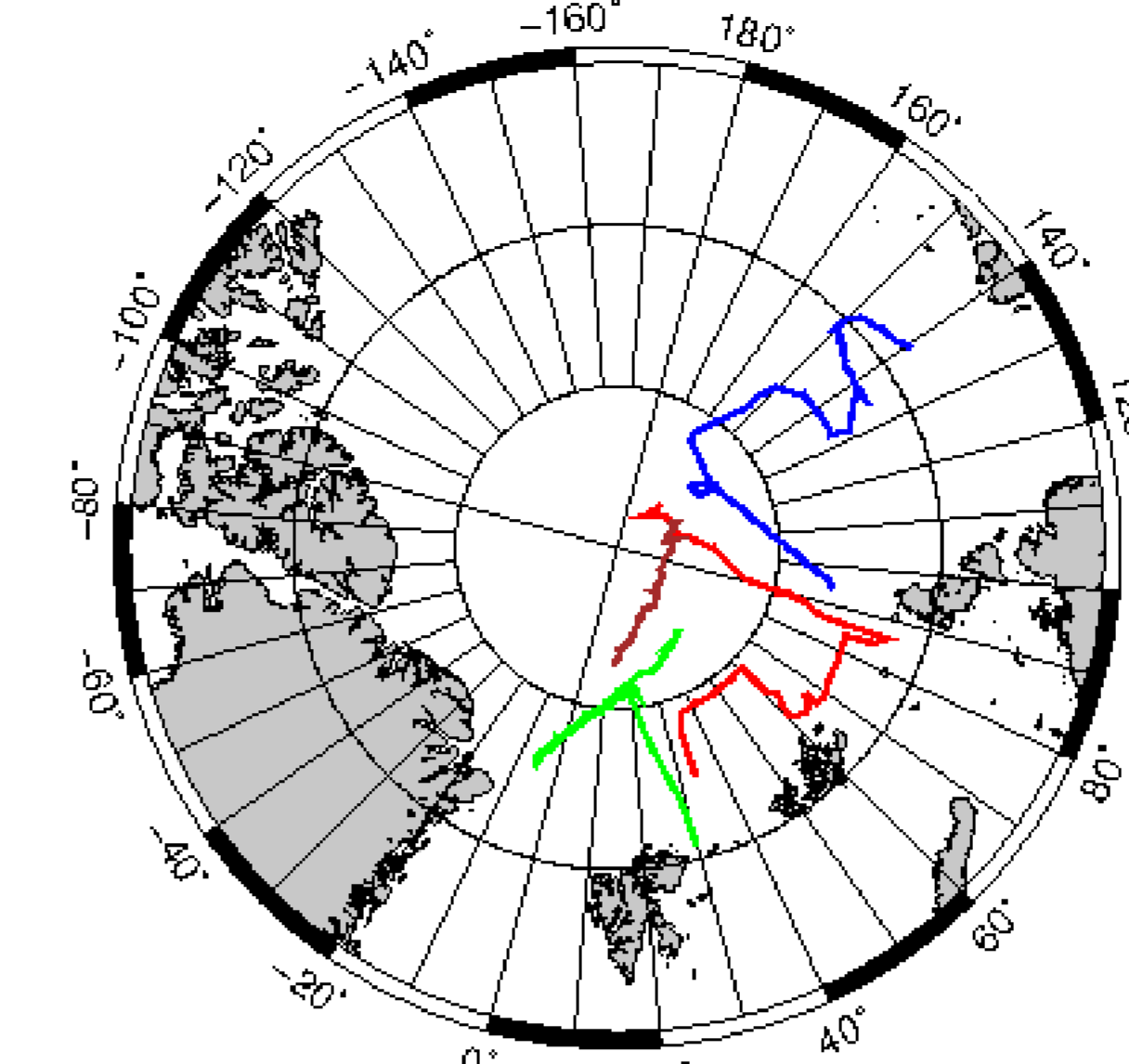


Typical ice situation during Polarstern cruises August 1996 and 2007. Only few ponds were present in 1996



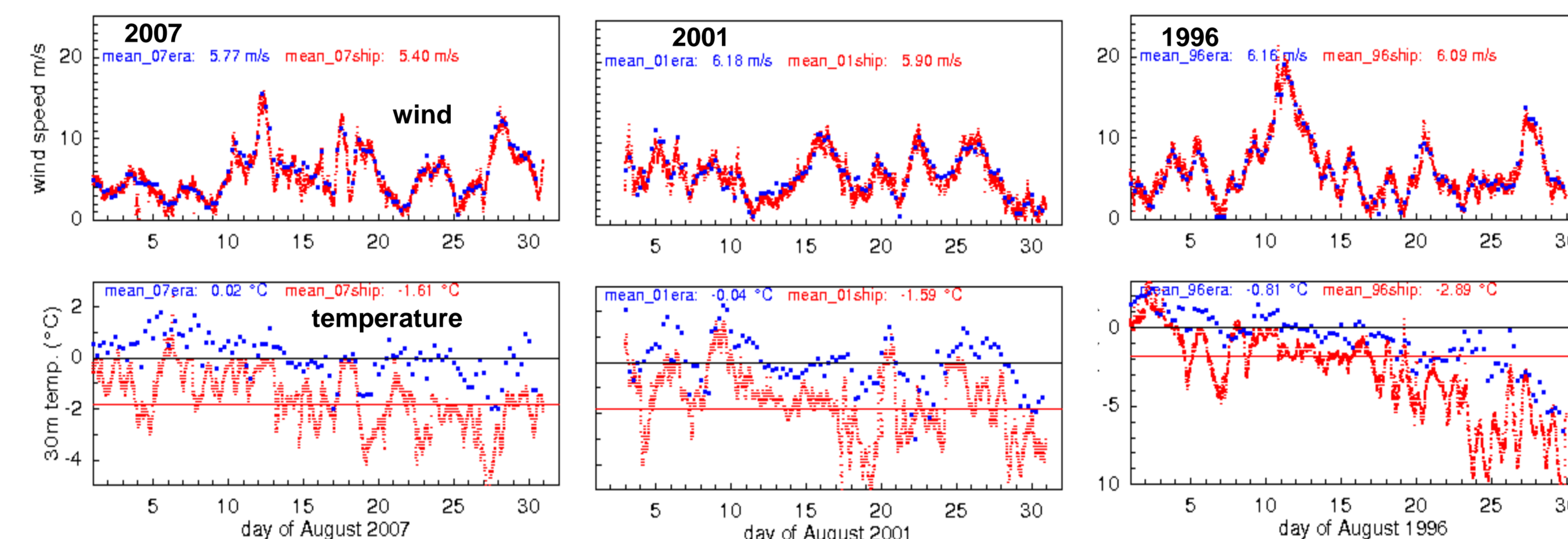
Routine meteorological observations during Polarstern cruises (soundings and near-surface observations) are always transmitted to the global telecommunication system (GTS) (e.g. König-Langlo, 2008). Thus one might expect that differences between ERA Interim and observations are larger than those shown here at locations far away from ships. However, Jakobson et al. (2012) found in a validation study that warm and moist biases of ERA Interim to observations in the ABL, not transmitted to GTS, were similar. Maybe, ERA-Interim does not give enough weight to sounding data.

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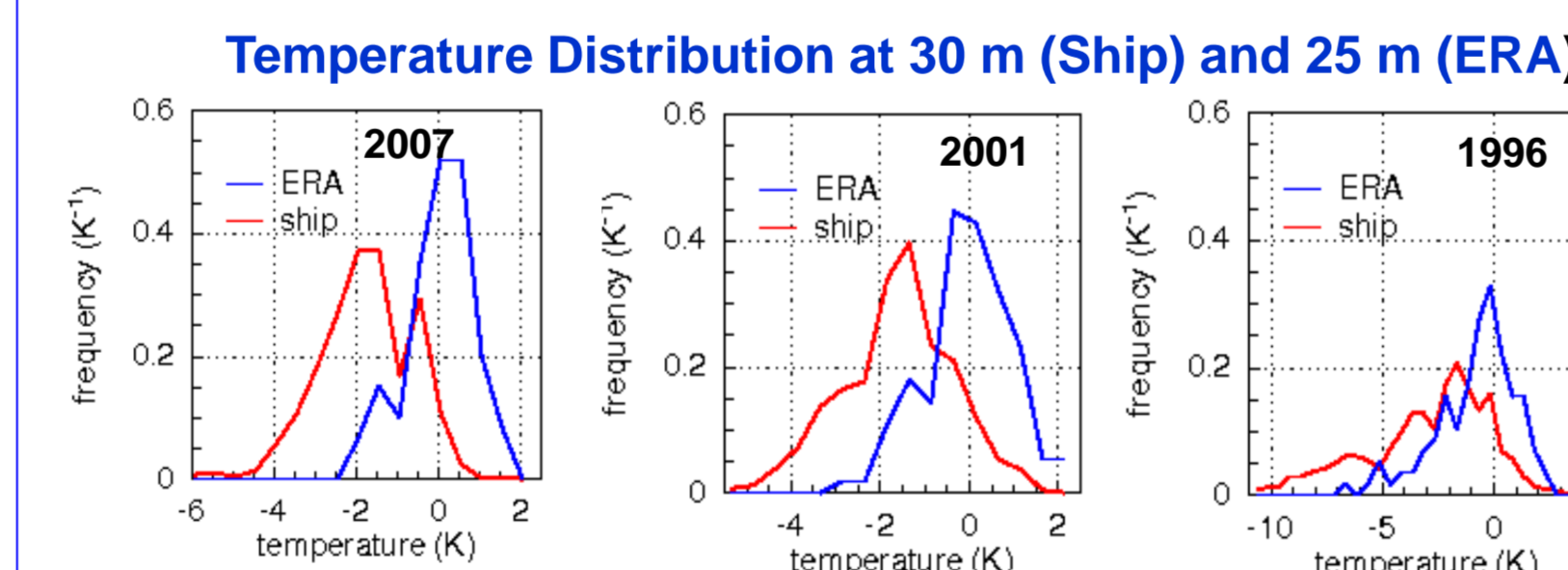


Cruise tracks of RV Polarstern between 3 and 31 August in 1996 (blue), 2001 (green), and 2007 (red). The brown track shows Tara drift in August 2007.

Ship Observations at 30 m Height and 6-Hourly ERA Interim Data at ~25 m (Model Level 59)



Ship and ERA wind agree well, but ERA overestimates observed near-surface temperature by 1.5 – 2.1 degrees. The ERA 1996 mean August temp. differs only slightly from other years, however, observations show that August 1996 was about 1.5 degrees colder than August values of the other years.



In all years, observed frequency distributions of temperature have a clear peak at the freezing point of sea water, while ERA Interim shows a peak at the melting point of fresh water.

MAIN RESULTS (Details in Lüpkes et al., 2010)

ERA Interim temperatures and observed temperatures agree well in the range between the top of the boundary layer capping inversion and 2000 m height, however, there are large differences in the boundary layer.

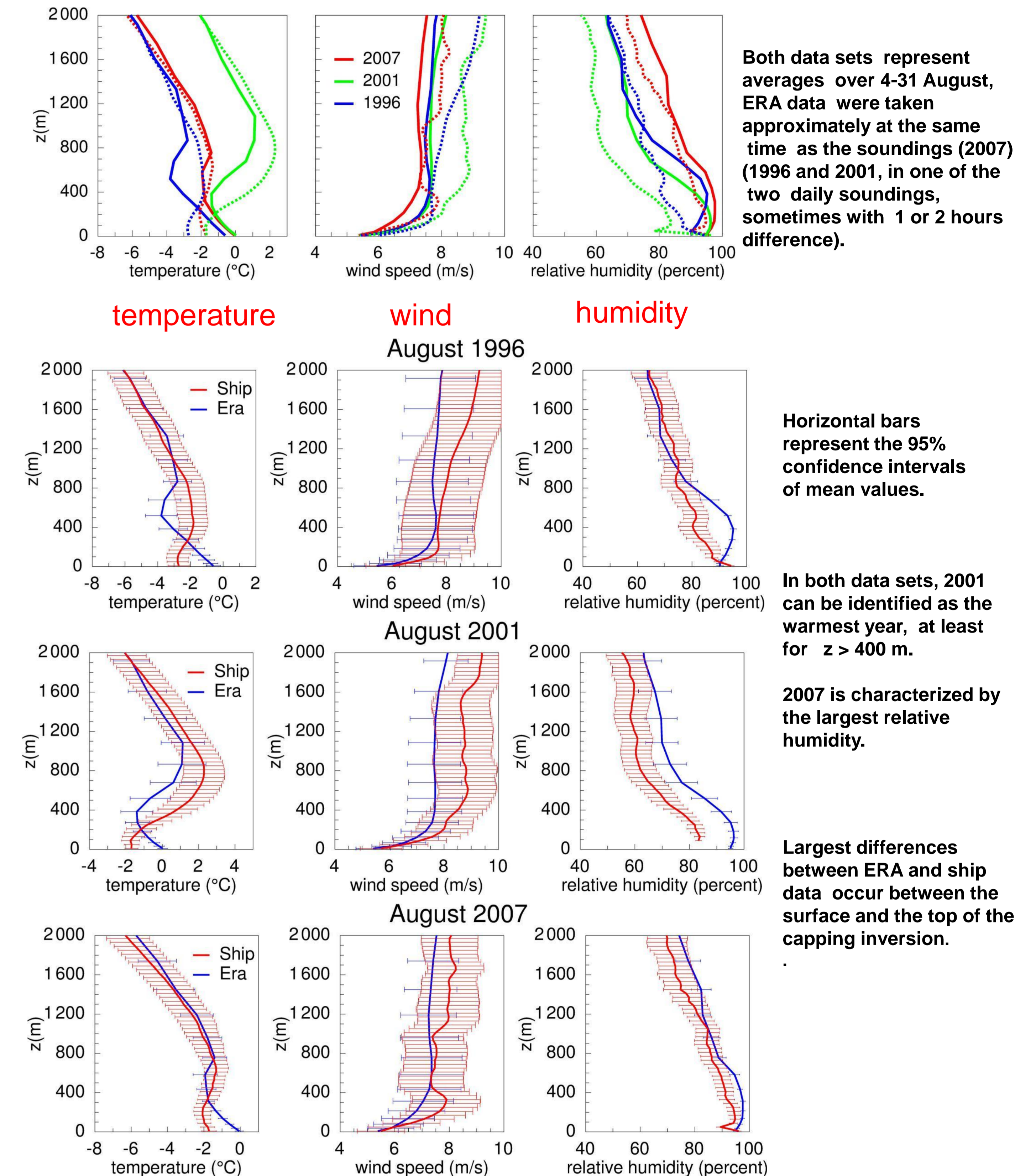
ERA Interim near-surface temperatures are biased by about 1.5-2 K towards higher temperatures.

ERA Interim overestimates the base height of the capping inversion sometimes by more than a factor of two and the stratification is biased towards neutral values.

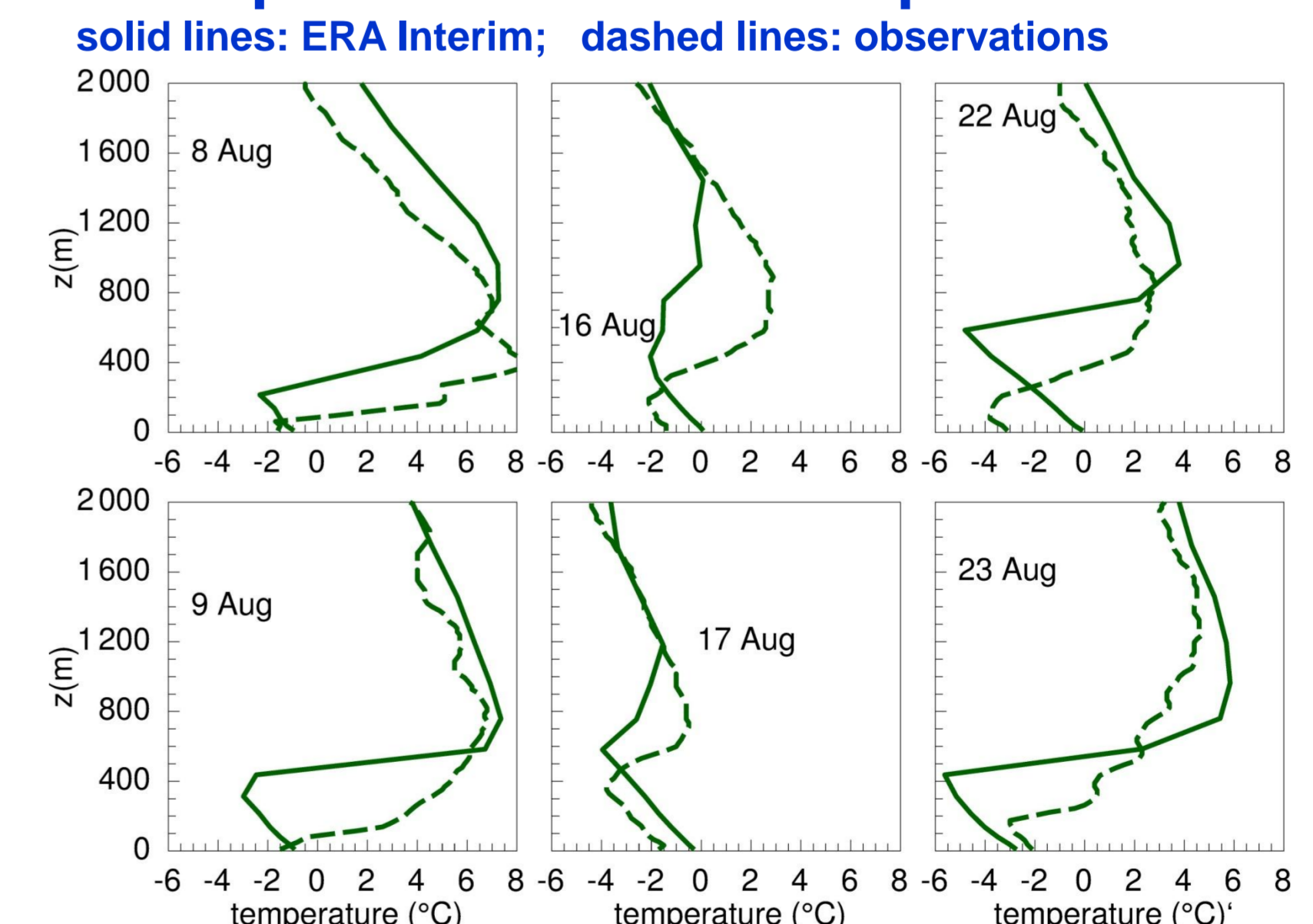
ERA Interim overestimates relative humidity in the boundary layer.

Wind speeds from ERA agree well with the observations. But between 1000 m and 2000 m, there is an underestimation of ERA by about 1 m/s.

Mean Data From Soundings and ERA Interim (dotted: observed ; solid: ERA Interim)



Examples of Selected Temperature Profiles (2001)



In individual profiles, differences between ERA Interim and observations can be very large.

This concerns absolute values, stratification, and boundary layer height

References

- König-Langlo (2008) Meteorological observations during Polarstern cruises ARK-XII; ARK-XVII/2, Alfred Wegener Institute, Bremerhaven, Germany .
- Jakobson, E., T. Vihma, T. Palo, L. Jakobson, H. Keernik, and J. Jaagus (2012), Validation of atmospheric reanalyses over the central Arctic Ocean, Geophys. Res. Lett., 39, L10802, doi:10.1029/2012GL051591.
- Lüpkes, C., T. Vihma, E. Jakobson, G. König-Langlo, and A. Tetzlaff (2010), Meteorological observations from ship cruises during summer to the central Arctic: A comparison with reanalysis data, Geophys. Res. Lett., 37, L09810, doi:10.1029/2010GL042724.