

Using NWP to assess the influence of the Arctic atmosphere on mid- latitude weather and climate

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- By how much could weather forecasts in the Northern mid-latitudes be improved if we had perfect knowledge of the Arctic?
- How can Arctic conditions influence northern mid-latitudes?
- Under which large-scale circulation conditions is the influence strongest?

Semmler et al., 2017, in press (AAS)

- IFS experiments started on the 1st and 15th of each month from 1979 to 2012 without and with relaxation applied from 75 N to 90 N
- 204 start points for each season
- Difference in mean absolute error evaluated

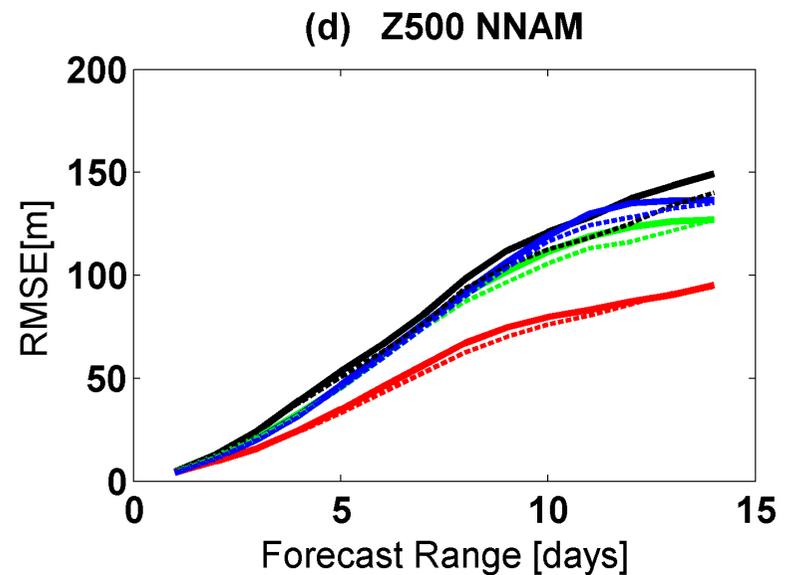
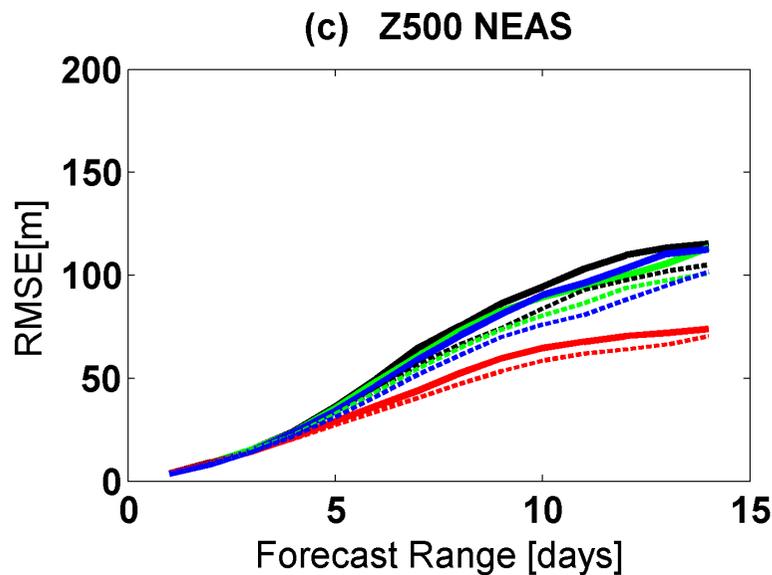
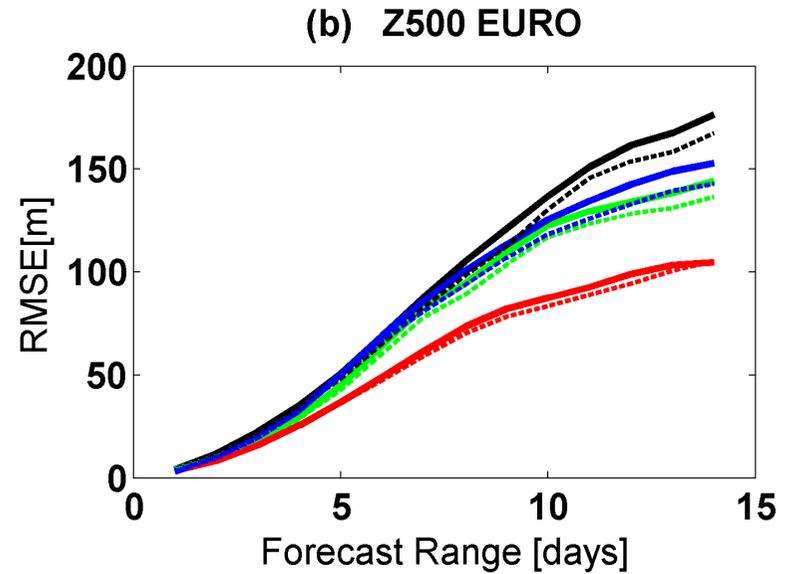
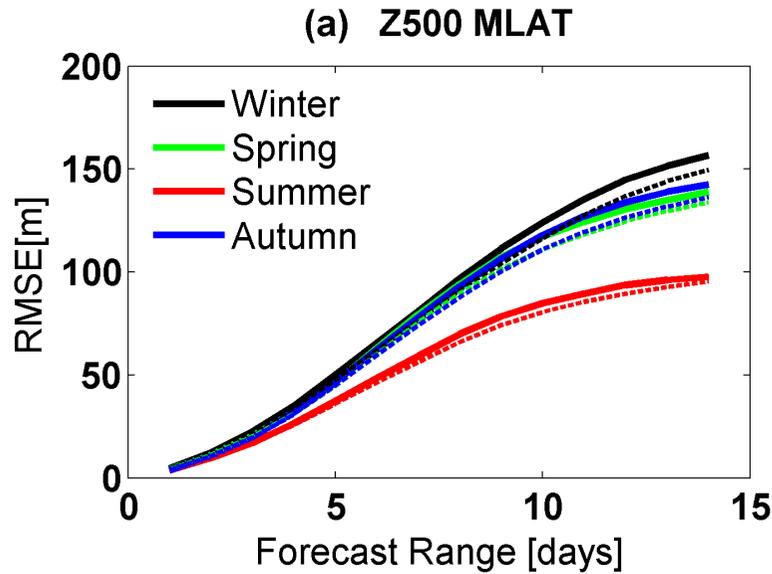


Mean absolute error



Forecast error growing over forecast time

Summer: smallest errors

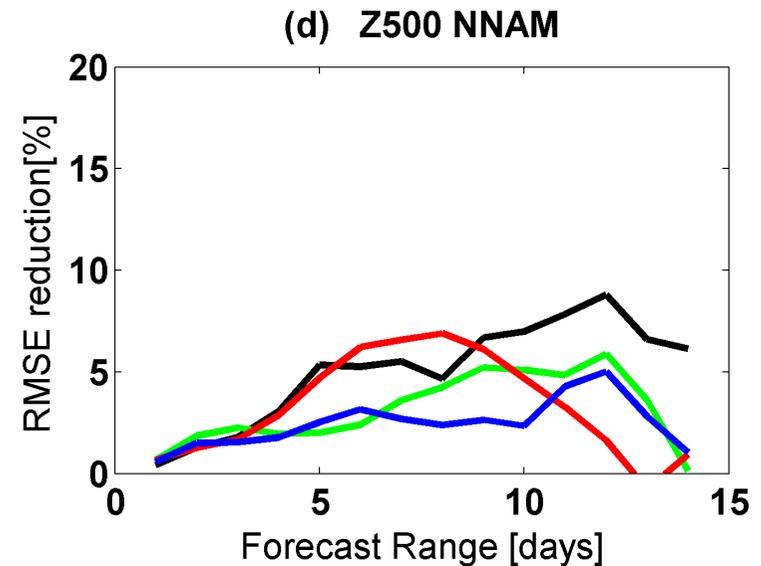
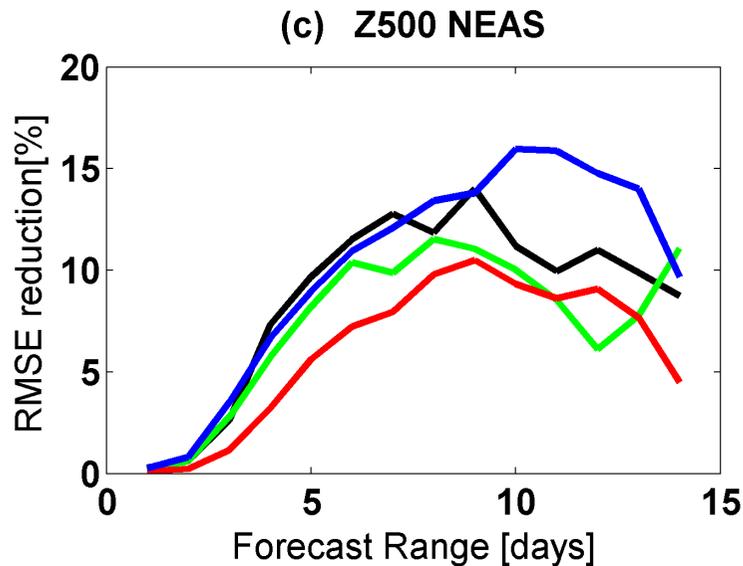
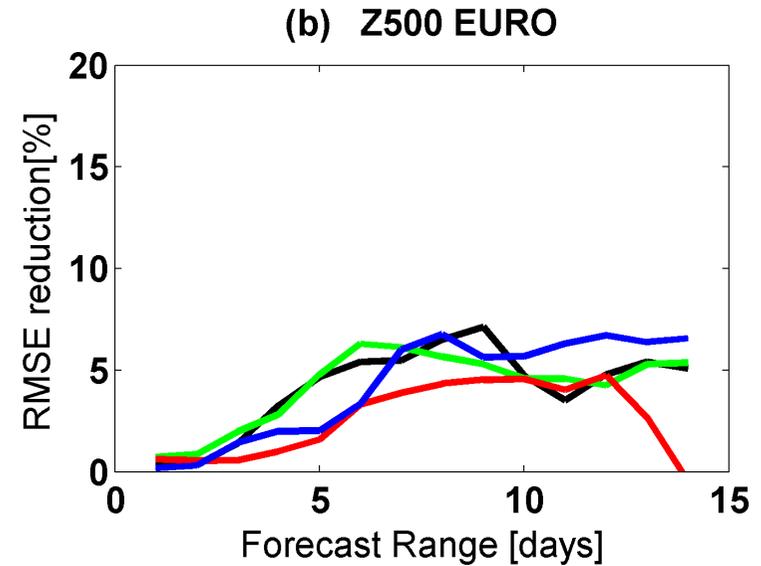
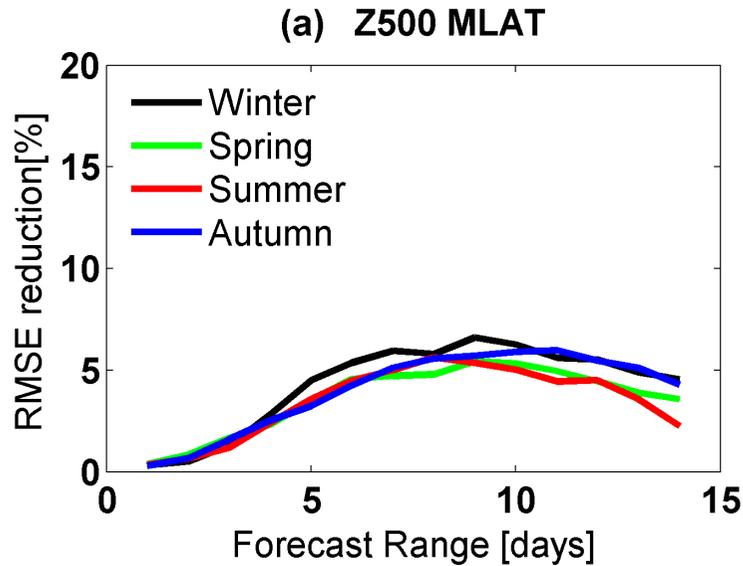


Mean absolute error reduction



Forecast error reduction relatively little averaged over mid-latitudes

But: over northern Asia clearly stronger effect



Z500 ERA-INTERIM (m)



Explanation of previous results:

Northerly component in the mean westerly flow over continents

Southerly component in the mean westerly flow over sea

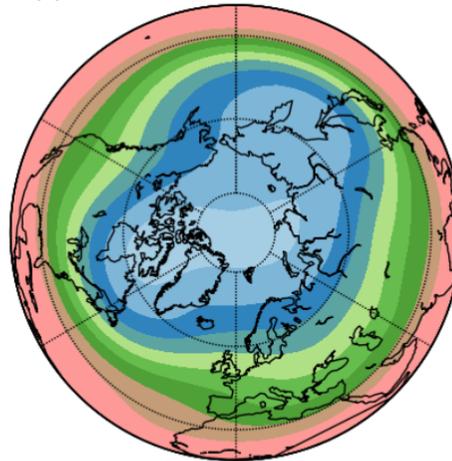
Winter

Spring

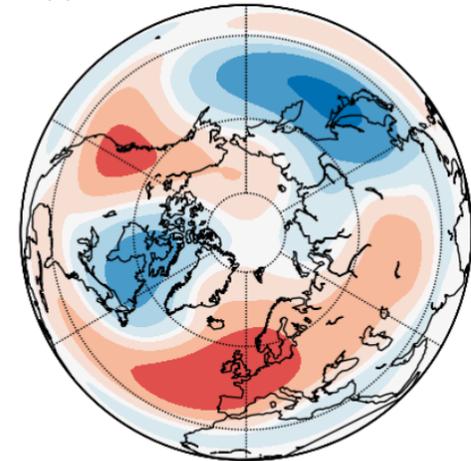
Mean

Deviation from zonal average

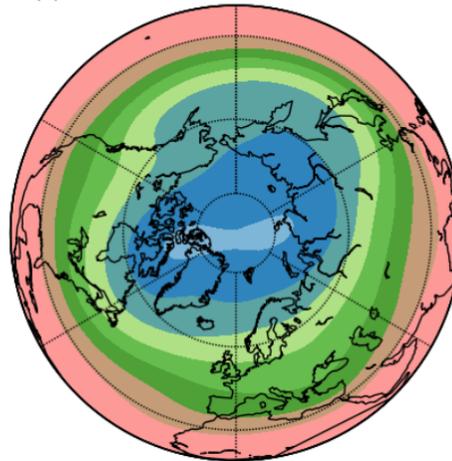
(a)



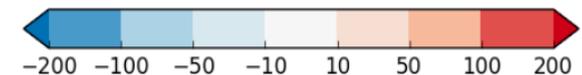
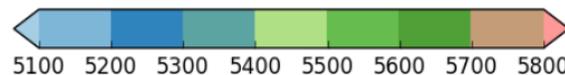
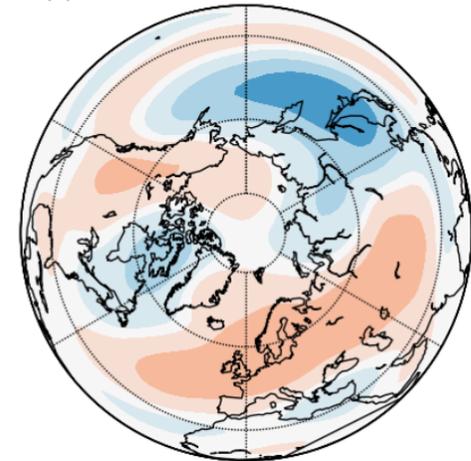
(b)



(c)



(d)



Z500 ERA-INTERIM (m)



In summer clearly weaker mean flow and clearly weaker deviation from zonal average and clearly lower standard deviation.

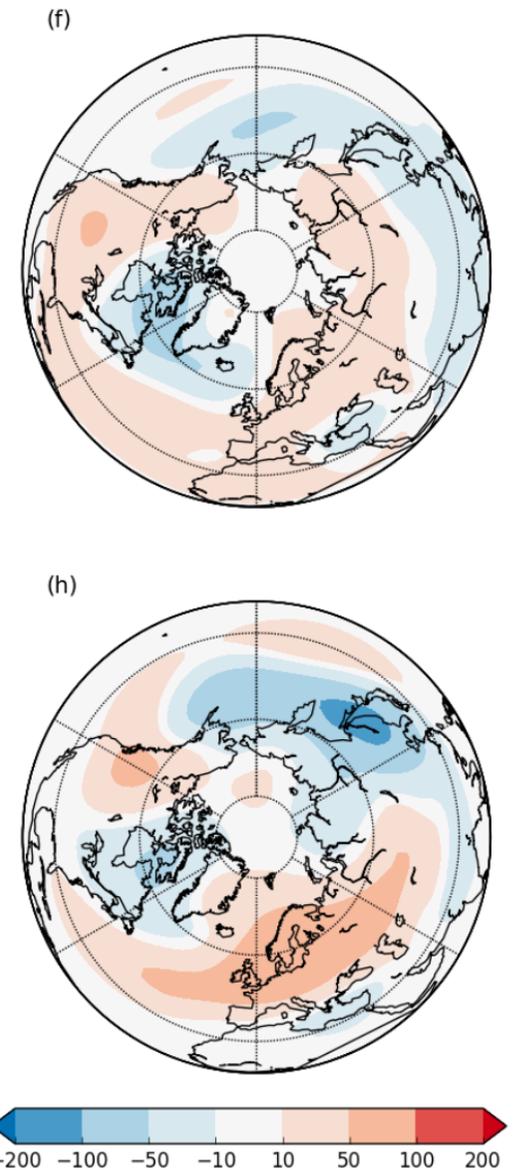
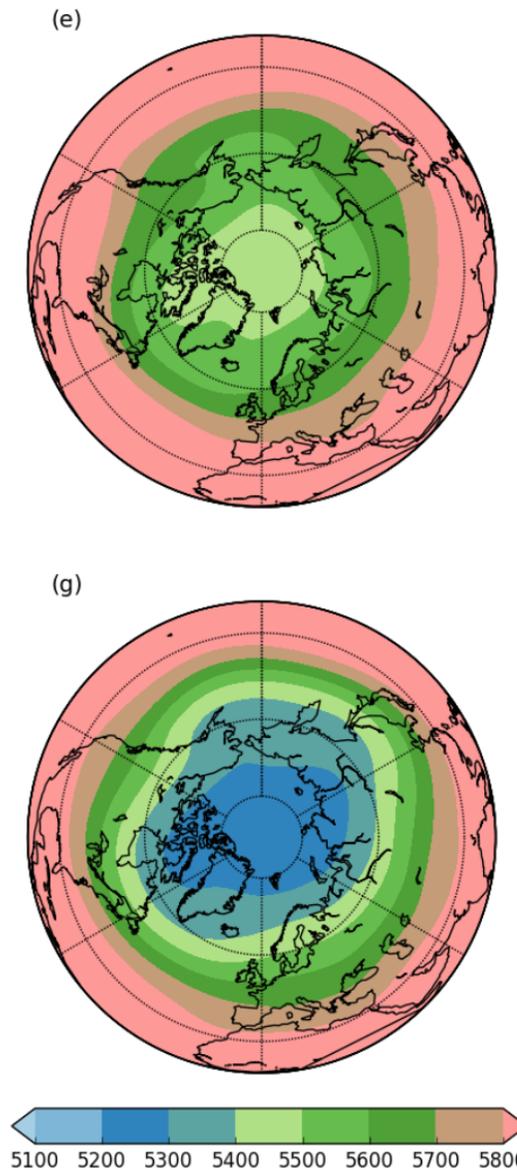
Summer

Therefore smaller forecast error reductions.

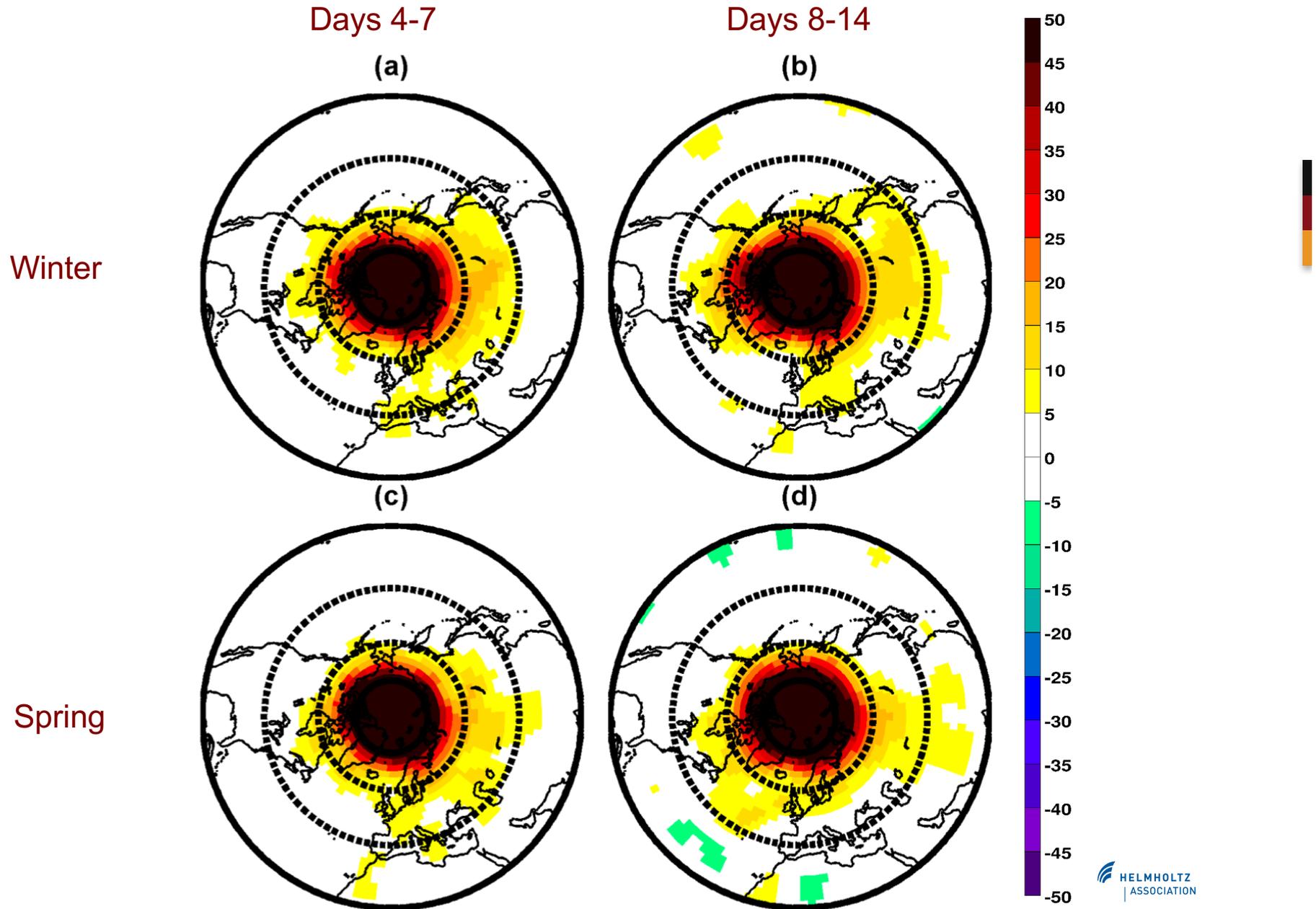
Autumn

Mean

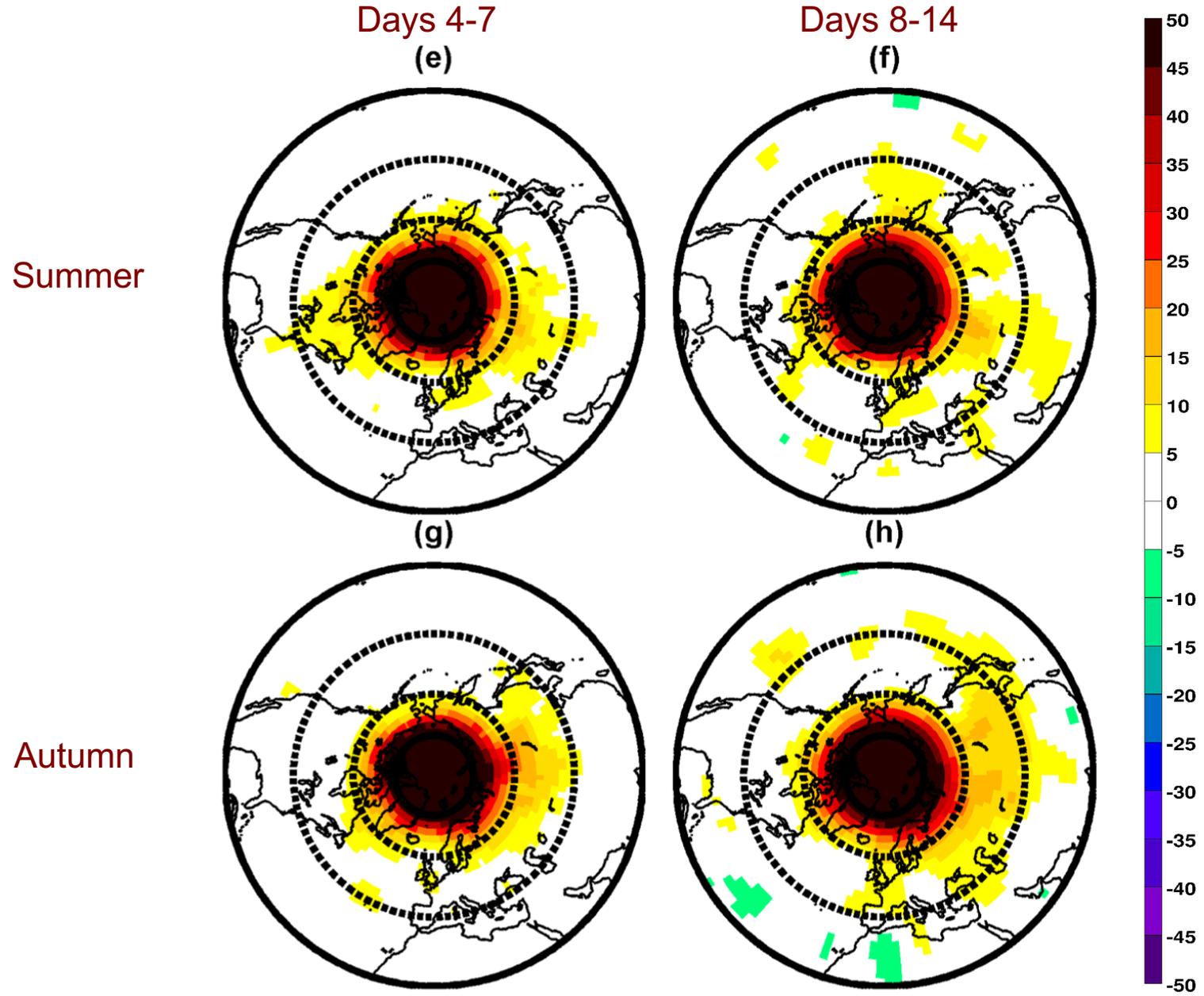
Deviation from zonal average



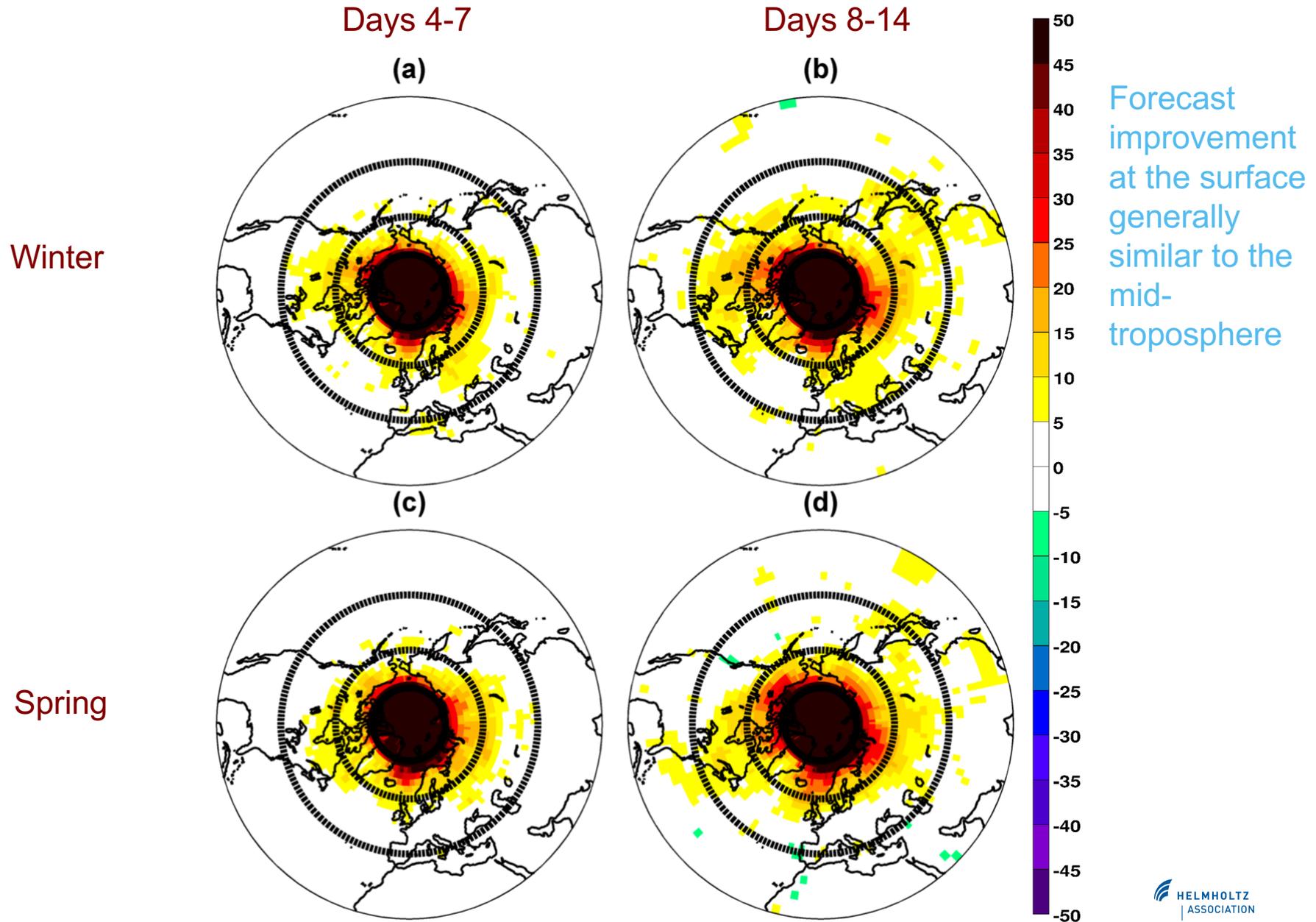
Mean abs. error reduction Z500 (%)



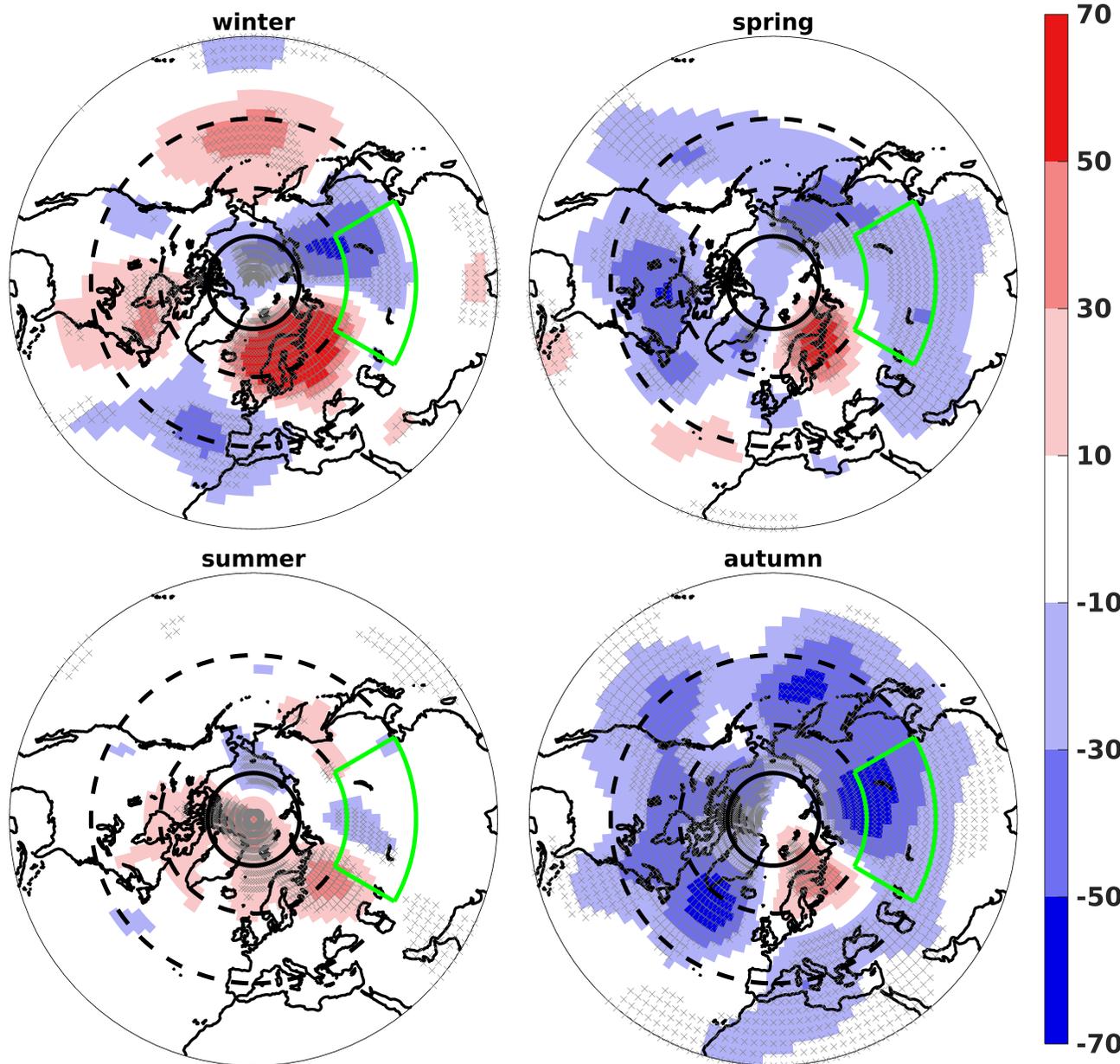
Mean abs. error reduction Z500 (%)



Mean abs. error reduction T2M (%)

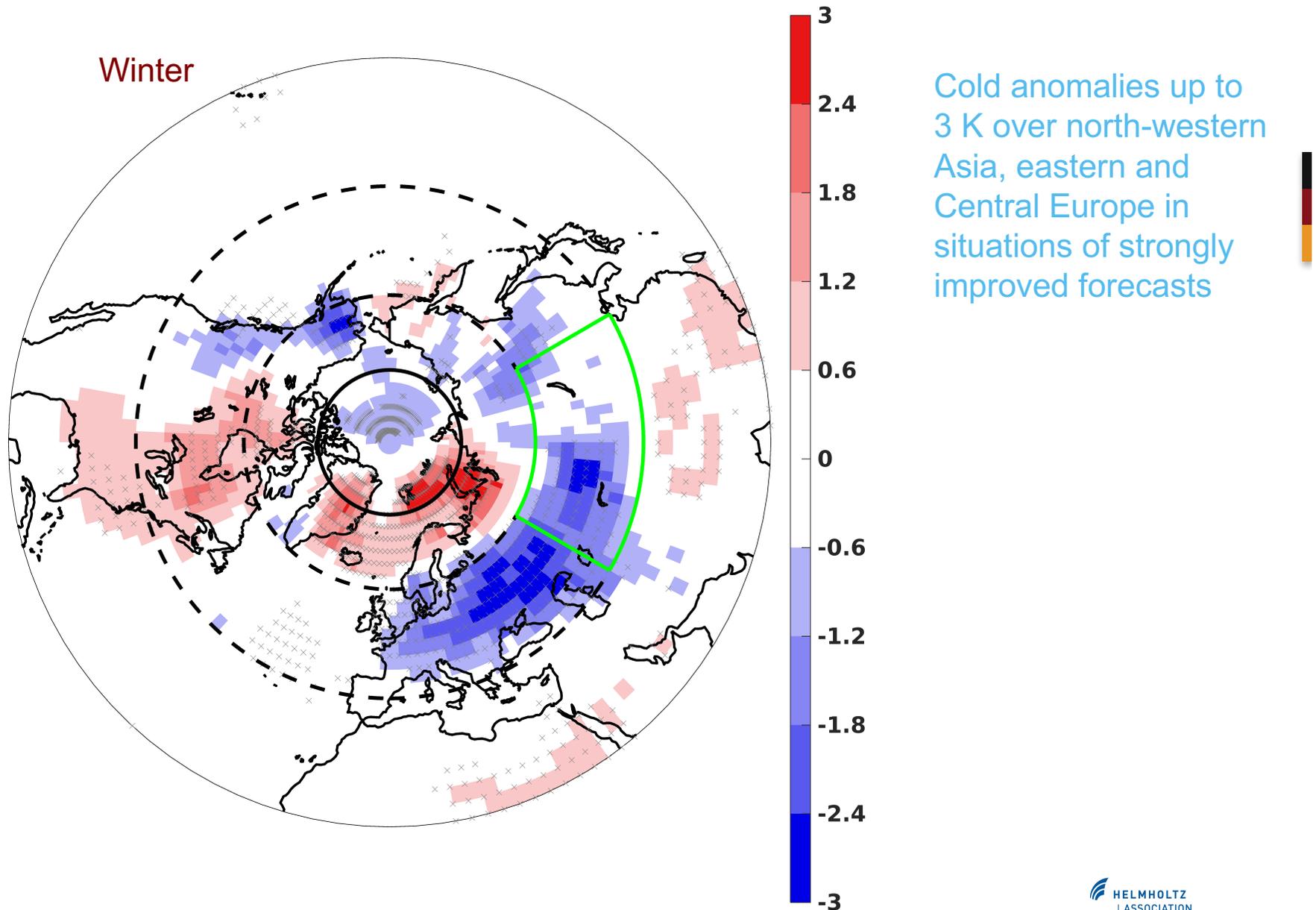


Composites Z500 (m)



Strongest forecast improvement over northern Asia in situations with northerly flow anomalies – especially in winter (in summer hardly visible).

Composites 2 m temperature (K)



Conclusions



- Strongest forecast improvements and therefore Arctic – northern mid-latitude linkages over northwestern Asia
 - Main pathways consistent with previous studies
- Cold anomalies over western Asia, eastern and central Europe in cases of anomalous northerly flow: indicating poor representation of such events in model?
- No trend in Arctic influence over the investigated 34 years

