

Effects of Sea Ice Initialization on Seasonal Forecasts: WGSIP

Ice Historical Forecast Project

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WGSIP co-chair

IceHFP Project

- ▶ Only a few seasonal prediction systems have an observation-based initialization of sea ice including
 - ▶ Environment Canada [Sigmond et al., 2013] (CCCma)
 - ▶ UK Met Office [Peterson et al., 2013]
 - ▶ NCAR/NCEPs [Wang et al., 2013]
- ▶ Sea Ice Historical Forecast Project (IceHFP) to examine the sensitivity to initialization of sea ice.
 - ▶ <http://www.wcrp-climate.org/wgsip/chfp/iceHFP.shtml>



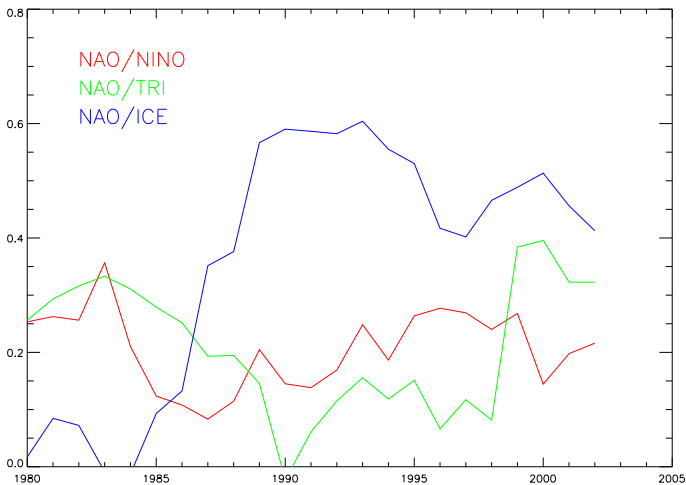
Evidence of Sea Ice Effect on Atmospheric Circulation

- ▶ Several recent studies suggest a link between autumn Arctic ice decline and a preference towards anti-cyclonic circulation in winter
 - ▶ [Petoukhov and Semenov, 2010]
 - ▶ [Deser et al., 2004]
 - ▶ [Overland and Wang, 2010]
 - ▶ [Francis et al., 2009]
 - ▶ ⇒ increased likelihood of (-) NAO/AO events in winter
 - ▶ Contributed to severe European winter of 2010/11?
 - ▶ [Maidens et al., 2012]

Effect Nov (Negative) Ice Extent on DJF NAO

IceHFP

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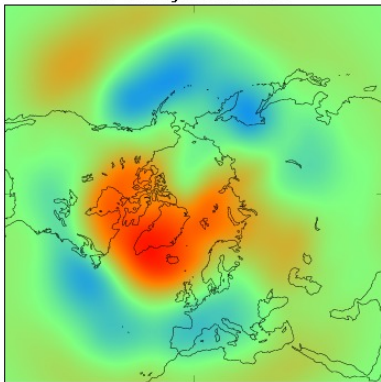
Correlation Nov (Negative) Ice Extent with DJF 500mb HGT

IceHFP

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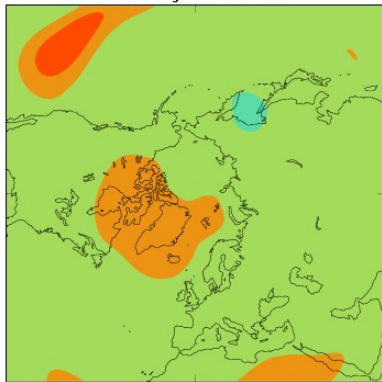
Regression

DJF ICE regression on HGT



Correlation

DJF ICE regression on HGT



IceHFP Experiment Methodology

- ▶ Initialize ensemble of seasonal forecast for in the year 2007
 - ▶ 2nd Lowest year in September ice extent.
 - ▶ Forecasts of Winter (DJF), Autumn (SON)
 - ▶ From November and August start dates
 - ▶ Near lowest ice situation applied for August/November.
- ▶ For each forecast two separate sea ice initializations
 - ▶ 1st set initialized to 2007 observations
 - ▶ 2nd set initialized to a climatology.
 - ▶ Climatology up to participants discretion.
 - ▶ In all cases observed August and November sea ice significantly below climatology.
- ▶ Repeat for 1996
 - ▶ Combined with 2007 eliminates differences due to climatology

IceHFP Participants

- ▶ UKMO/GloSea4 [Arribas et al., 2011].
 - ▶ Drew Peterson
- ▶ Max Planck Institute Hamburg
 - ▶ Steffen Tietsche and Dirk Notz
- ▶ Météo-France/CNRS [Chevallier et al., 2012]
 - ▶ Mattieu Chevallier
- ▶ CCCma/CanSIPS [Merryfield et al., 2012]
 - ▶ Bill Merryfield and W.-S. Lee
- ▶ IC3
 - ▶ Virginie Guemas

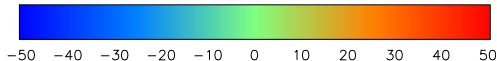
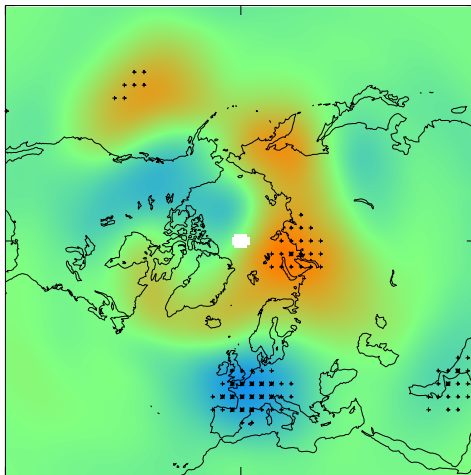
DJF 500hPa in iceHFP experiments

MultModel h500 for 2007 in DJF

IceHFP

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- ▶ Difference 2007 vs ice climatology
- ▶ Low minus high ice

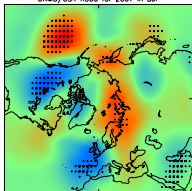


DJF 500hPa in iceHFP experiments

IceHFP

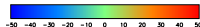
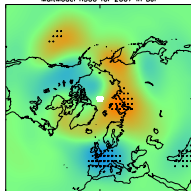
UKMO

UKMO/GS4 h500 for 2007 in DJF



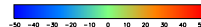
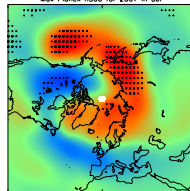
Multi-Model

MultiModel h500 for 2007 in DJF



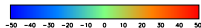
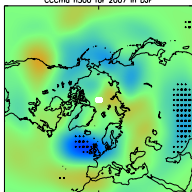
Max Planck

Max Planck h500 for 2007 in DJF



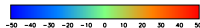
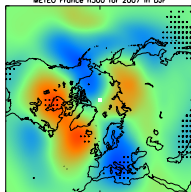
CCCma

CCCma h500 for 2007 in DJF



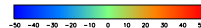
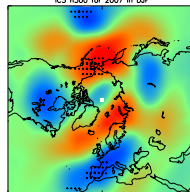
MétéoFrance

METEO France h500 for 2007 in DJF



IC3

IC3 h500 for 2007 in DJF



How much
due to
different
climatologies?

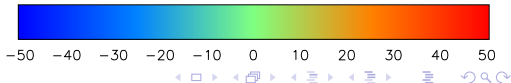
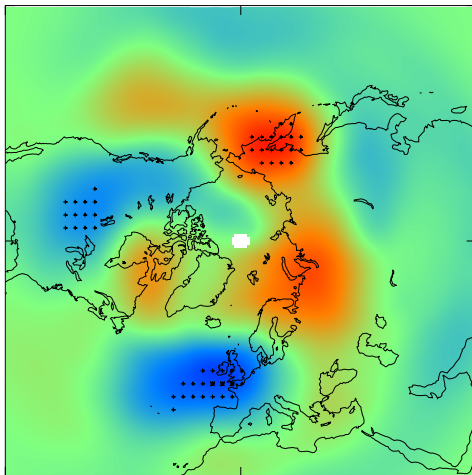
DJF 500hPa in iceHFP experiments

IceHFP

Drew Peterson

- Only effect of 2007 vs 1996 ice!

MultModel h500 for diff in DJF

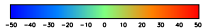
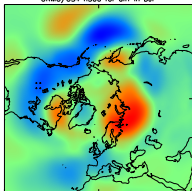


DJF 500hPa in iceHFP experiments

IceHFP

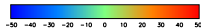
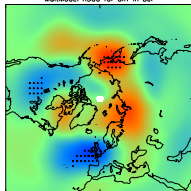
UKMO

UKMO/GS4 h500 for diff in DJF



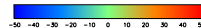
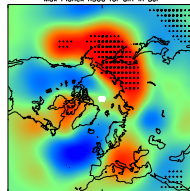
Multi-Model

MultiModel h500 for diff in DJF



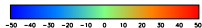
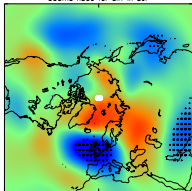
Max Planck

Max Planck h500 for diff in DJF



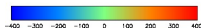
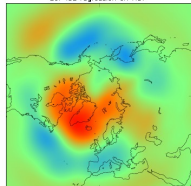
CCCma

CCCma h500 for diff in DJF



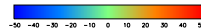
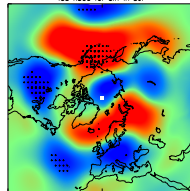
REGRESS

DJF ICE regression on HGT



IC3

IC3 h500 for diff in DJF

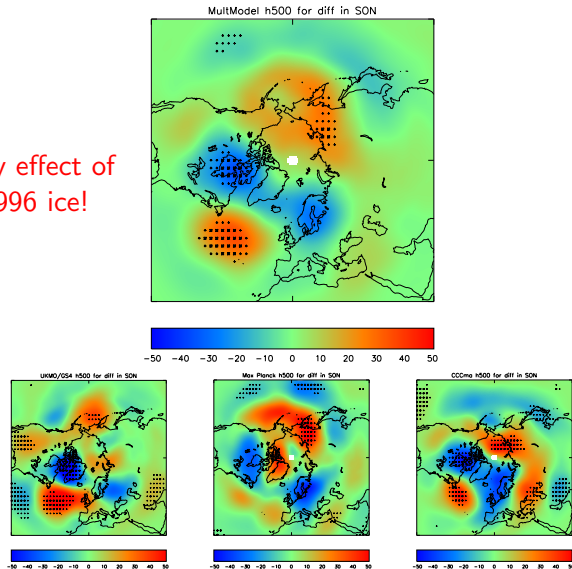


SON 500hPa in iceHFP experiments

IceHFP

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- Again only effect of 2007 vs 1996 ice!



SON 500hPa in iceHFP experiments

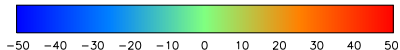
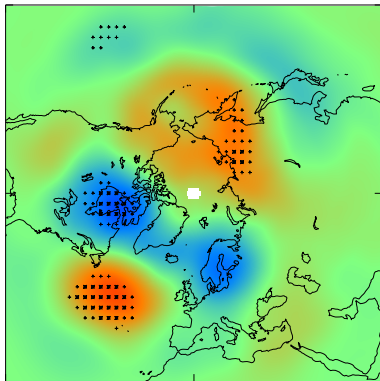
IceHFP

Multi Model

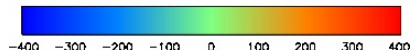
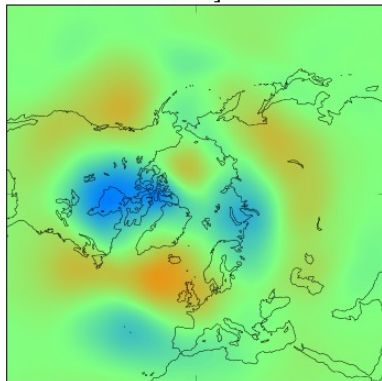
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Regression
not sig.

MultModel h500 for diff in SON



SON detrended ICE regression on HGT



Conclusions

- ▶ Multiple Models show similar effects of ice initialization.
 - ▶ Similar to observed regressions??
 - ▶ But is there an observed pattern?
- ▶ Winter circulation has blocking pattern over Northern Russia and Siberia
 - ▶ Lows/Troughs over North America and Eastern Atlantic/Western Europe
 - ▶ Very Marginally negative NAO
- ▶ Fall circulation has almost positive NAO pattern.
 - ▶ Large troughs over Europe and North America
 - ▶ High height over Azorian Atlantic and Bering Strait
 - ▶ (Detrended) regression high is further north.