

Blue Action and
The role of the stratosphere for seasonal
prediction over the North Atlantic region

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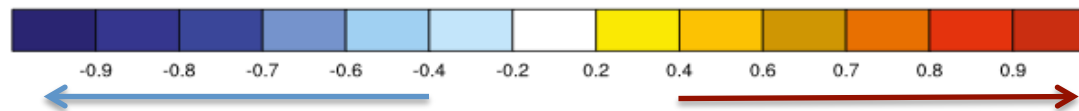
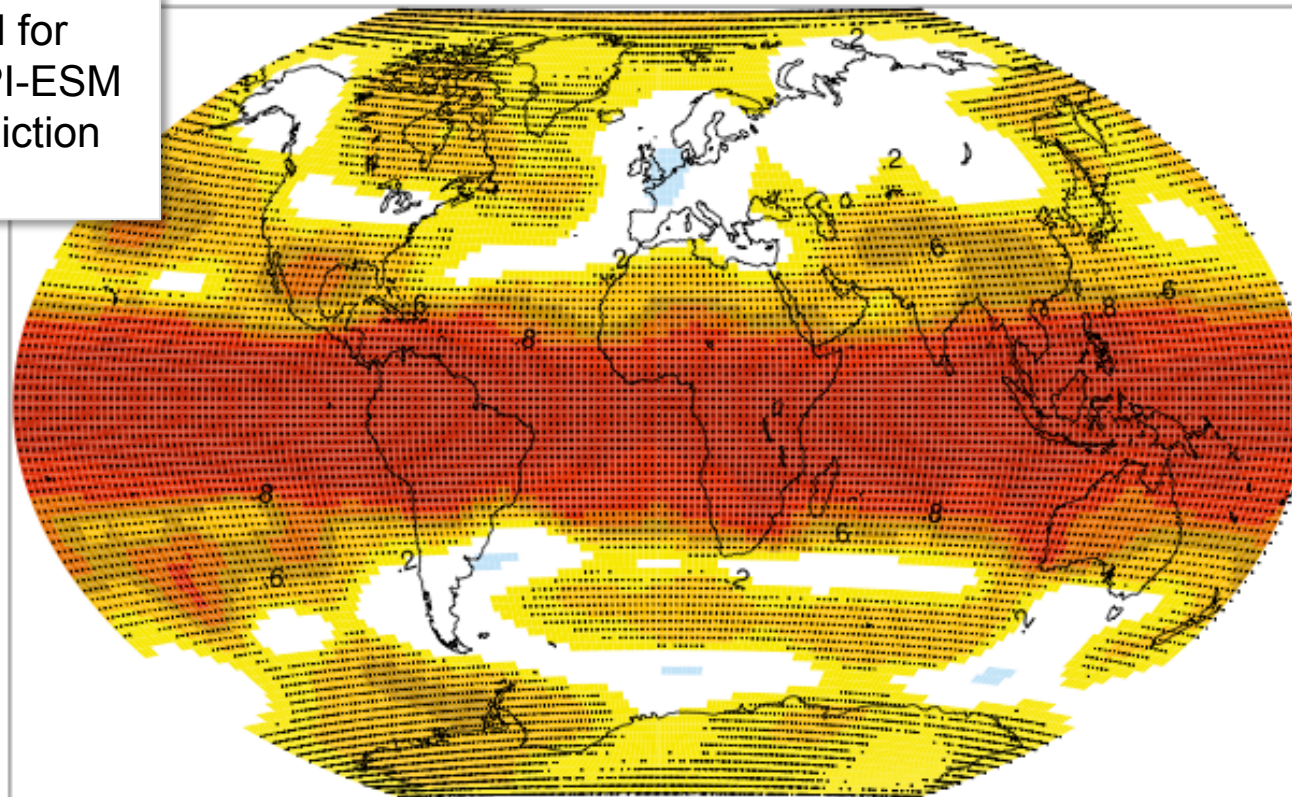
GEOMAR



SEASONAL PREDICTION

How well do we predict the extratropics?

Prediction skill for DJF in the MPI-ESM seasonal prediction model



poor prediction skill

high prediction skill

Domeisen et al., 2015

OVERVIEW

1. Predictability on a variety of timescales

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2. Predictors on **seasonal** timescales

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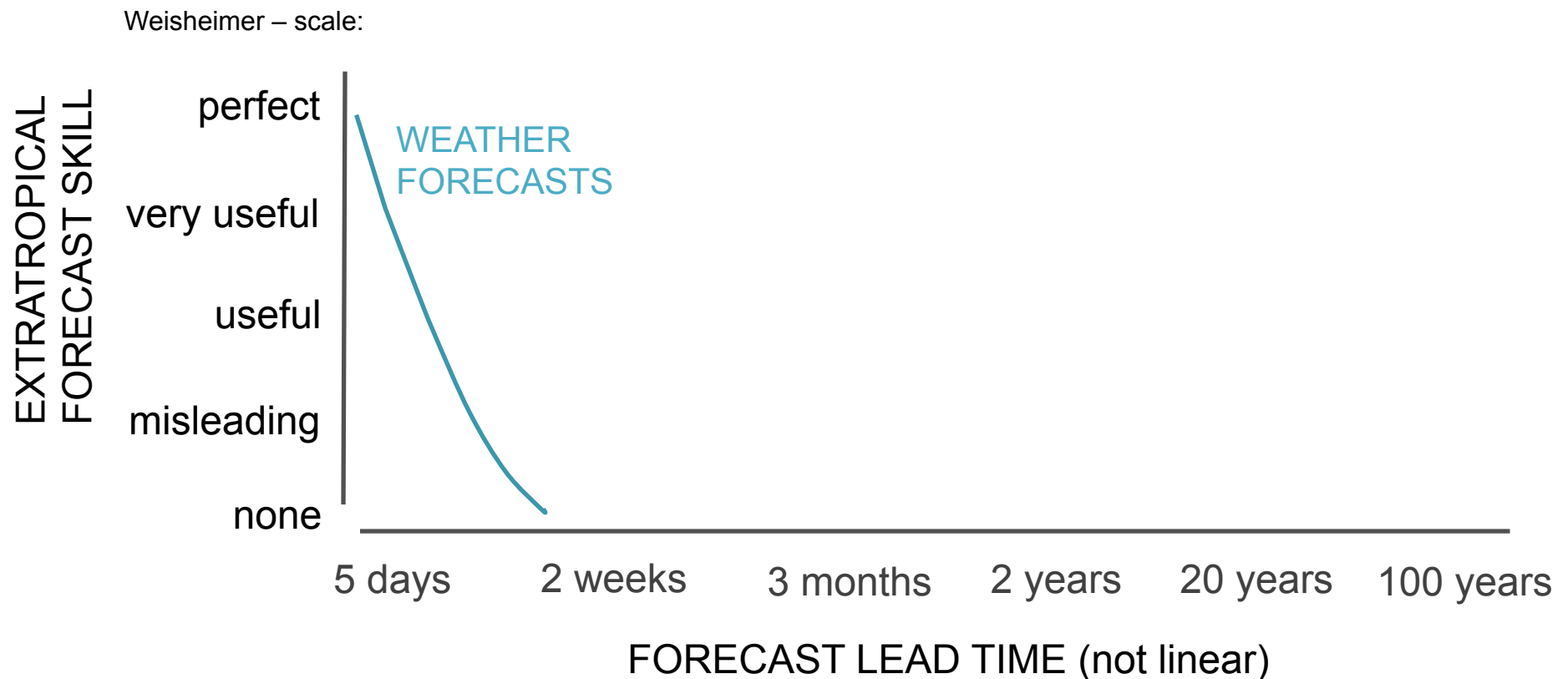
OVERVIEW

1. **Predictability** on a variety of timescales
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4. **Outlook** for seasonal prediction

FORECASTING THE EXTRATROPICS

1. predictability – 2. predictors – 3. the stratosphere – 4. outlook

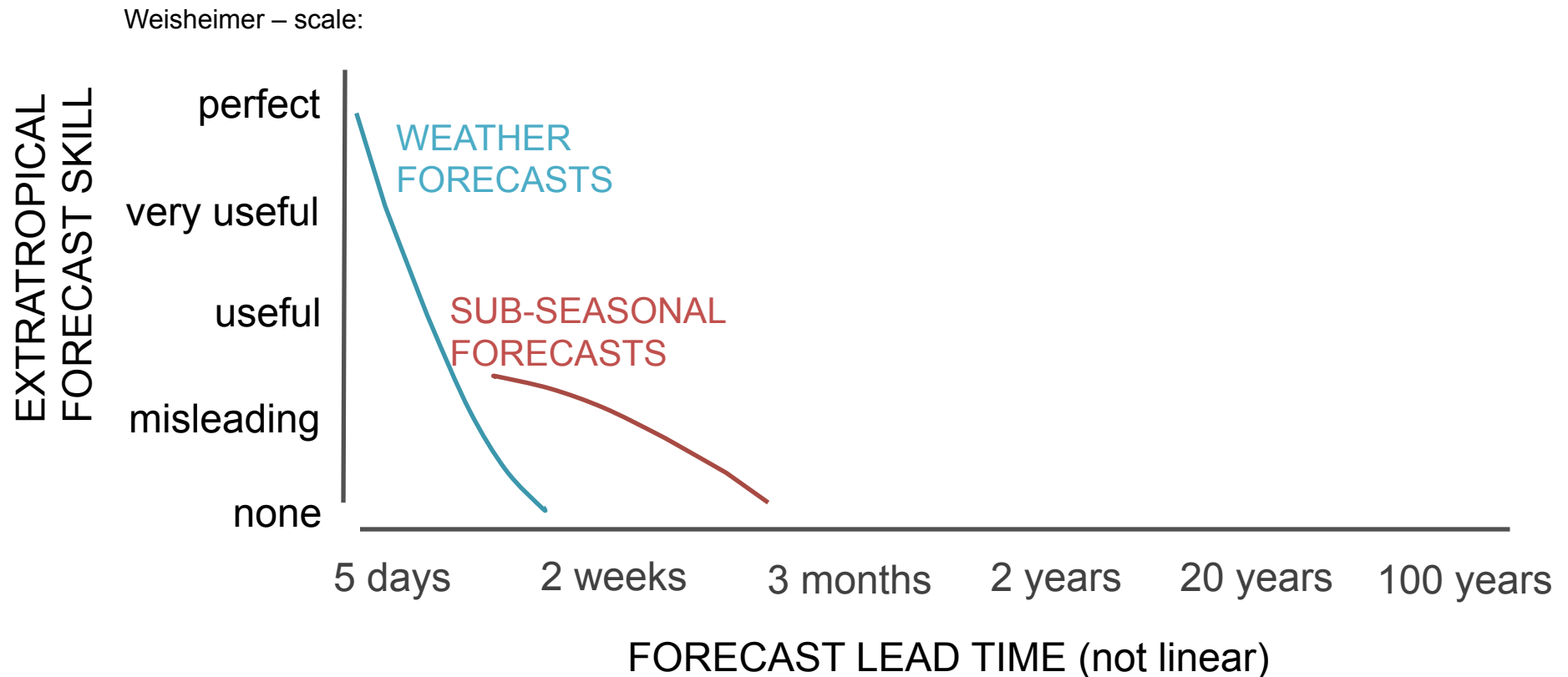
The skill associated with different forecasting timescales varies



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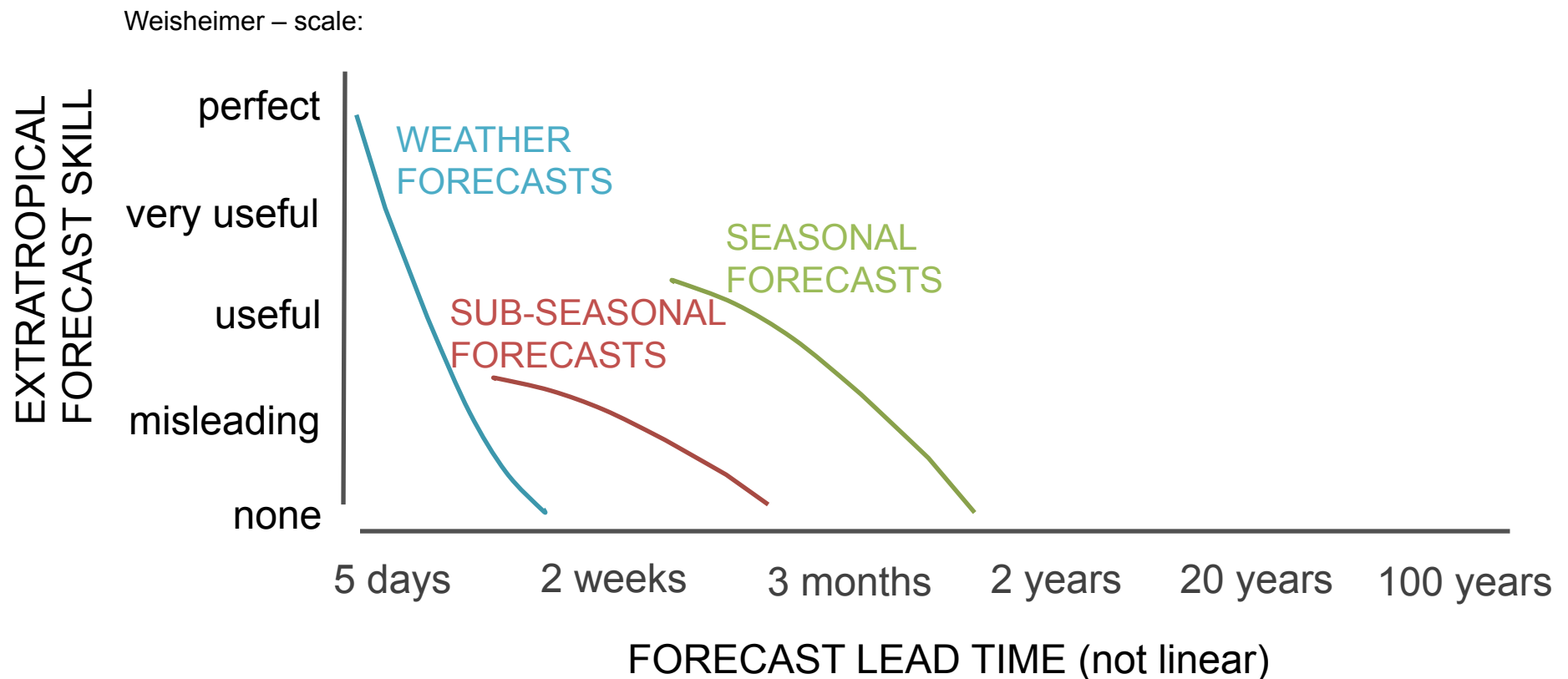
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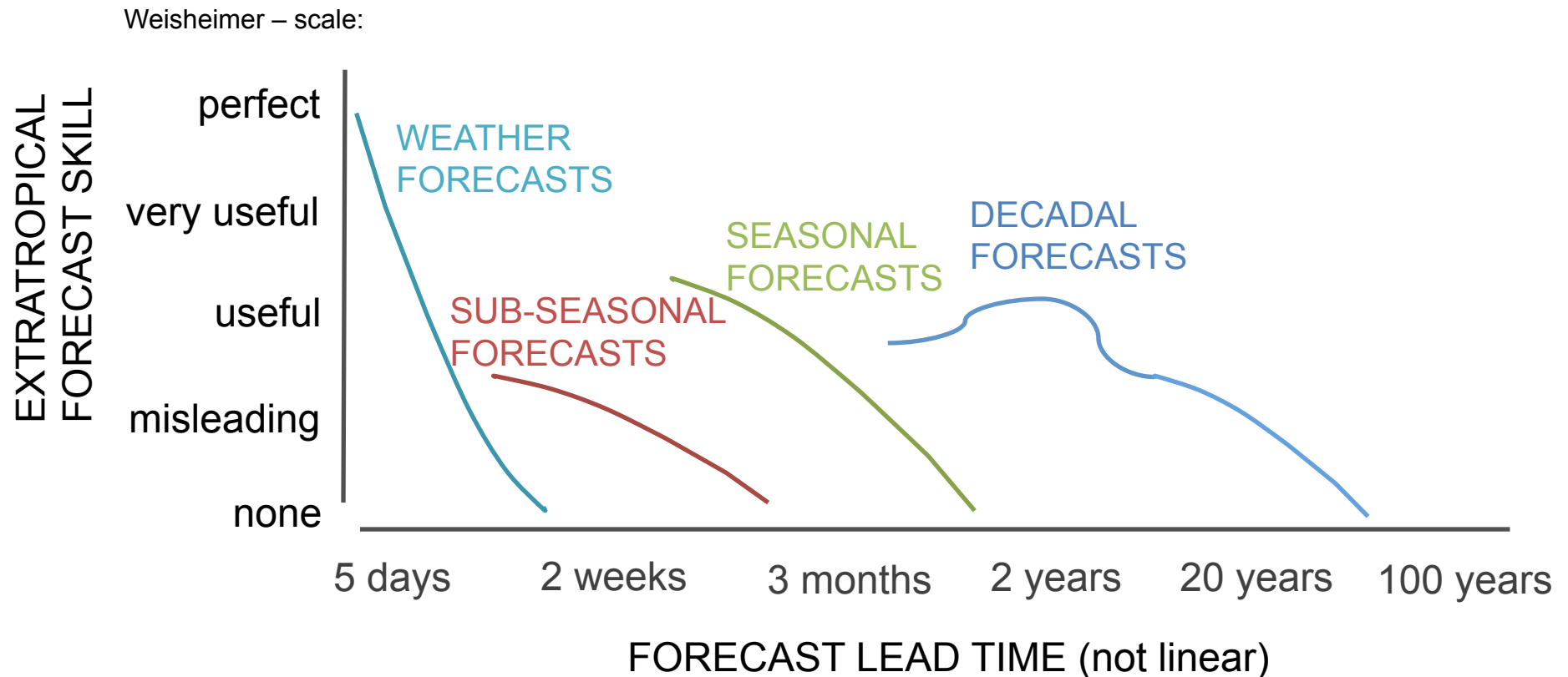
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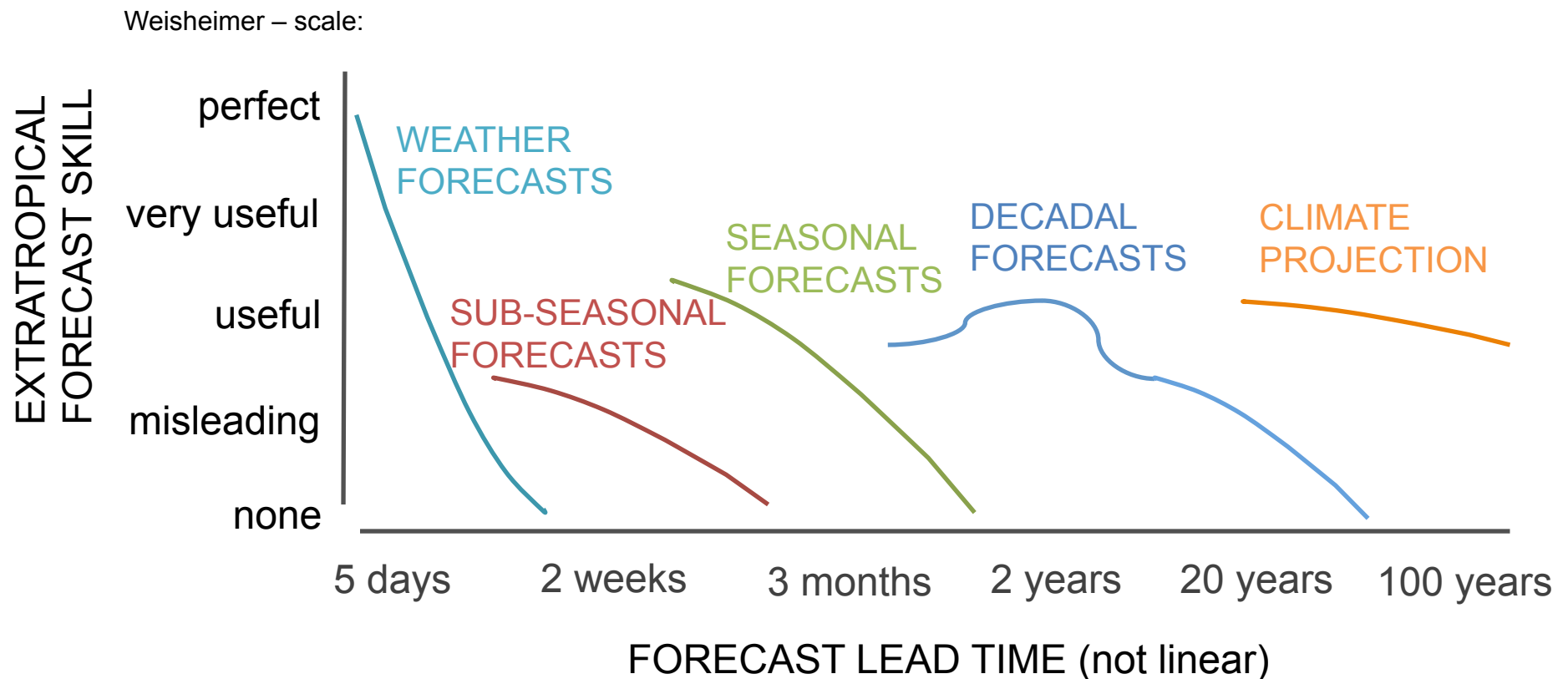
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The skill associated with different forecasting timescales varies



PREDICTORS FOR THE EXTRATROPICS

1. predictability – 2. predictors – 3. the stratosphere – 4. outlook

Strong seasonality in the available predictors

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

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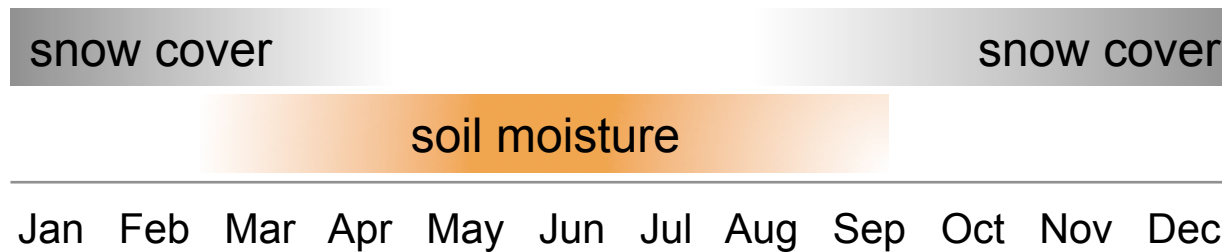
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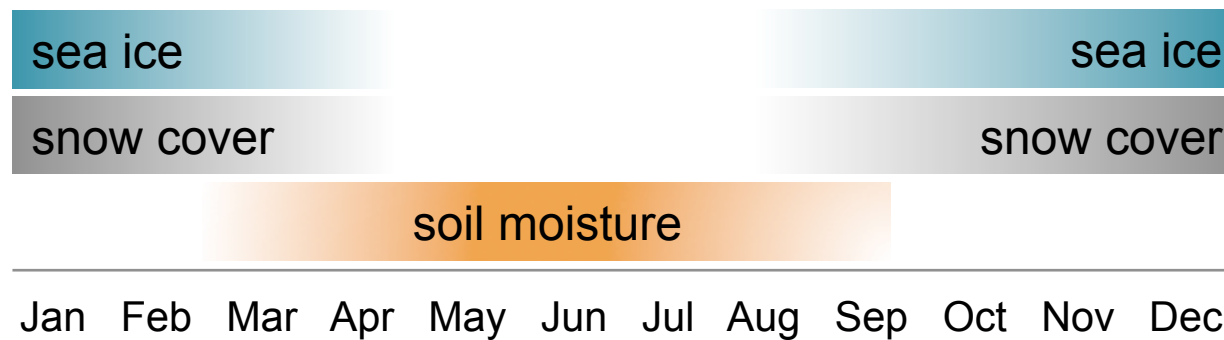
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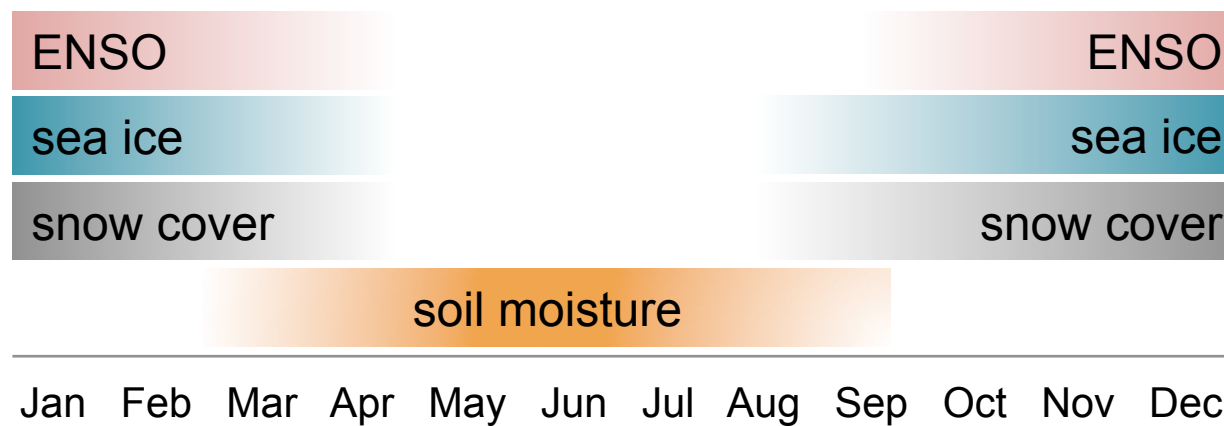
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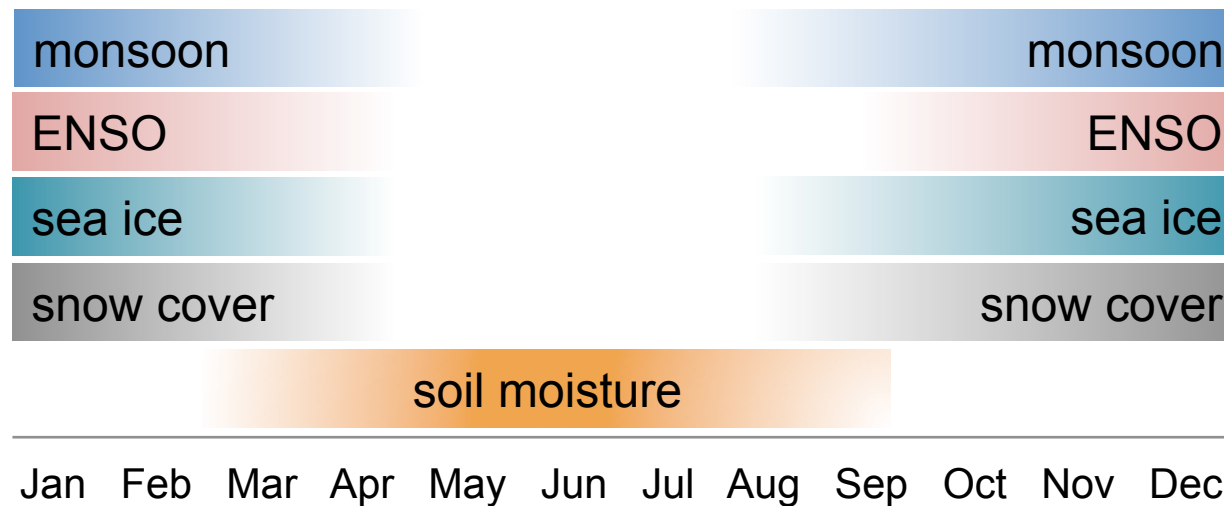
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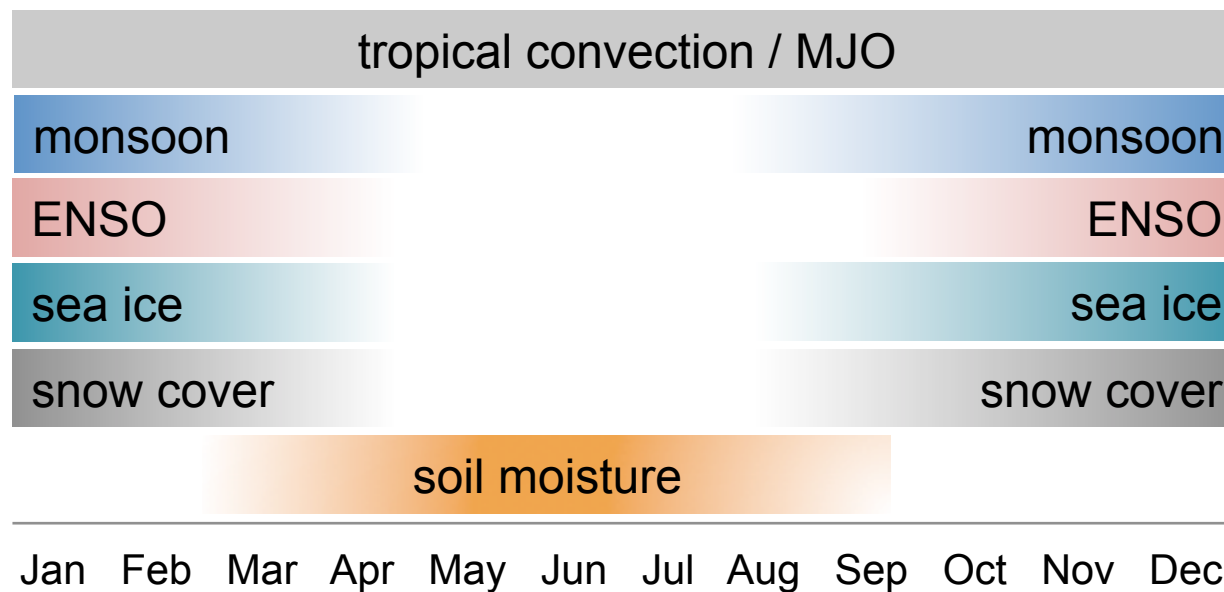
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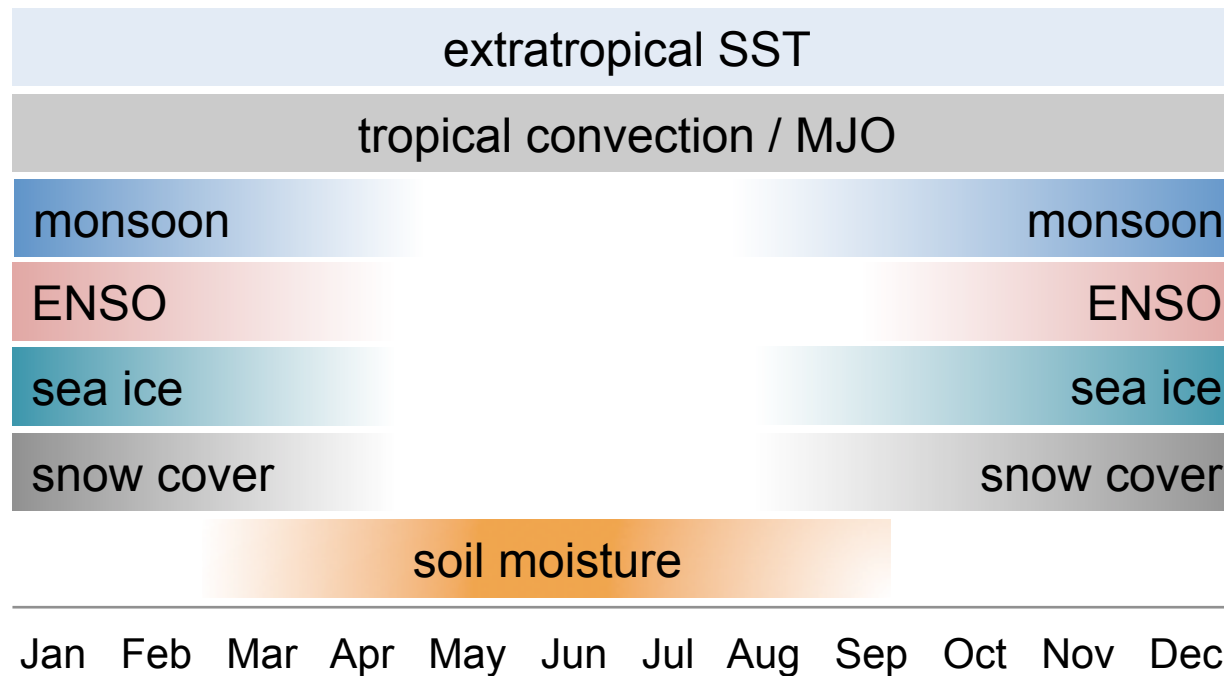
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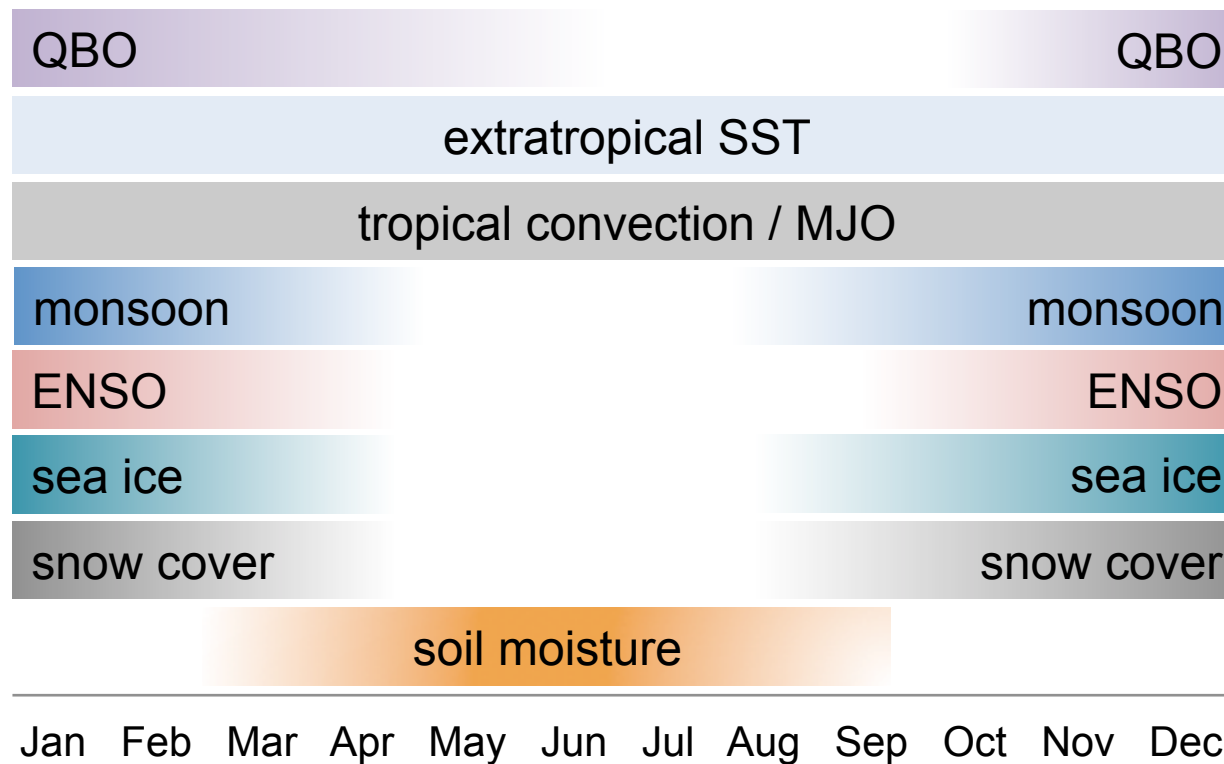
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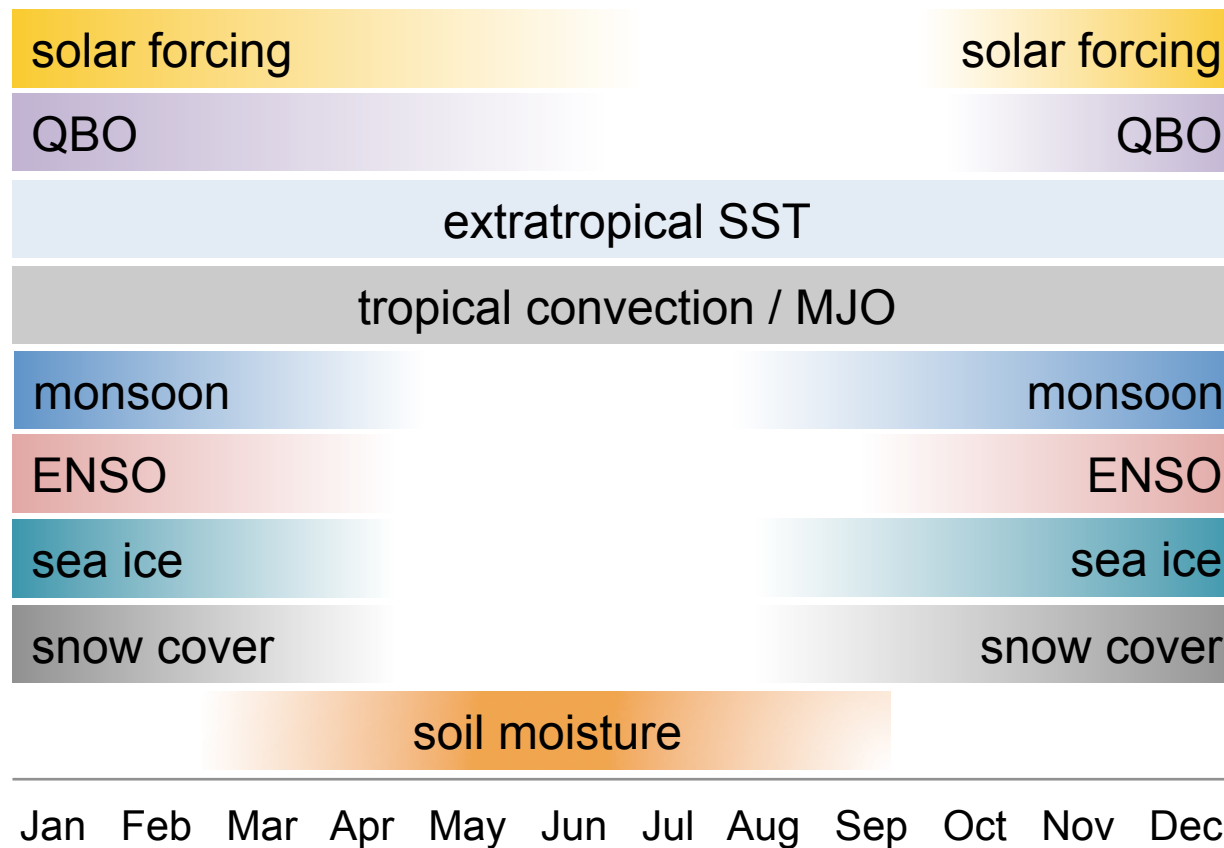
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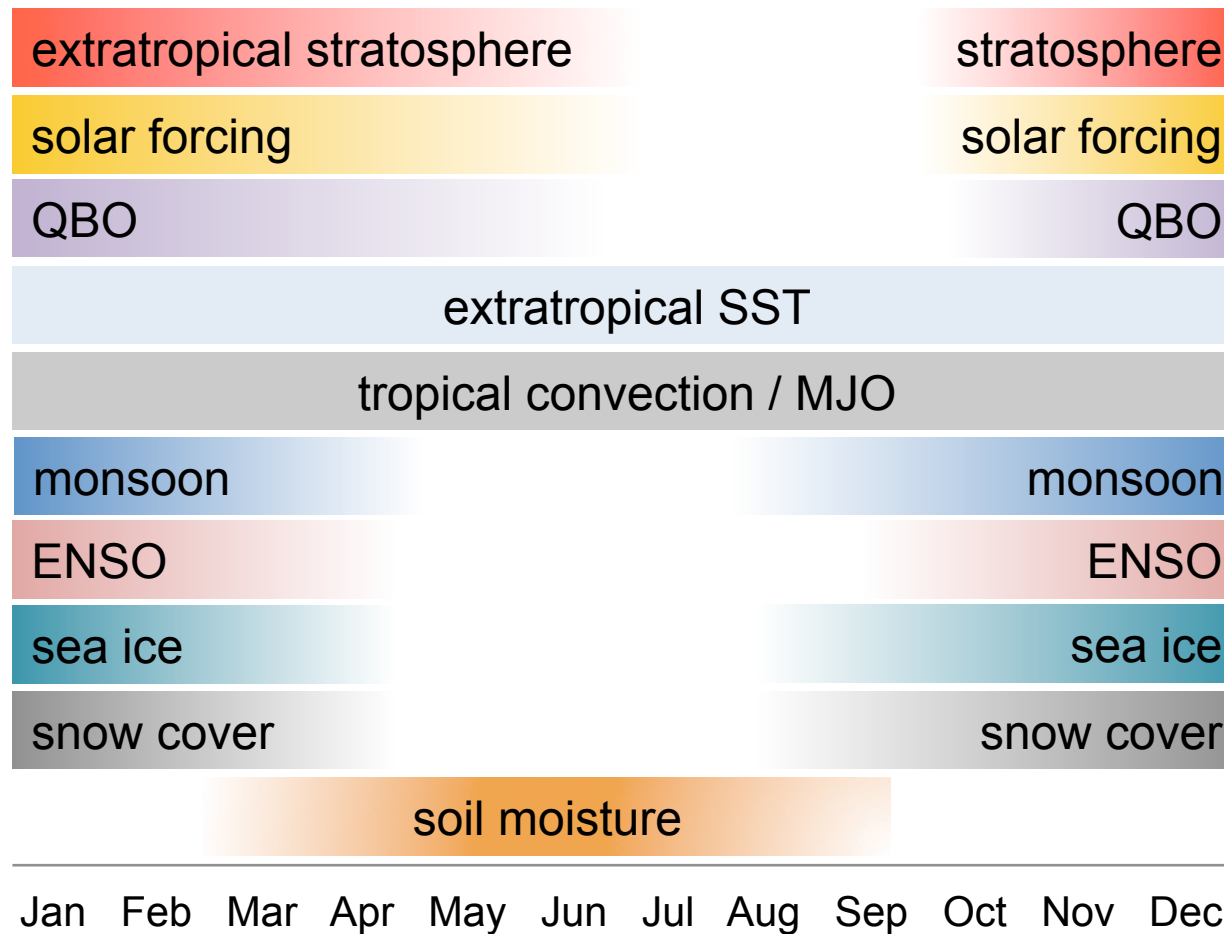
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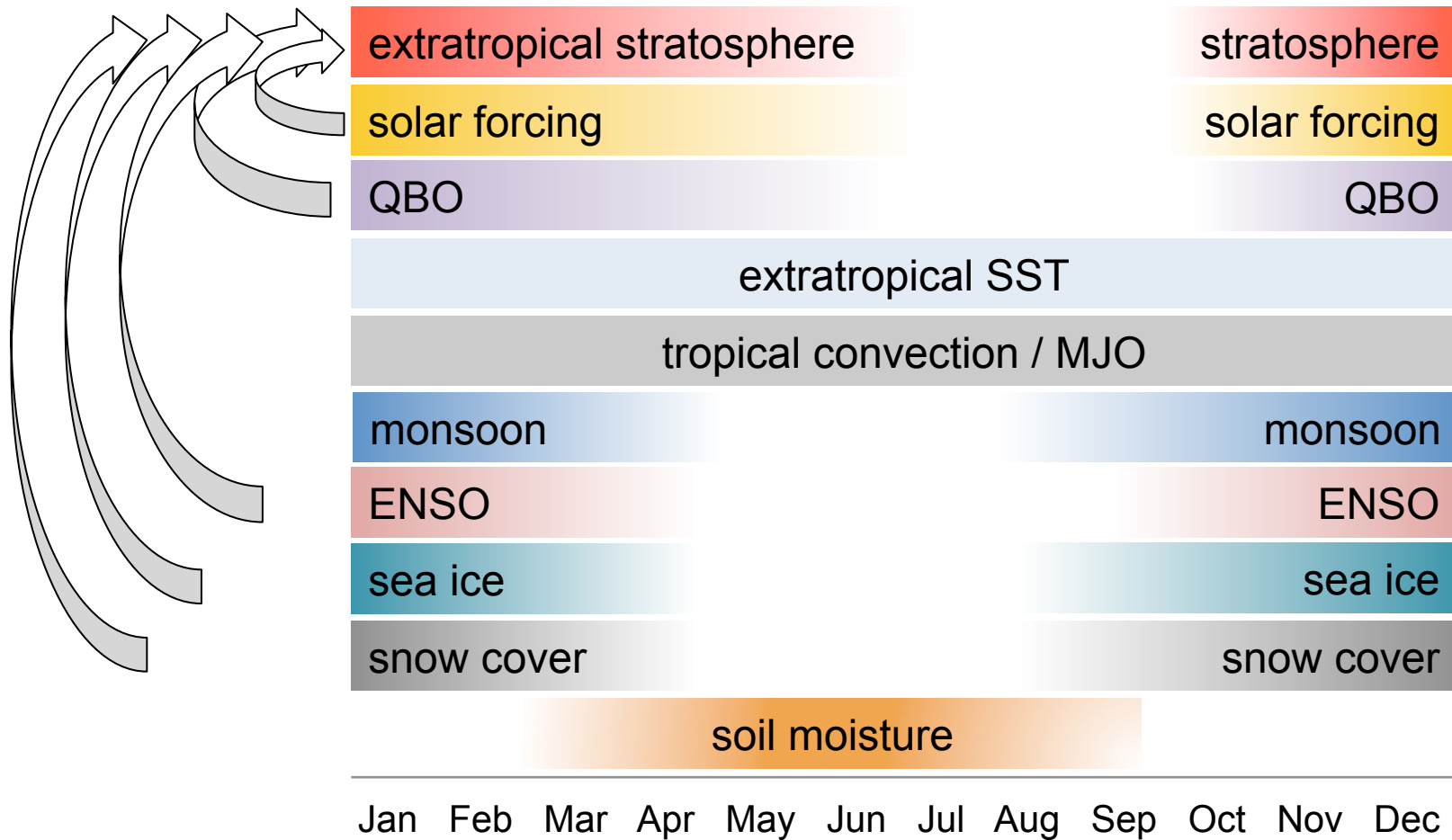
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PREDICTORS FOR THE EXTRATROPICS

1. predictability – 2. predictors – 3. [the stratosphere](#) – 4. outlook

Many predictors are modulated by the stratosphere



MODULATION OF PREDICTORS BY THE STRATOSPHERE

1. predictability – 2. predictors – 3. [the stratosphere](#) – 4. outlook

sea ice Sun et al. (2015)

solar forcing

Kodera & Kuroda (2002)
Matthes et al. (2004)
Kodera (2002)
Matthes et al. (2006)
Scaife et al. (2013)
Gray et al. (2014)
Thieblemont et al (2015)

surface forcing

Smith & Kushner (2012)
Nakamura & Honda (2002)

snow cover

Cohen & Entekhabi (1999)
Smith et al. (2010)
Cohen & Jones (2011)

ENSO

Ineson & Scaife (2009)
Butler & Polvani (2011)
Garfinkel & Hartmann (2008)
Bell et al. (2009)
Manzini (2009)
Li & Lau (2013)
Domeisen et al. (2015)
Richter et al. (2015)
Butler et al. (2016)
Iza et al. (2016)

QBO

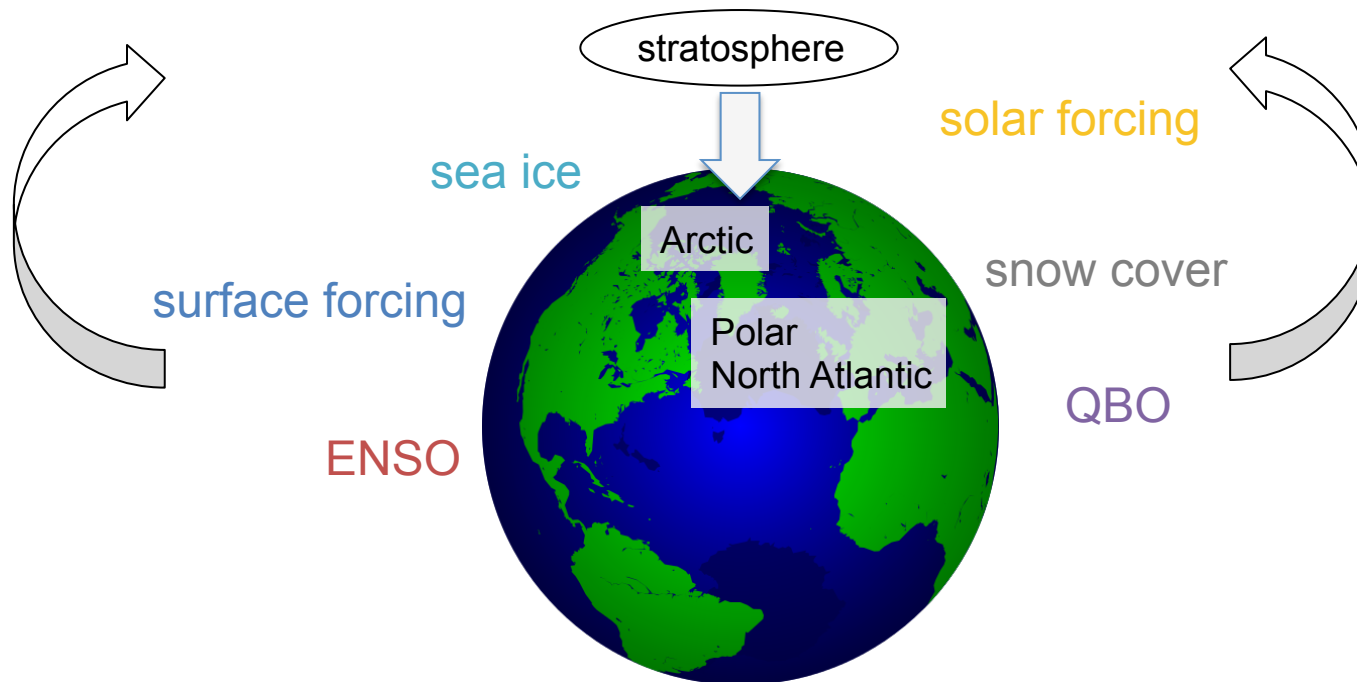
Holton & Tan (1980)
Labitzke (1992)
Garfinkel & Hartmann (2010)
Anstey & Shepherd (2014)
Scaife et al. (2014)



THE STRATOSPHERE AS A MODULATOR

1. predictability – 2. predictors – 3. [the stratosphere](#) – 4. outlook

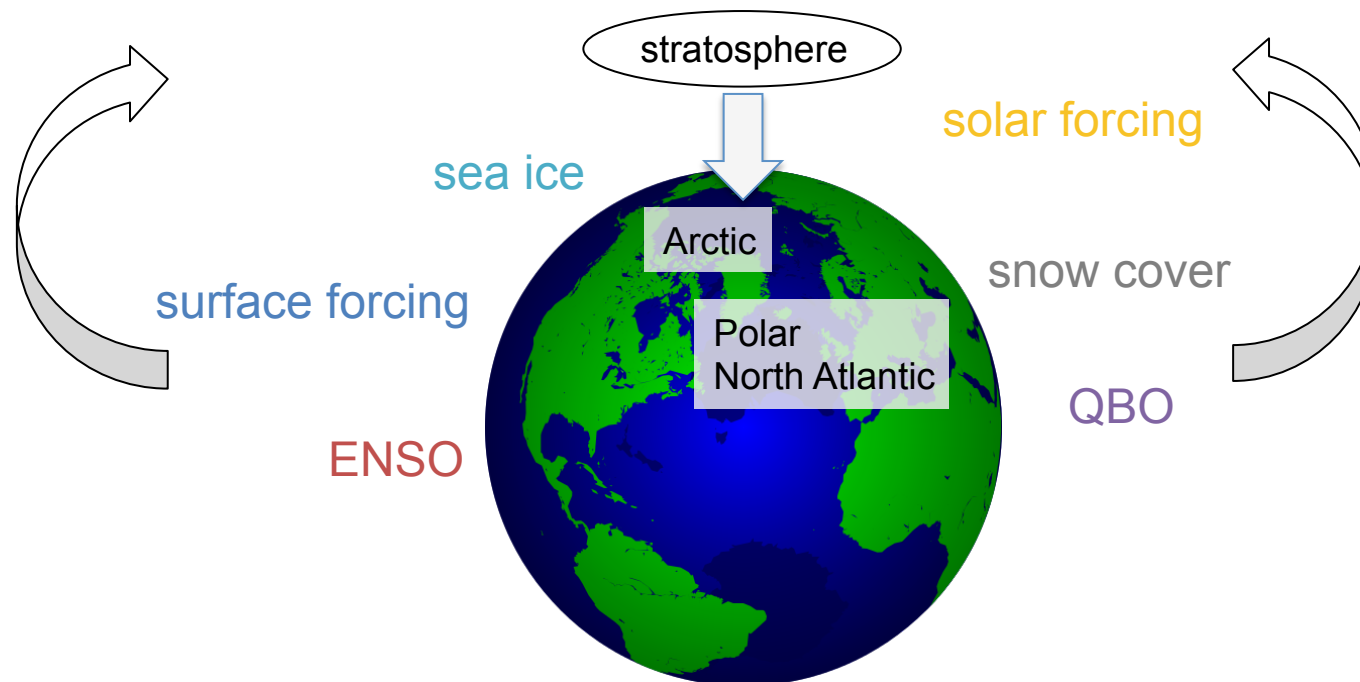
The stratosphere acts as a [modulator for a variety of teleconnections](#).



THE STRATOSPHERE AS A MODULATOR

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The stratosphere acts as a **modulator for a variety of teleconnections.**



The influence of the Northern Hemisphere stratosphere as a modulator is **strongest over the Polar and North Atlantic / Europe region** and for **boreal winter** (Butler et al., 2014).

THE STRATOSPHERE AS A MODULATOR

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The stratosphere acts as a [modulator for a variety of teleconnections](#).

Two issues emerge:

1. How well do we [predict the NH winter stratosphere](#)?
2. How well do we [predict the surface impacts](#)?

The influence of the Northern Hemisphere stratosphere as a modulator is [strongest over the Polar and North Atlantic / Europe region](#) and for [boreal winter](#) (Butler et al., 2014).

PREDICTING THE STRATOSPHERE

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Answer: it depends.

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Much of the predictability depends on the occurrence of a sudden stratospheric warming (SSW) event. These events are possible to predict at lead times of 5 days to 1 month.

e.g. Taguchi (2014), Tripathi et al. (2015), Tripathi et al. (2016), Hitchcock et al., in prep

PREDICTING THE STRATOSPHERE

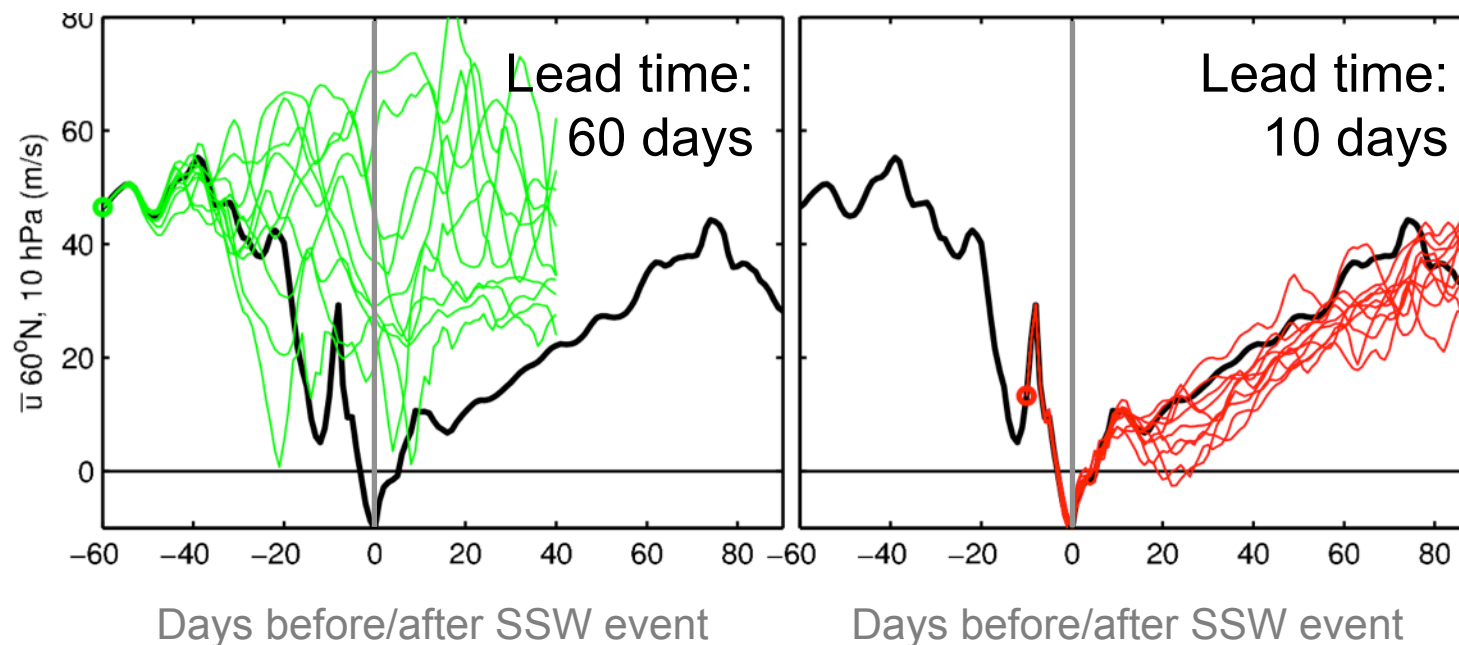
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Gerber et al (2009)

PREDICTING THE TROPOSPHERE

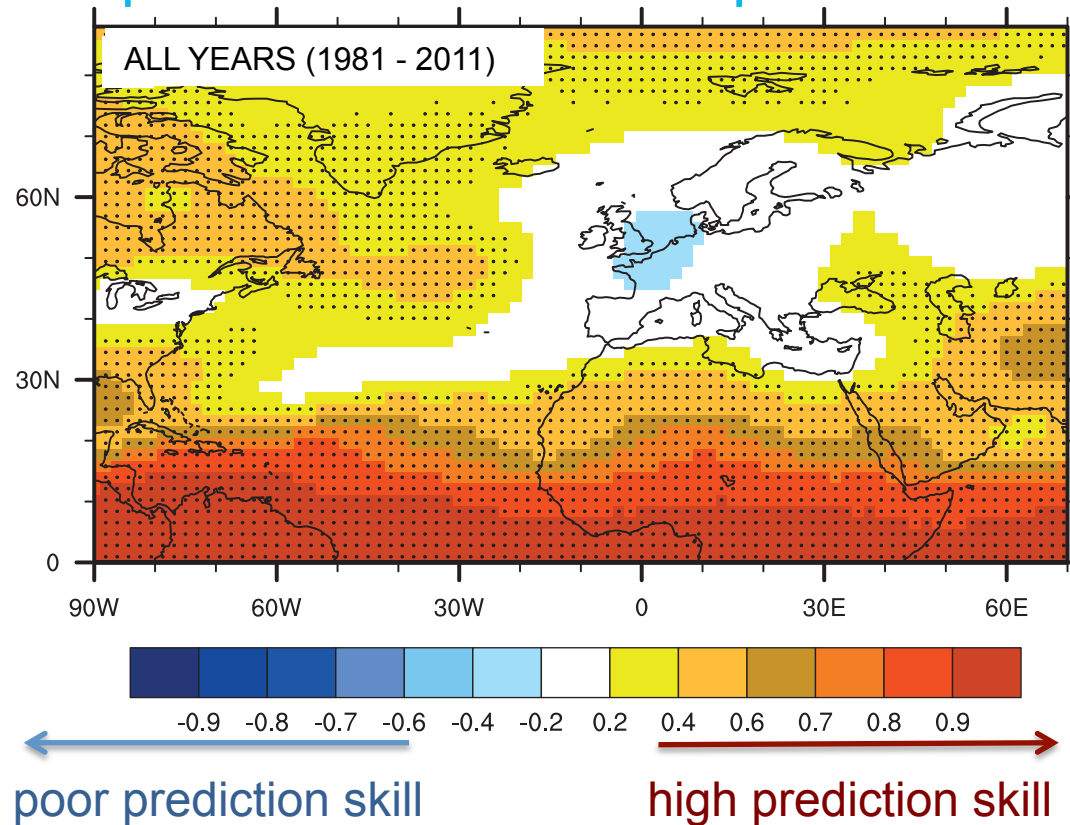
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2. How well do we predict the surface impacts?

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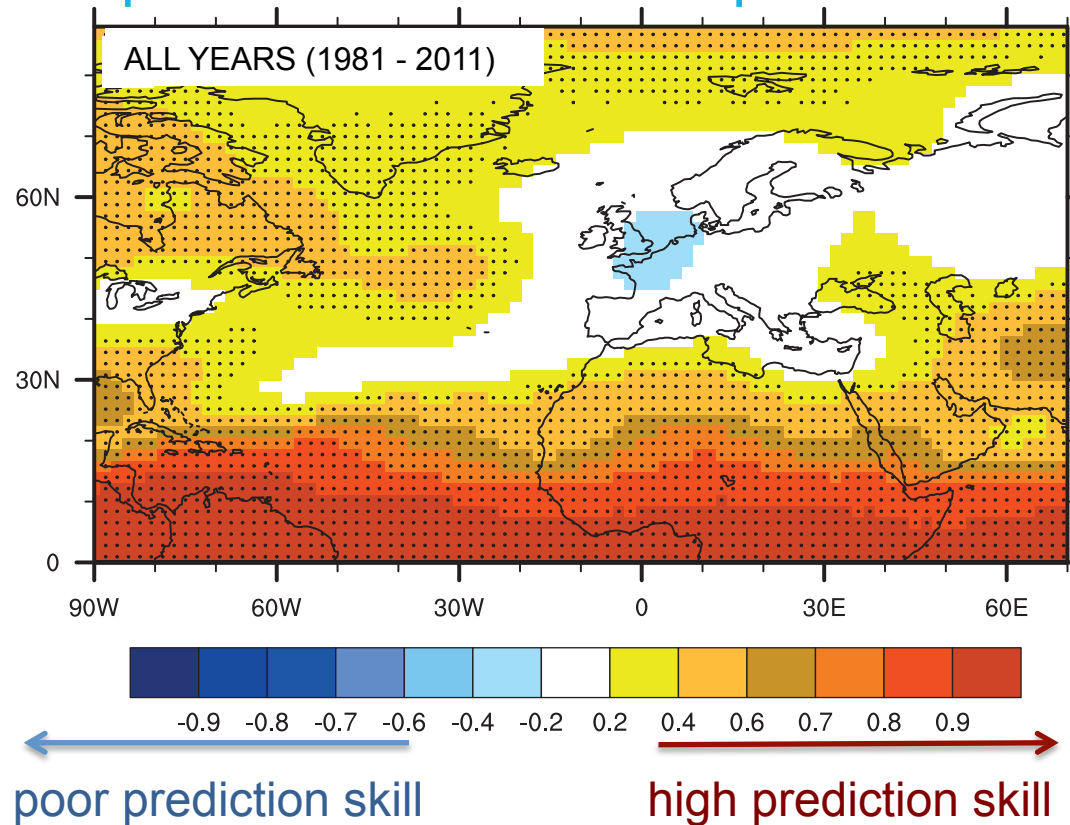
PREDICTION SKILL FOR 500hPa GEOPOTENTIAL HEIGHT FOR DJF

Domeisen et al (2015), J. Clim.

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Prediction skill over the North Atlantic is low...

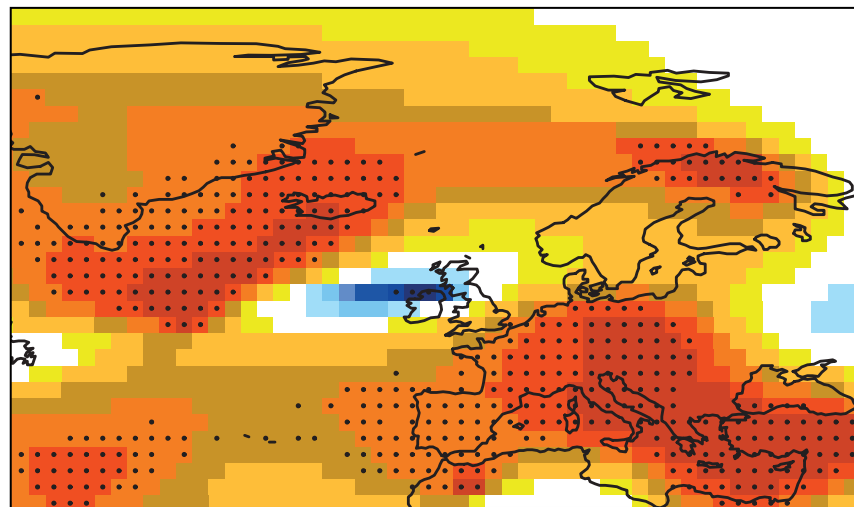
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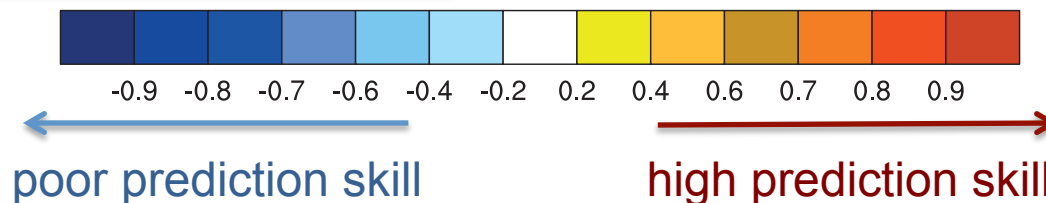
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EL NINO YEARS WITH
ACTIVE STRATOSPHERE (SSW event)



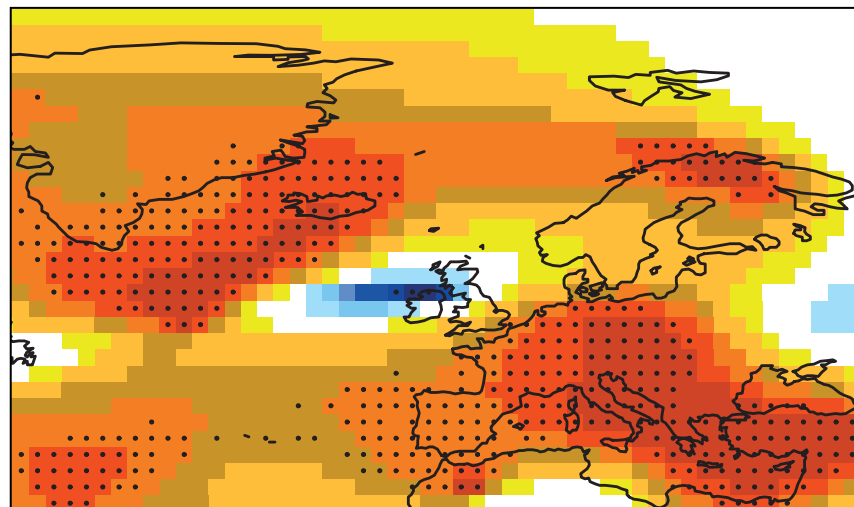
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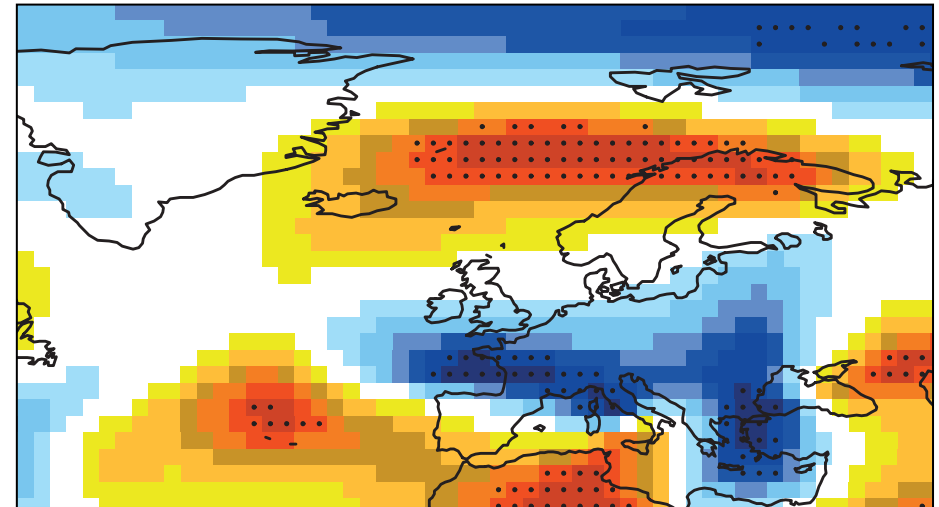
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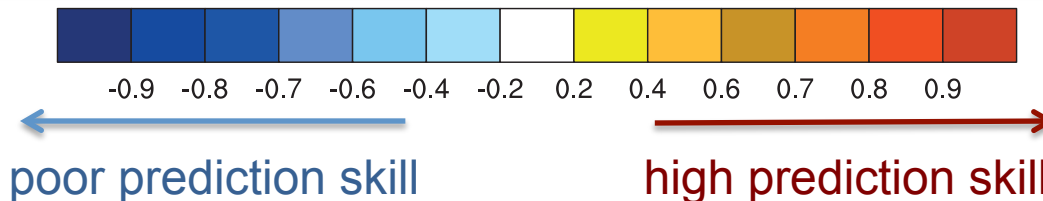
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EL NINO YEARS WITH
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EL NINO YEARS WITH
INACTIVE STRATOSPHERE (no SSW event)



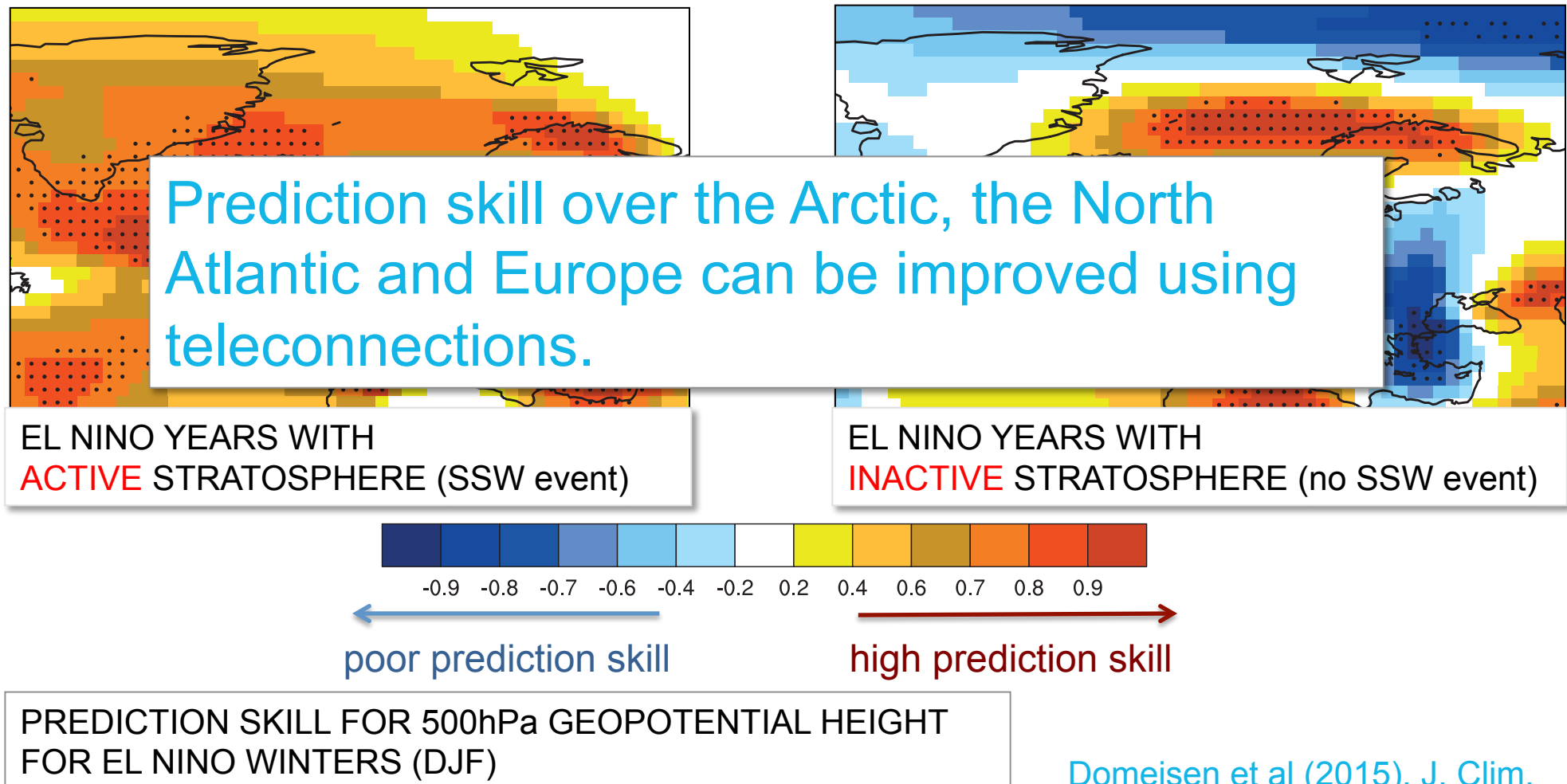
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Can the timescales of stratospheric predictability be extended?

Stratospheric event
Predictability: 5 days – 1 month
Hitchcock et al., in prep.



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Baldwin & Dunkerton, 2001

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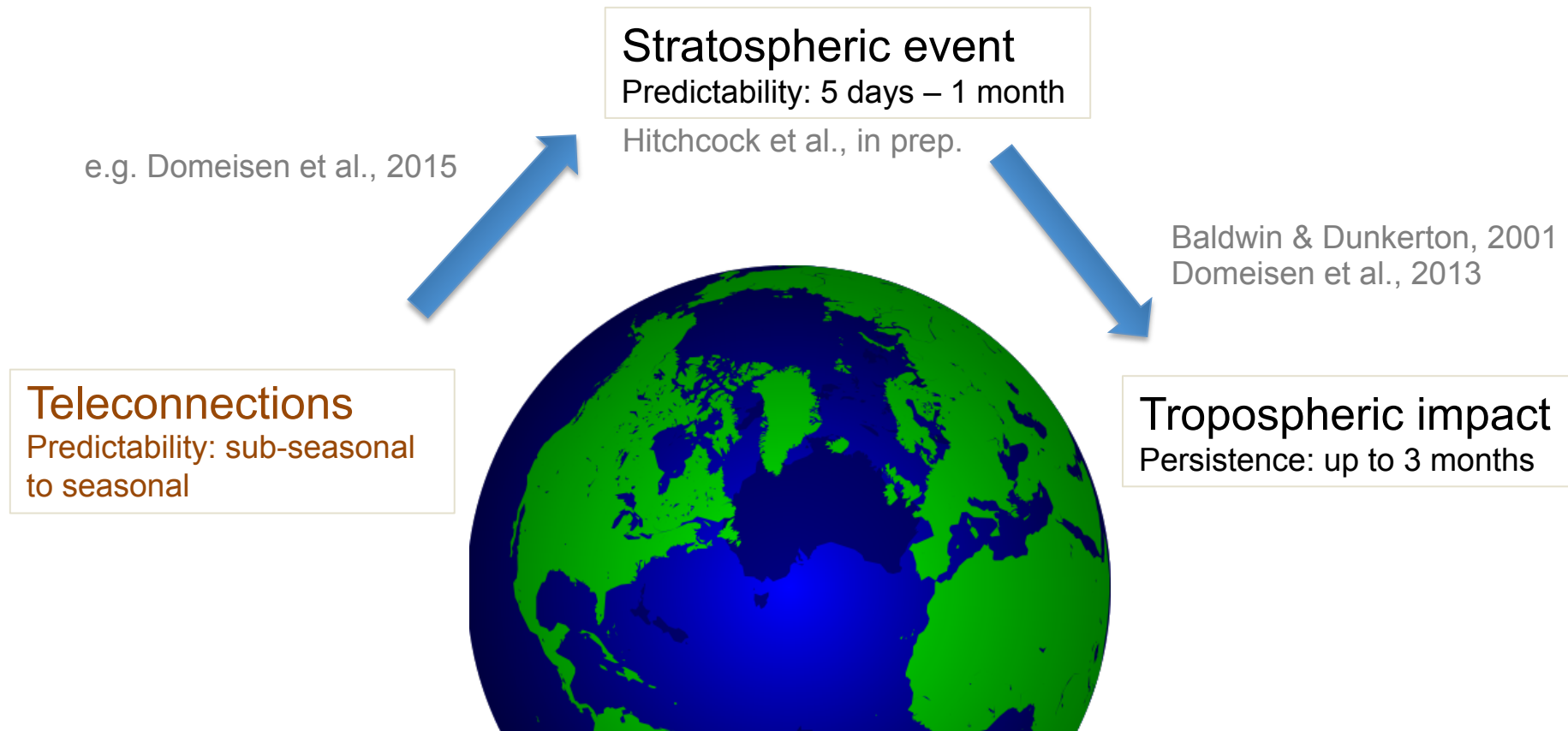
Tropospheric impact

Persistence: up to 3 months

PREDICTING THE TROPOSPHERE

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Can the timescales of stratospheric predictability be extended?



OUTLOOK

1. predictability – 2. predictors – 3. the stratosphere – 4. [outlook](#)

What can we expect from seasonal prediction over the next 5 years?

OUTLOOK

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What can we expect from seasonal prediction over the next 5 years?

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What can we expect from seasonal prediction over the next 5 years?

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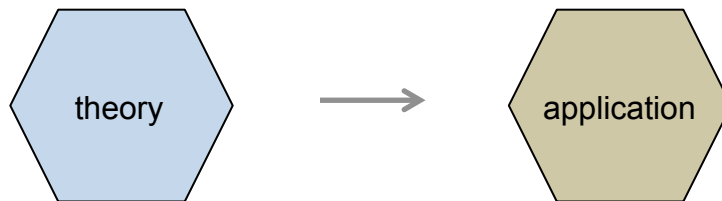
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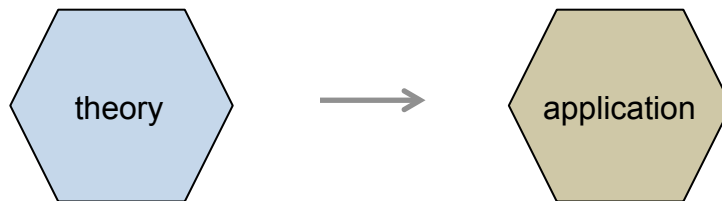


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