

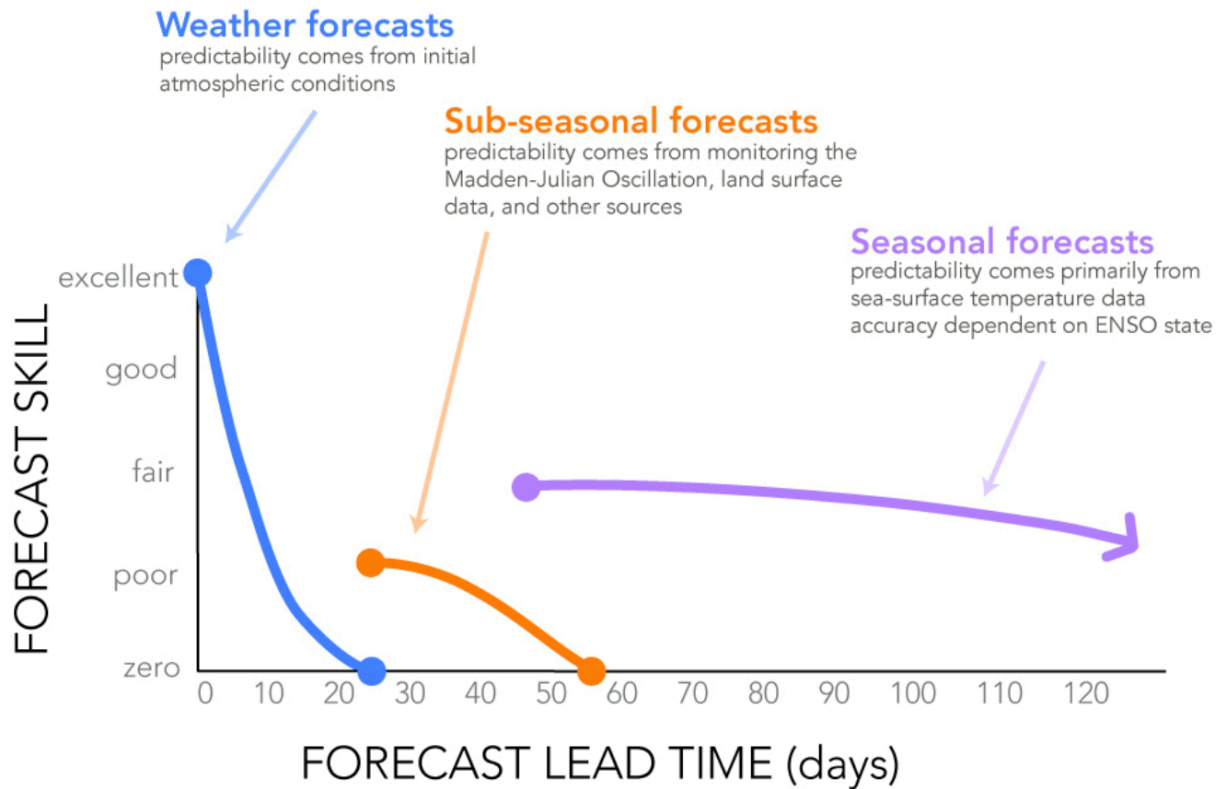
Benefits of a stochastic parameterizations in subseasonal to seasonal forecasts

EGU, April 28, virtual

JUDITH BERNER, NCAR

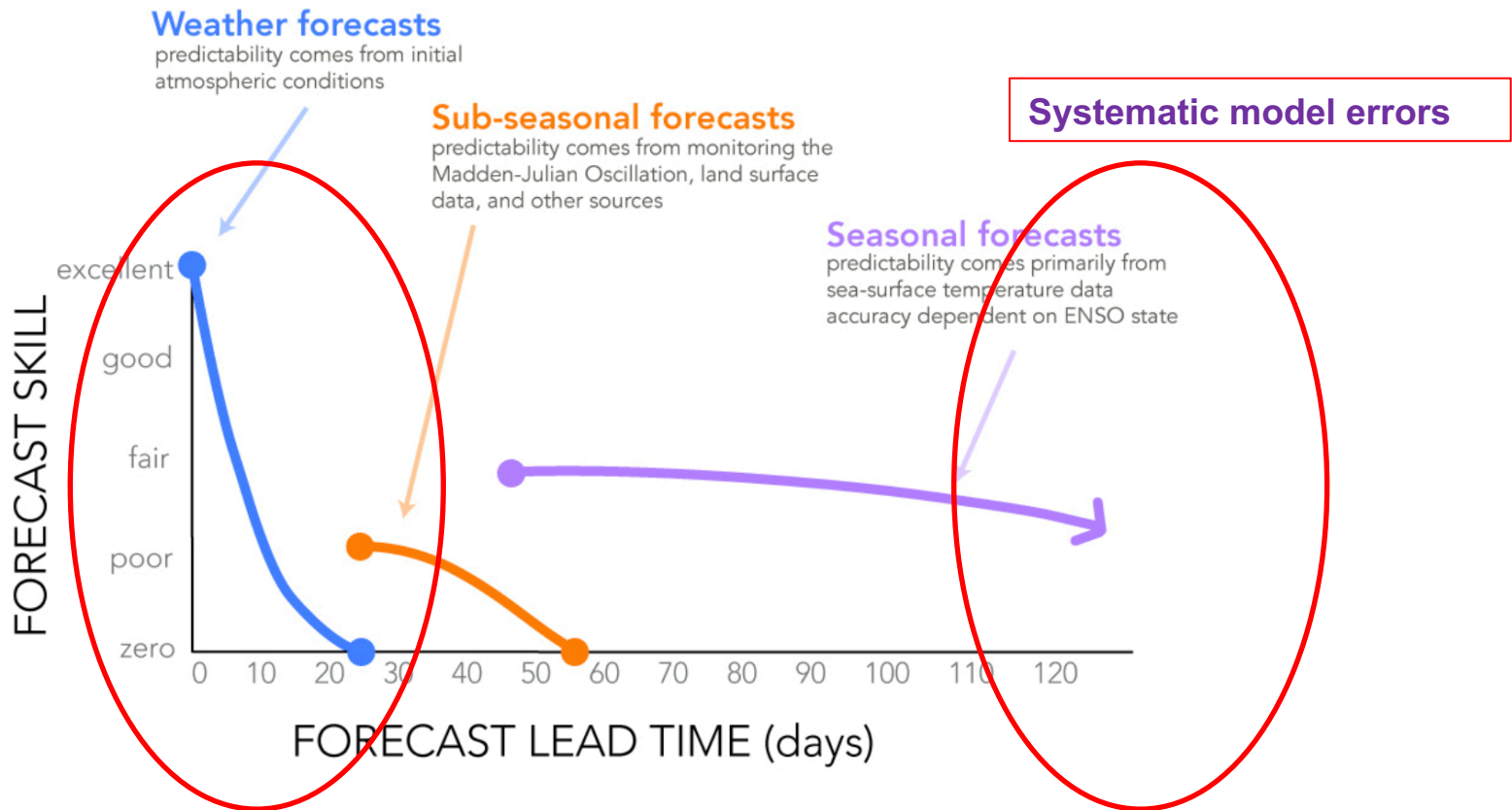


S2S predictability



<https://iri.columbia.edu/news/qa-subseasonal-prediction-project/>

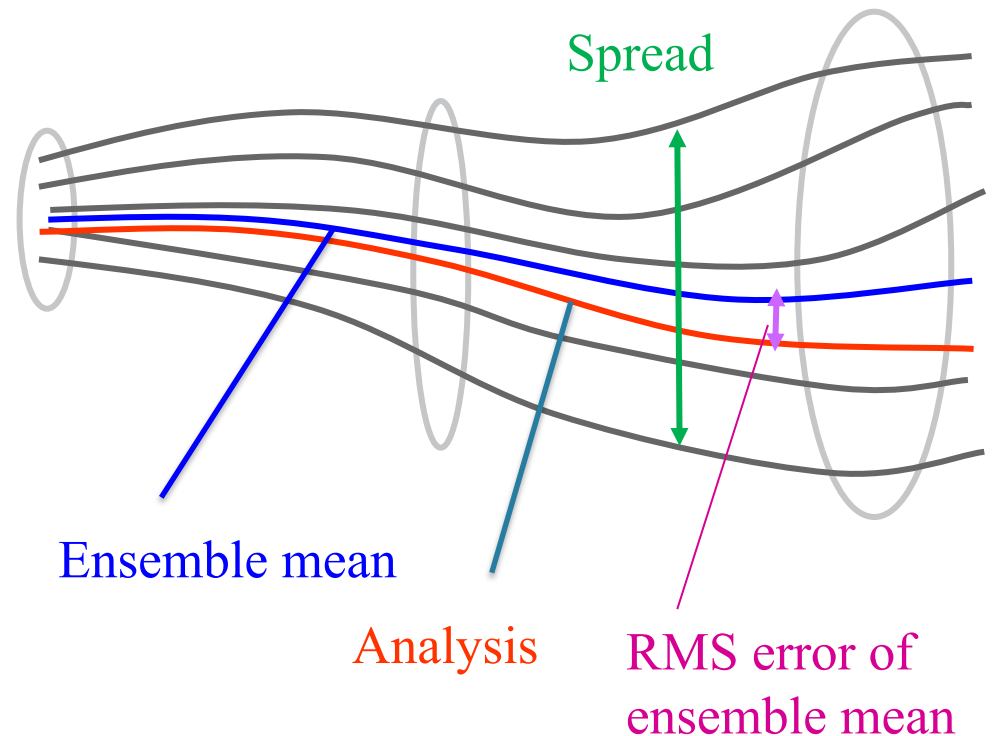
Model error



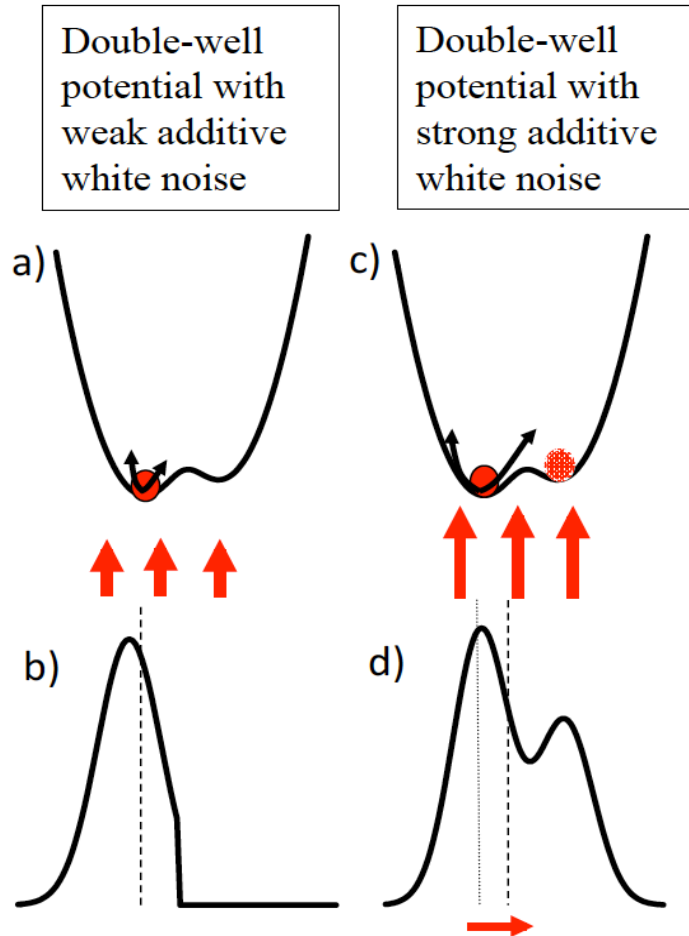
<https://iri.columbia.edu/news/qa-subseasonal-prediction-project/>

Stochastic parameterizations in NWP

- Flow-dependent spread should represent flow-dependent predictability (RMS error)
- Ensemble predictions systems tend to be underdispersive
- Stochastic parameterizations are used to increase spread
- ❖ This addresses the random component of model error



Potential of stochastic parameterizations

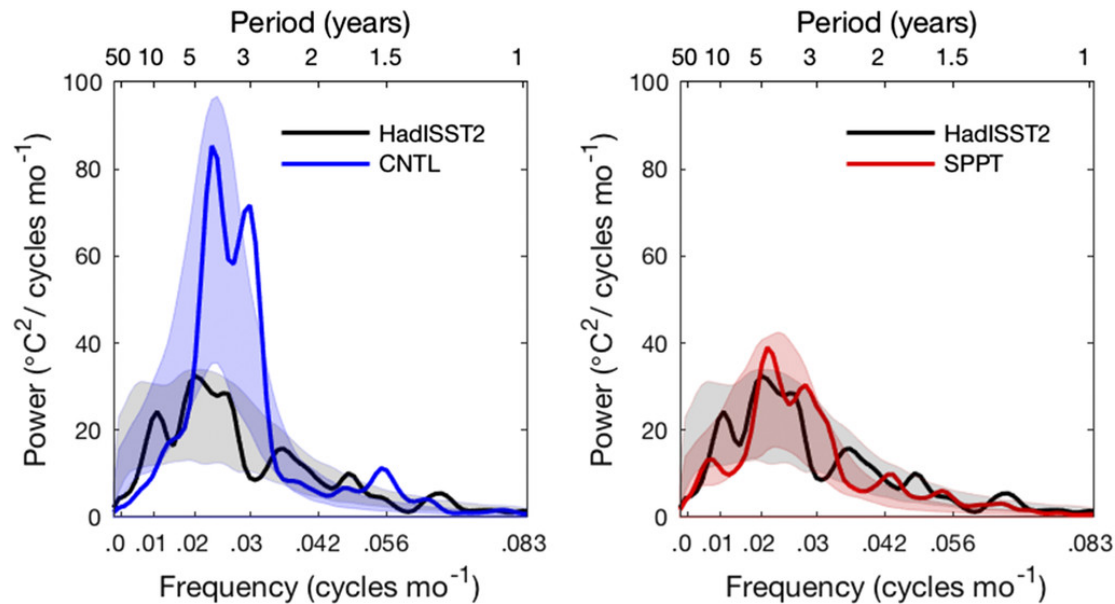


Stochastic parameterizations have the potential

- to increase ensemble spread
- to reduce systematic model error

Berner et al. 2016, BAMS

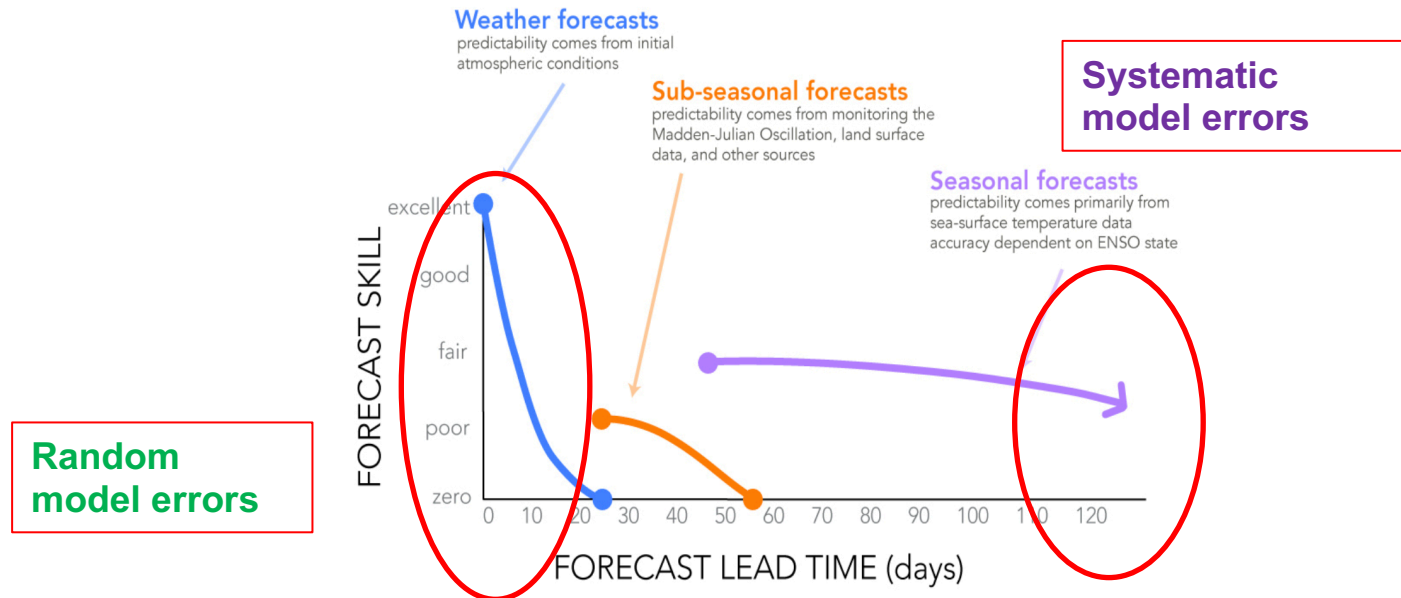
Potential of stochastic parameterizations to reduce systematic model errors



Christensen et al 2016, QJRMS
Berner et al. 2018, J. Clim

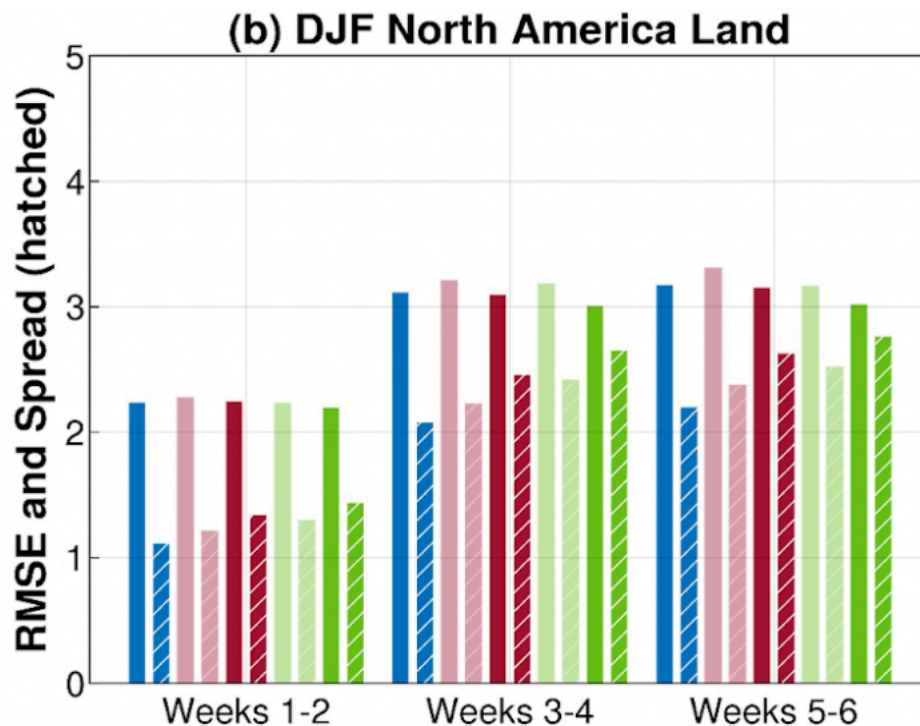
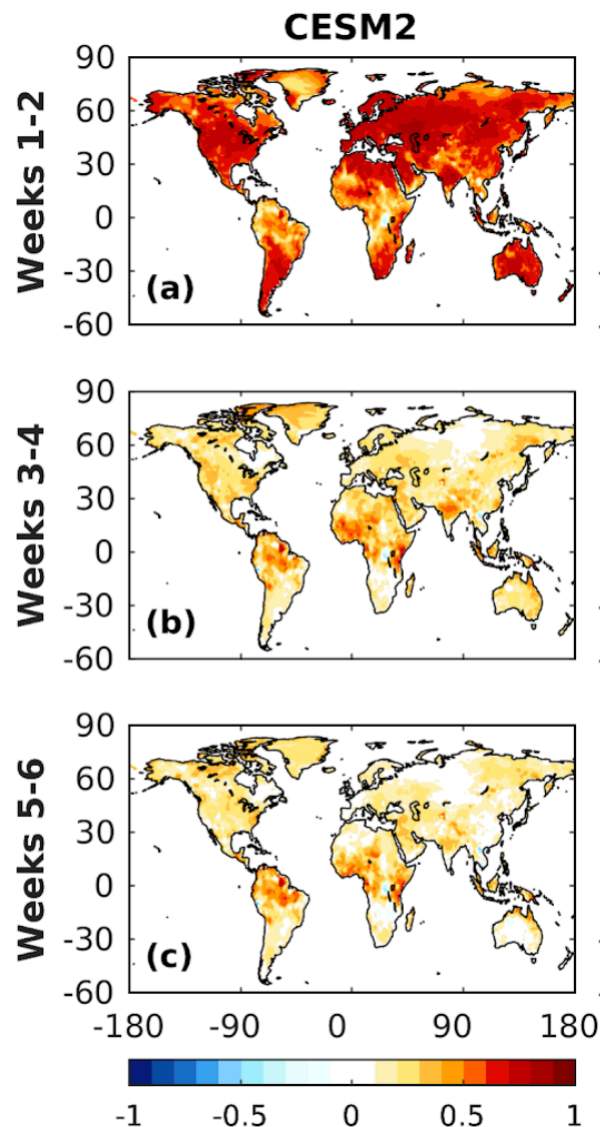
❖ This addresses the systematic component of model error

Model error on the S2S timescale



- ❖ Both - systematic and random model error play a role
- ❖ Biases from “fast physics” often develop in the first days to weeks
- ❖ S2S verification is done on anomalies, not full fields
- ❖ Abundance of data (compared to climate)
- S2S timescale is an opportunity for model development

S2S with the Community Earth System Model CESM2

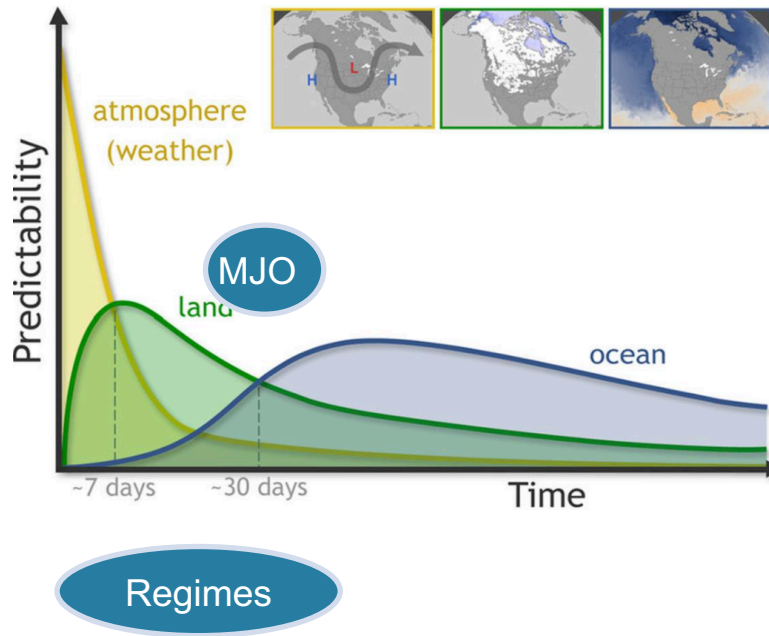


- ACC shows skillfull S2S forecasts over land
- Ensemble system is under-dispersive, although lead-time dependent bias is removed

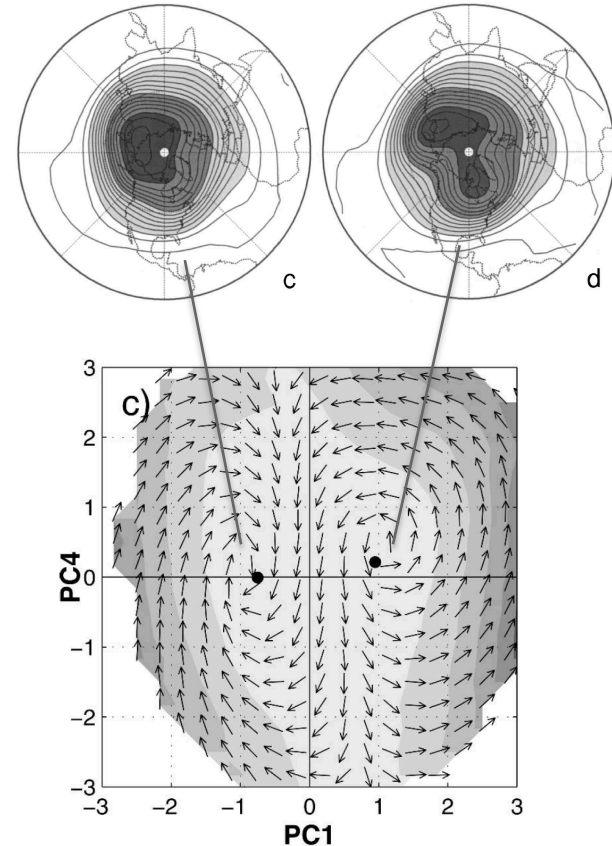
Richter et al. 2021

Sources of S2S predictability

https://www.weather.gov/sti/stimodeling_s2sreport

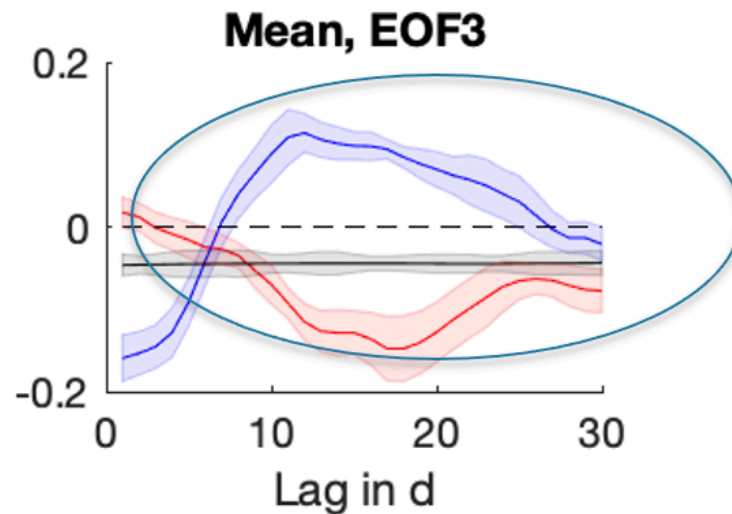
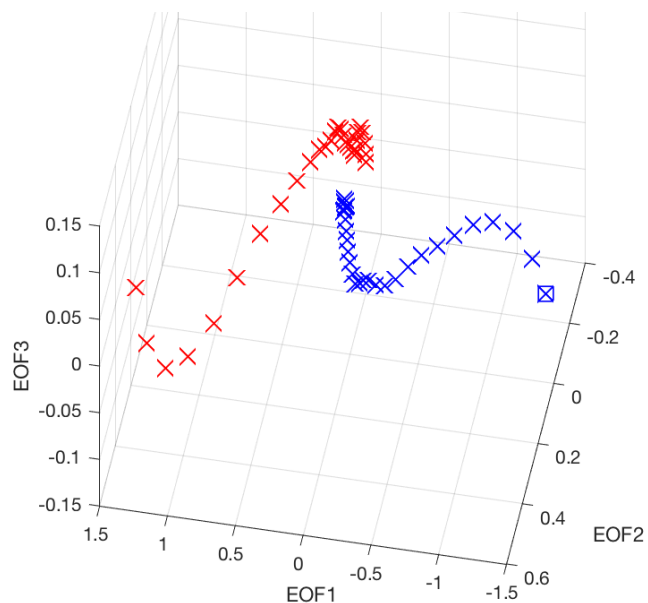


Zonal and block regimes



Branstator and Berner, 2007

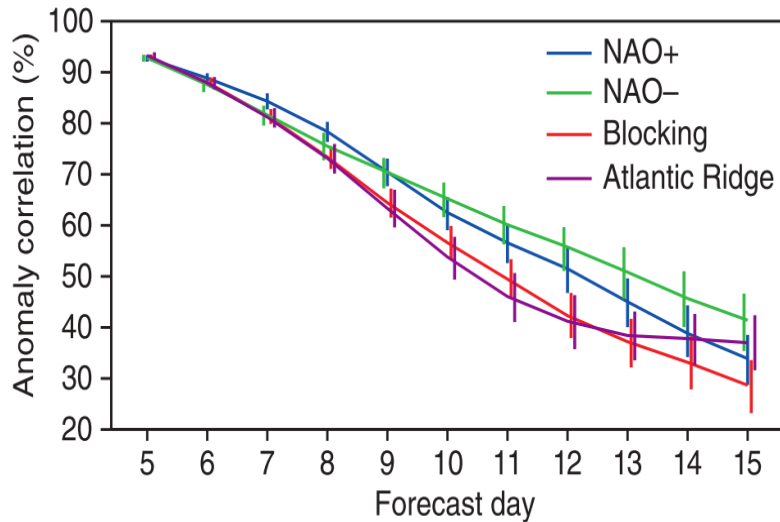
Evolution of states initialized in NAO+/- in CESM1



Berner 2021, in preparation

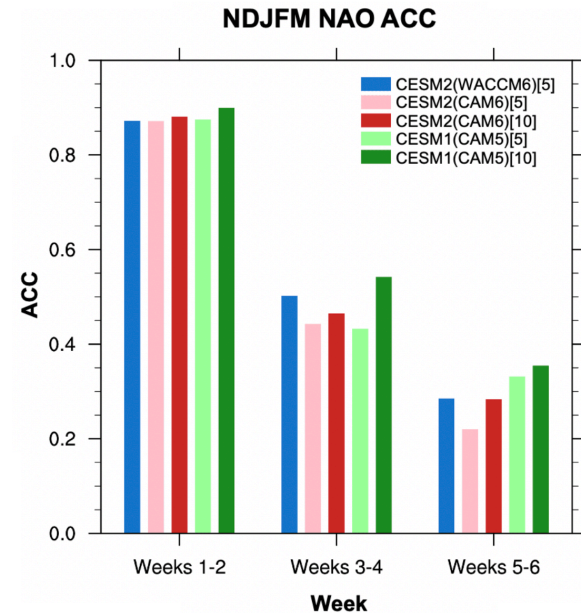
❖ Emergent signal, here from 8-30d in EOF 3

Regimes



Ferranti et al. 2015

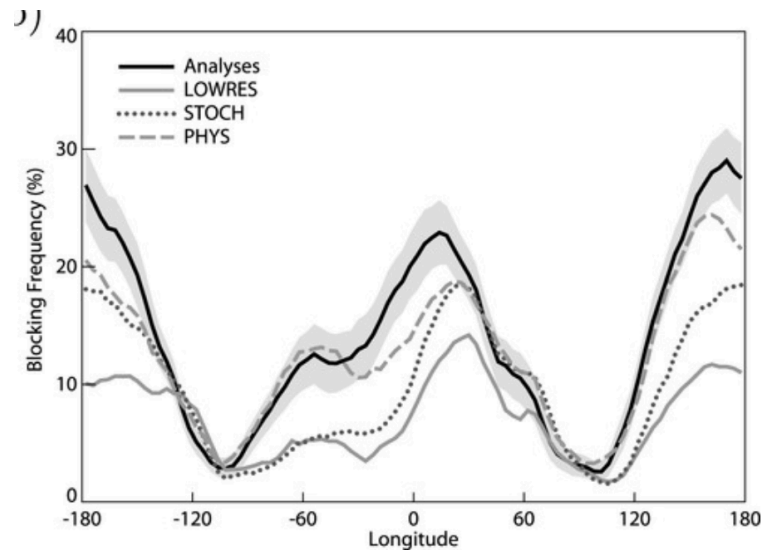
- Extended predictability (by 2-3 days) of states that project at initial time on NAO- or NAO+



Richter et al. 2021

- Skill in predicting biweekly NAO index

Impact of stochastic parameterization on regime behavior



Berner et al. 2012

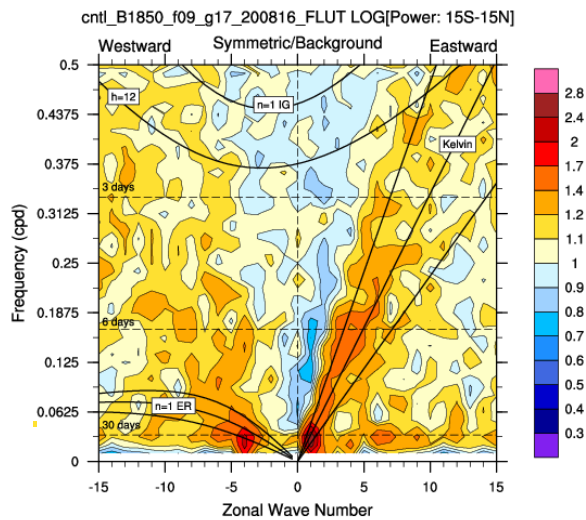
- Stochastic parameterizations can improve regimes behavior (by reducing the z500 error)

Future work

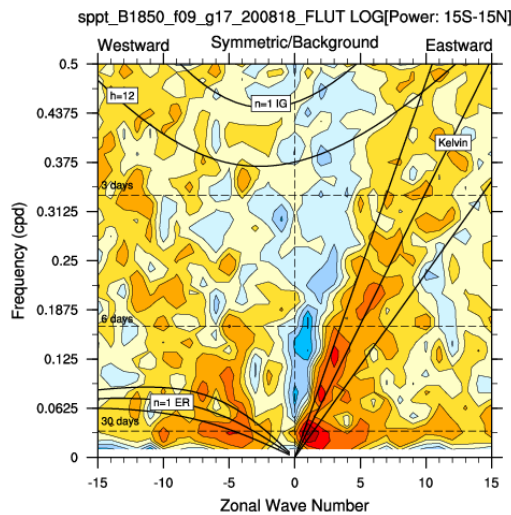
- Repeat S2S simulations with stochastic parameterization scheme SPPT (following SubX protocol for period 1999-2020)
- Development of a python based verification package for S2S forecasts (deterministic, probabilistic and state-dependent)
- Investigate the impact on regimes, MJO and other S2S predictors

Space-time spectra

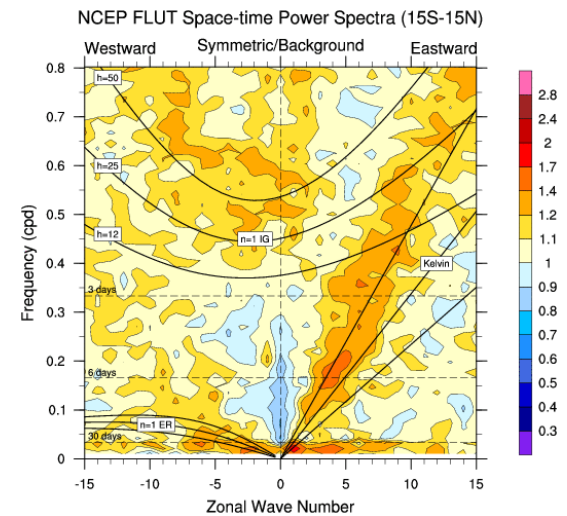
CNTL



SPPT



OBS



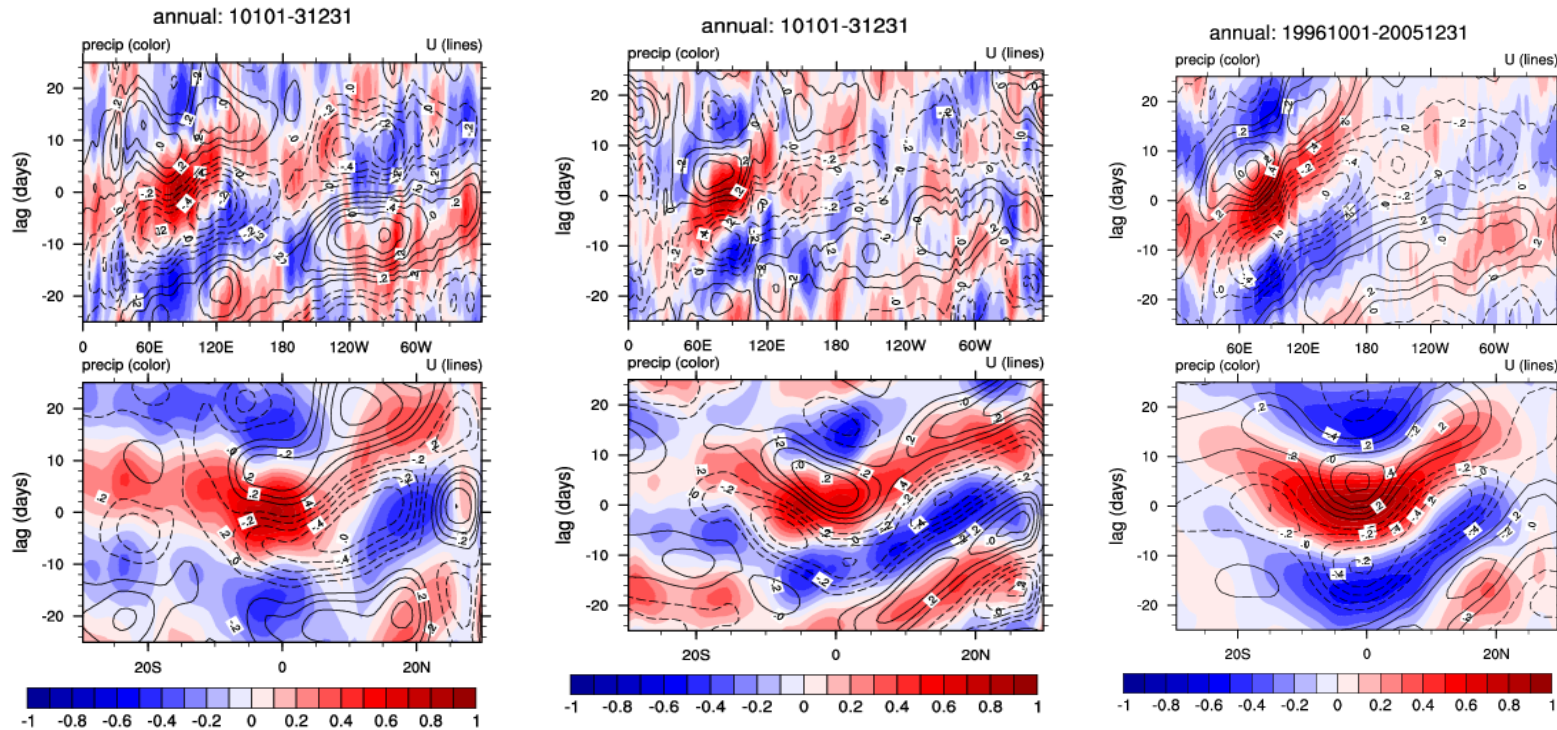
Space-time spectra of OLR and PRECP for experiments CNTL (left), SPPT (middle) and NCEP reanalysis (right). Simulations span a period of 3 years and use pre-industrial forcing.

Lag-longitude and lag-latitude diagrams

CNTL

SPPT

OBS



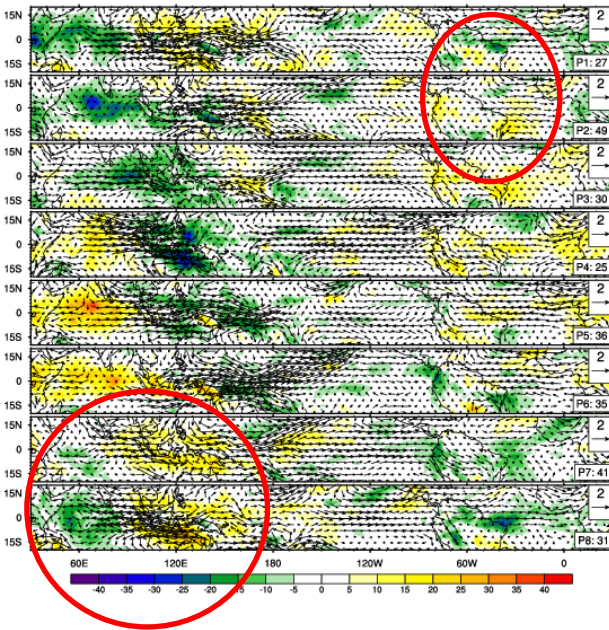
Top: Lag-longitude diagram of 10°N – 10°S -averaged precipitation anomalies (colors) and 850-hPa zonal wind anomalies (contours) correlated against precipitation at the Indian Ocean reference point.

Bottom: Lag-latitude diagram of 80° – 100°E -averaged precipitation anomalies (colors) and 850-hPa zonal wind anomalies (contours) correlated against precipitation at the Indian Ocean reference point at the equator.

Life cycle of the Madden-Julian Oscillation, Nov-Apr

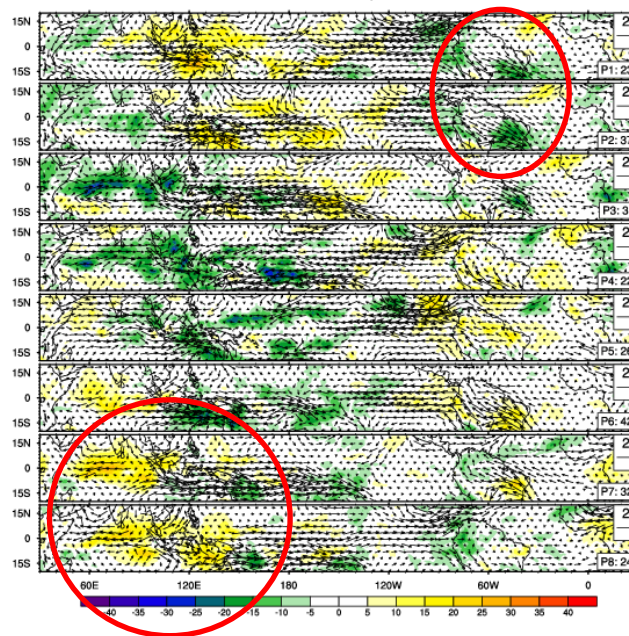
CNTL

1-3: Nov to Apr



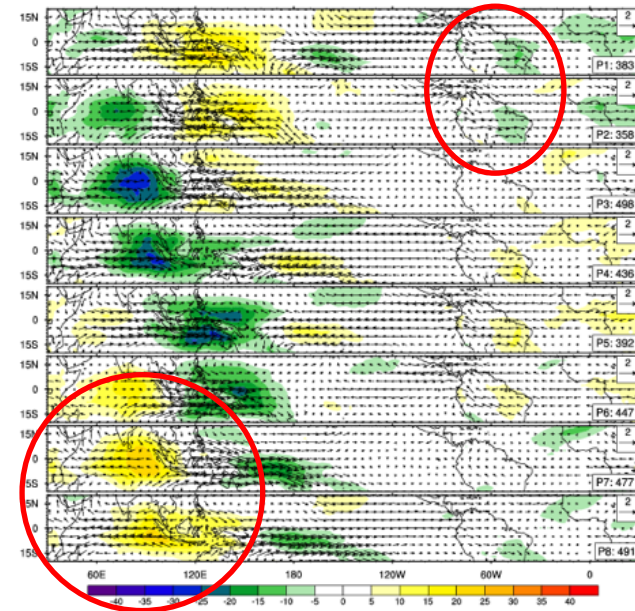
SPPT

1-3: Nov to Apr



OBS

1980-2010: Nov to Apr



Life cycle of the Madden-Julian Oscillation: Composite November to April 20–100 day filtered OLR and 850 hPa wind anomalies as a function of the MJO phase. (left) CNTL, (middle) SPPT and (right) NCEP reanalysis.

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CGD Events / 2021 ASP Summer Colloquium & Workshop

ASP SUMMER COLLOQUIUM & WORKSHOP

2021 ASP Summer Colloquium

July 12-23, 2021



Workshop on Subseasonal to Seasonal (S2S) Science and Predictions

August 2-6, 2021

THE SCIENCE OF SUBSEASONAL TO SEASONAL (S2S) PREDICTIONS

Scientific Leads: Judith Berner (NCAR), Aneesh Subramanian (CU Boulder)

Overview

Every year, the Advanced Study Program hosts a summer colloquium designed for graduate students on subjects that represent new or rapidly developing areas. The colloquium brings together experts from NCAR and the community at large together with a small group of 25-30 graduate students.

In 2021, the Advanced Study Program Summer Colloquium will be on the topic of "The Science of

COLLOQUIUM & WORKSHOP INFORMATION

Colloquium Dates: 12 - 23 July 2021

Workshop Dates: 2 - 6 August 2021

Venue: Virtual

Overview

Agenda *Coming Soon

Invited Speakers

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Scientific Workshop

CGD EVENTS

Upcoming Events

Past Events

Seminar Series

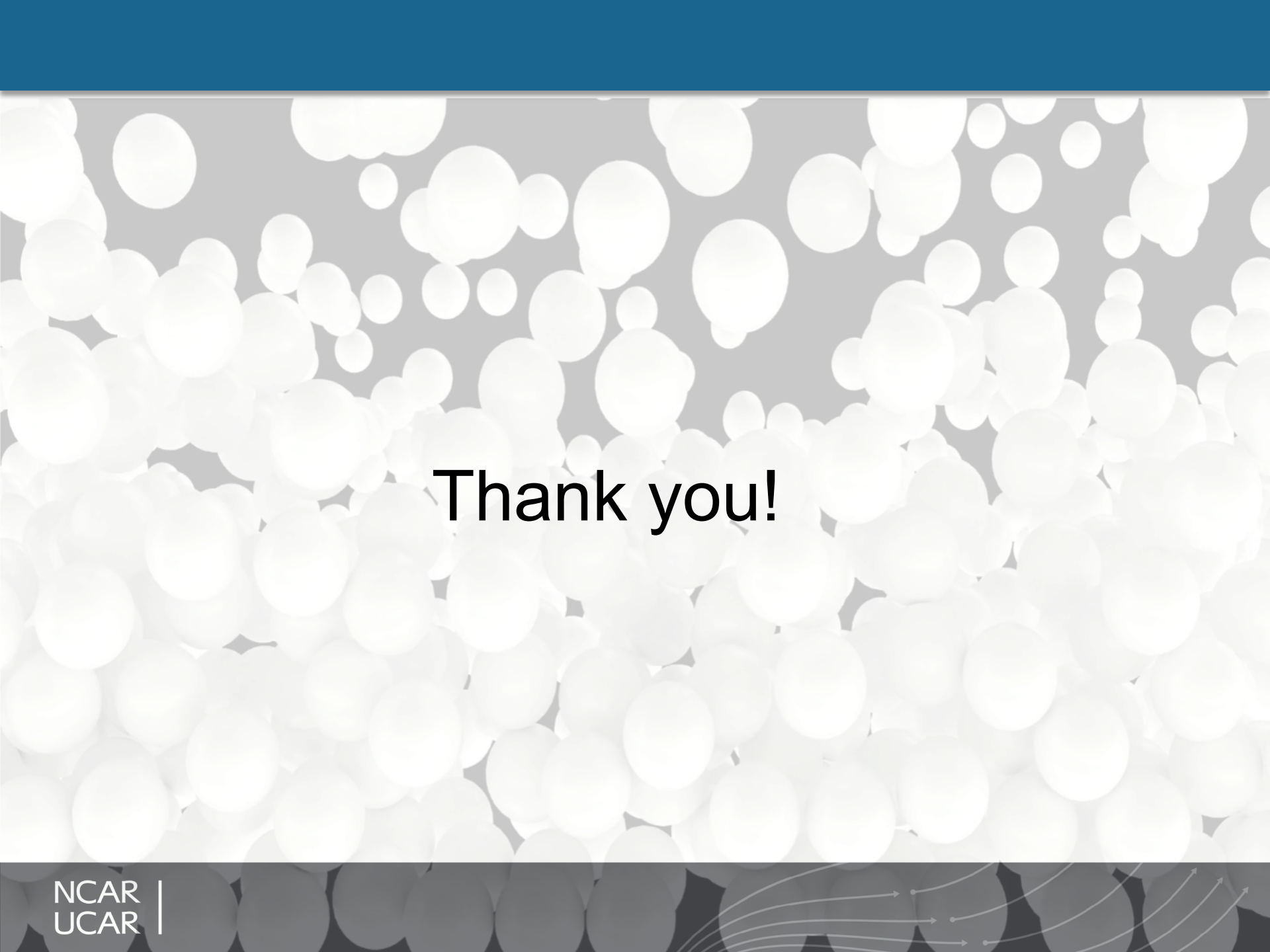
Research Reports

CESM EVENTS

Upcoming Events

Working Group Meetings

NCAR
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The background of the slide is a light gray field filled with numerous white circles of varying sizes, creating a dense, bubbly effect. A solid dark blue horizontal bar is positioned at the very top of the image.

Thank you!