

# GFDL and the NMME

Nat Johnson

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**Contributors:** Thomas L. Delworth, Liwei Jia, Colleen McHugh, Feiyu Lu, William Cooke, Fanrong Zeng, Andrew Wittenberg, Hiroyuki Murakami, Xiaosong Yang, and many more

# GFDL and the NMME:

Fostering research on seamless predictability across timescales

❖ **Developing next generation models and methods to inform and advance NOAA's future forecasting efforts**

➤ **Identifying new sources of predictability & predictive skill.**

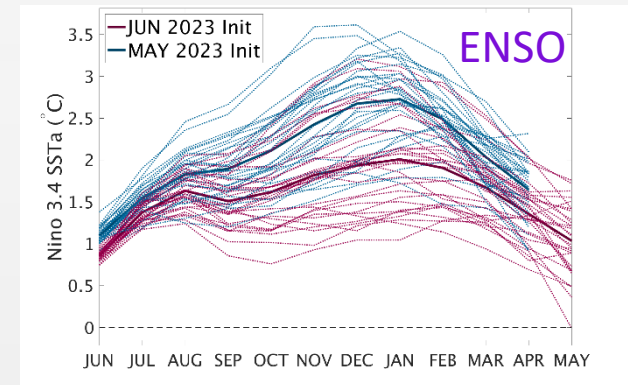
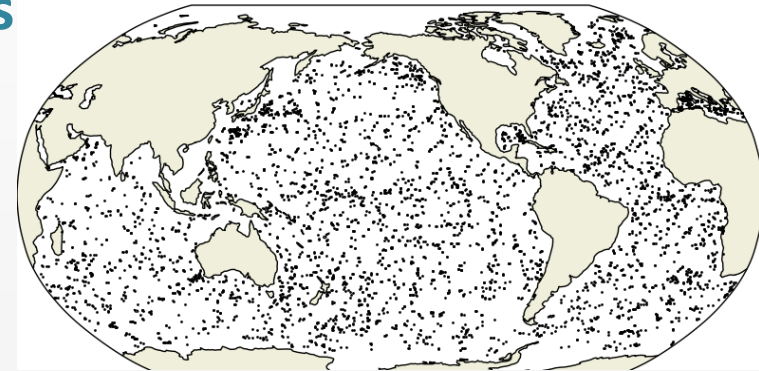
- e.g., understanding how climate & weather interact

➤ **Improving models** (resolution, physics, ensembles, etc.) to better capture the relevant processes, precursors, and PDFs for predictions

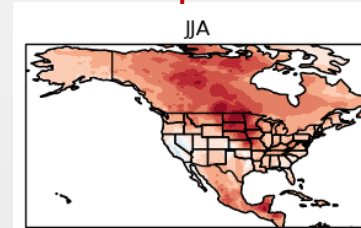
➤ **Understanding how and why predictability varies**

- e.g., due to noise, intrinsic modulation, mode interactions, and climate changes

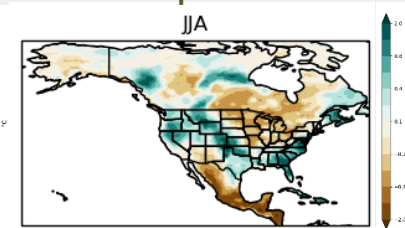
Argo float locations 06/23



Temperature



Precipitation





# GFDL and the NMME:

## Developing innovative seasonal forecast prototypes

### Seasonal Forecasts of Major Hurricanes and Landfalling Tropical Cyclones using a High-Resolution GFDL Coupled Climate Model

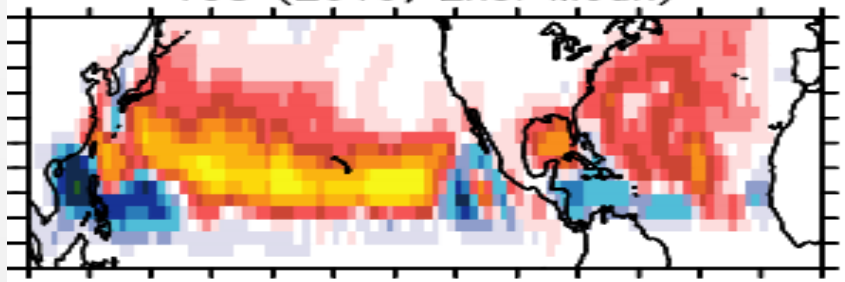
HIROYUKI MURAKAMI,<sup>a,b</sup> GABRIEL A. VECCHI,<sup>a,b</sup> GABRIELE VILLARINI,<sup>c</sup>  
THOMAS L. DELWORTH,<sup>a,b</sup> RICHARD GUDGEL,<sup>a</sup> SETH UNDERWOOD,<sup>d</sup>  
XIAOSONG YANG,<sup>a,e</sup> WEI ZHANG,<sup>a,b,c</sup> AND SHIAN-JIANN LIN<sup>a</sup>

<sup>a</sup> NOAA/GFDL, Princeton, New Jersey  
<sup>b</sup> Atmospheric and Oceanic Sciences Program, Princeton University, Princeton, New Jersey  
<sup>c</sup> IHR—Hydroscience and Engineering, The University of Iowa, Iowa City, Iowa  
<sup>d</sup> Engility, NOAA/GFDL, Princeton, New Jersey  
<sup>e</sup> University Corporation for Atmospheric Research, Boulder, Colorado

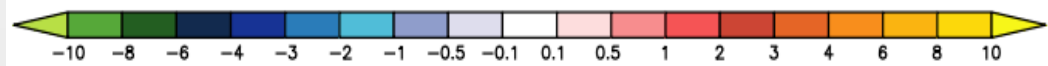
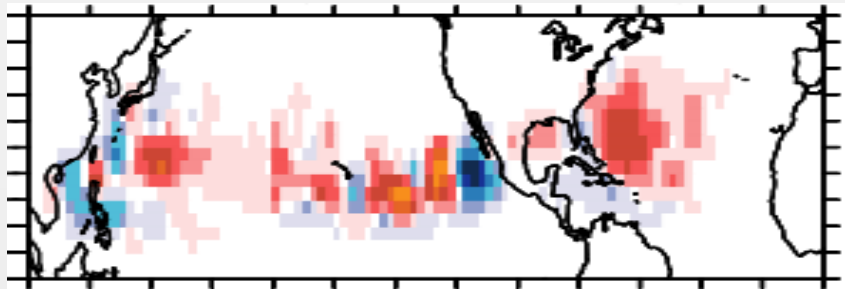
(Manuscript received 19 March 2016, in final form 1 August 2016)

### Hurricane density anomaly forecasts (July – Nov 2019)

Hurricanes (winds  $\geq 64$ kt)



Major Hurricanes (winds  $\geq 96$ kt)



# yr<sup>-1</sup> (2.5° grid)<sup>-1</sup>

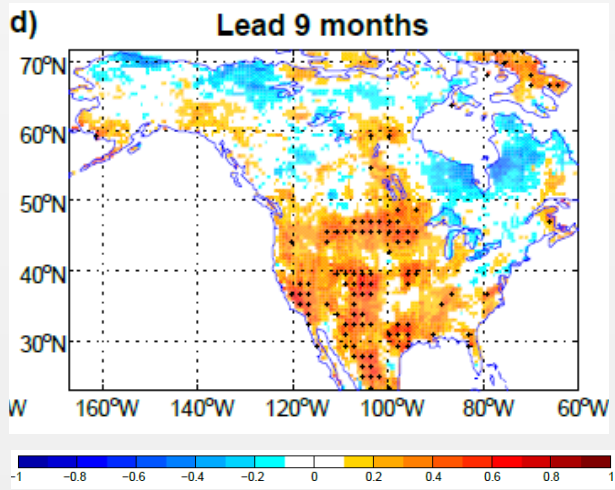
RESEARCH HIGHLIGHT | 07 April 2022

### Scorching summers can now be predicted months earlier

Sophisticated global climate model offers as much as nine months notice of extreme heat in some parts of North America.

North America's summer heatwaves – like those that blasted the western United States and Canada in 2021 – have just become easier to plan for. This is thanks to a model that can predict an increased likelihood of extreme heat months before it hits<sup>1</sup>.

### SPEAR forecast skill of JJA temperature extremes



Source: Jia et al. (2022, J. Climate)

# GFDL and the NMME:

## Developing innovative seasonal forecast prototypes

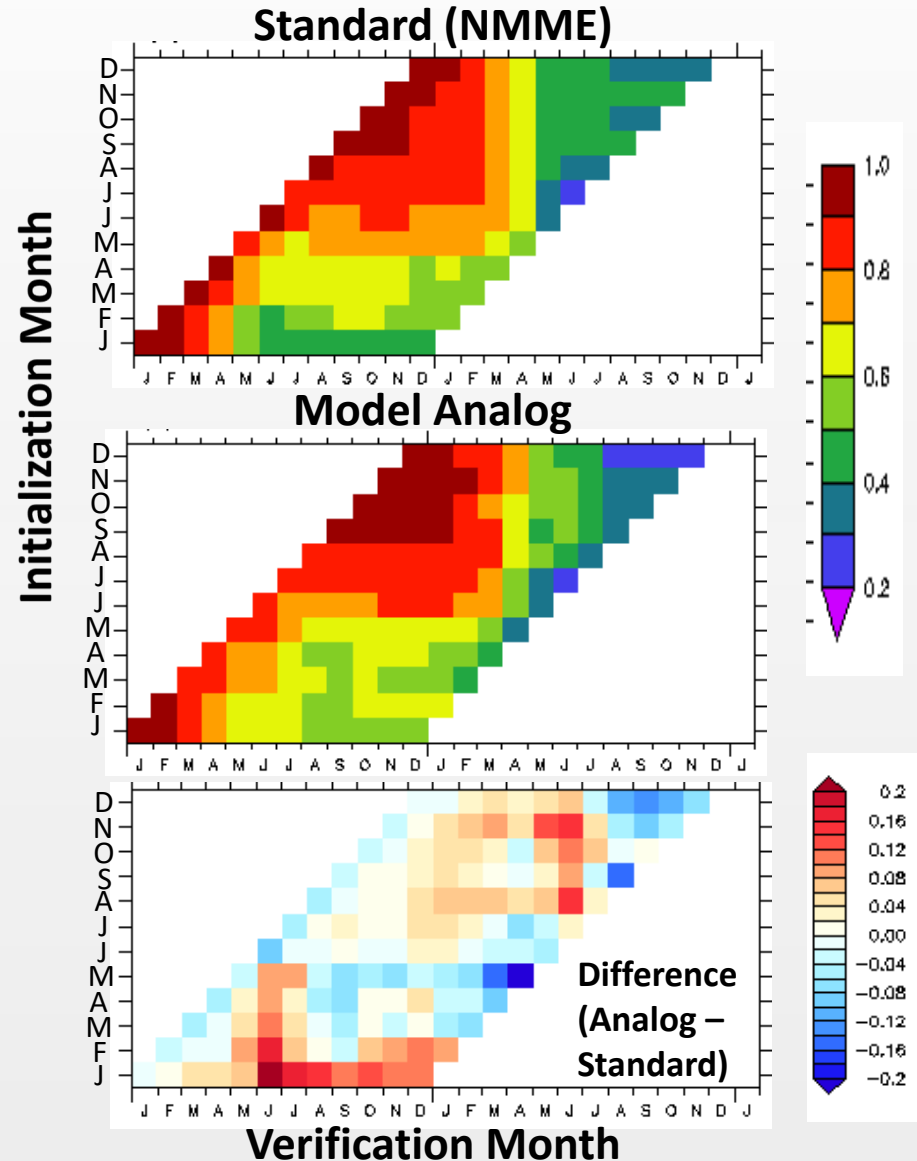
### Model analog-based ENSO forecasts

- **Top:** Standard initialized SPEAR forecasts from NMME
- **Middle:** ENSO forecasts based on analogs (SST and SSH) from SPEAR large ensemble with historical forcing (900 years)
- **Bottom:** Model analog ENSO forecasts have comparable skill (sometimes better!) than the standard SPEAR forecasts

*Model analogs may be a computationally inexpensive complement to our initialized seasonal forecasts*

Source: Zeng et al. (in prep.)

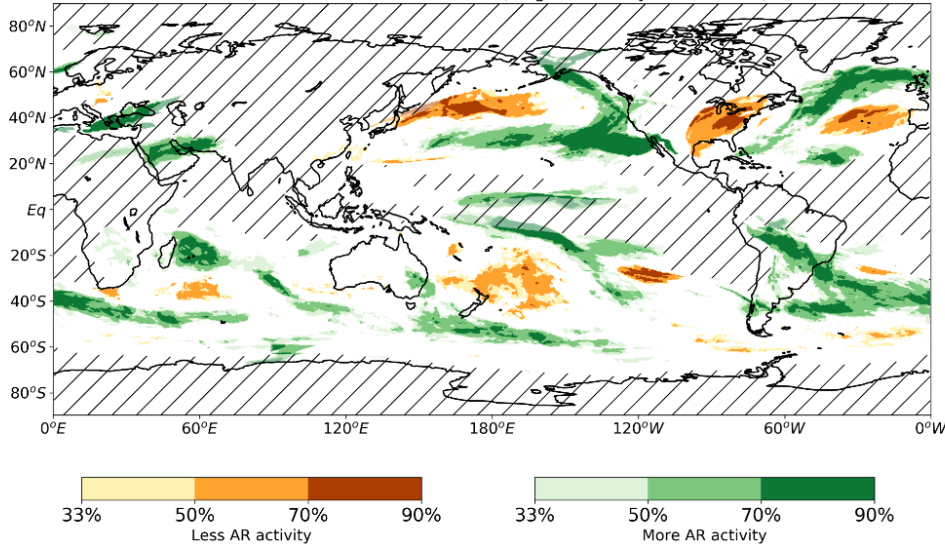
### Niño-3.4 correlation skill (1991-2022)



# R2O: Transitioning new **seasonal atmospheric river (AR)** forecast products

## Seasonal AR Forecast Prototype

Probabilistic Forecast of AR (target season: Jan-Mar 1995)



Source: Tseng et al. (2021, GRL)

- ❖ NOAA Weather Program Office Climate Testbed project extending Tseng et al. (2021) to the development of seasonal AR forecast guidance
- ❖ Collaboration between GFDL and CPC
- ❖ **Expected outcome:** CPC tool and web-based guidance for seasonal AR activity and associated extreme precipitation derived from SPEAR and possibly other NMME models

# Suggestions and questions from a GFDL perspective

- If there are demands for providing new variables, it may help to define different **"tiers" of participation** for data providers (as CMIP has done).
- It would be useful to have quantitative data on **what NMME products have provided the most value** so far.
- If new variables are proposed, then it would be helpful to receive **evidence of the value** that these new variables would deliver so that the data providers could evaluate the cost versus benefit of extending their efforts.
- It may be helpful to develop more formal **O2R channels**. For example, if users of the data (e.g., CPC) identify systematic biases and diagnostics connected with those biases, then it would be useful if there were more opportunities to communicate this information to the model developers.
- Given the promise shown by **model-analog methods** for seasonal predictions, would the NMME be open to receiving forecast products generated by such methods?