



# *OAR-NWS Retreat*

## *Climate Forecasts: Closing the Gap Between Short-Term and Decadal Prediction*

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# Outline

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- Strategic Challenges
- Tactical Challenges
- Example of “Team NOAA” Success:  
Advancing Short-Term Climate Prediction  
through the Climate Test Bed
- Ongoing Science – Operations Opportunities
- CFS V. 1 → CFS V. 2



# Challenges

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- Strategic Challenges
  - Climate Change/Climate Variability
  - Climate – Weather Linkages
- Tactical Challenges
  - To accelerate R2O – Need to support “O2R”
  - Address the science and modeling issues through an operational/research framework
    - Research is facilitated through reanalysis and real-time data assimilation, model runs, reforecasts with assured easy access

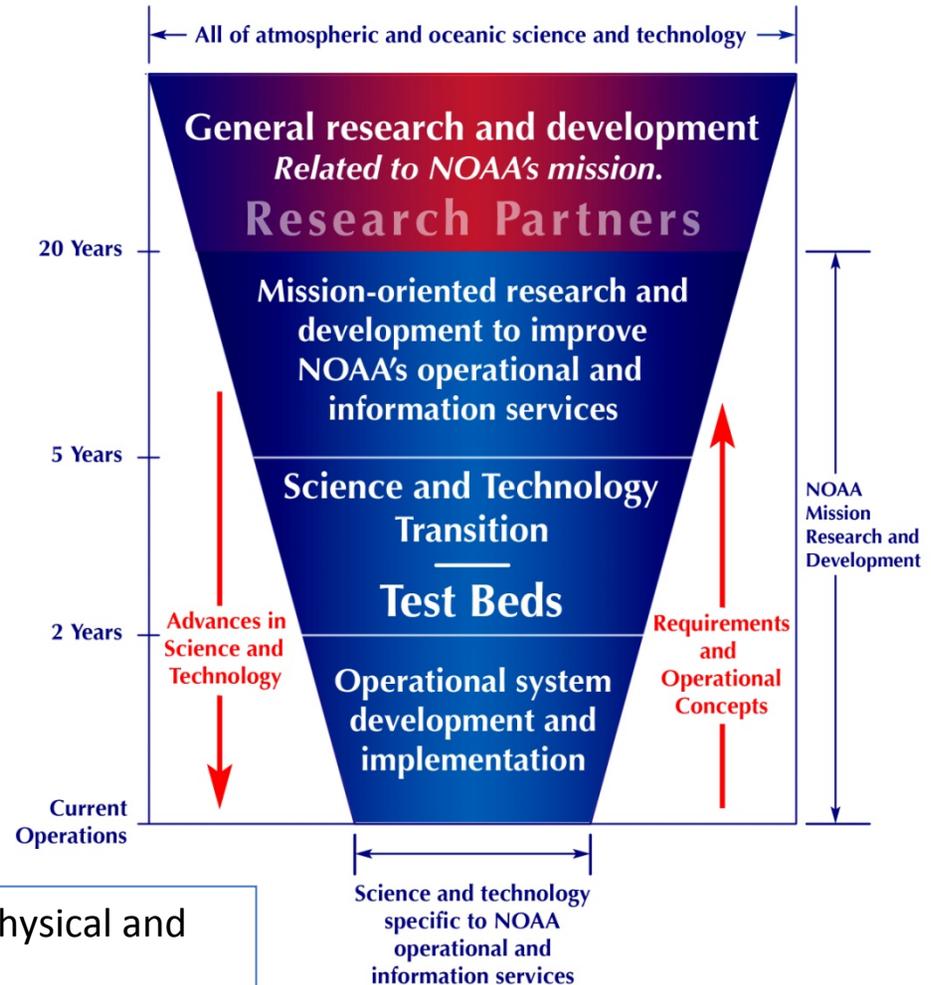


# NOAA Research and Development Funnel



NOAA is working on:

1. Research to Operations Policy (complete)
2. An overarching view of NOAA's research and development that provides criteria for research location
3. A better understanding of how to apportion resource allocations



Reference - "Research Location in NOAA: Physical and Social Sciences". March 2006, 72 pp.

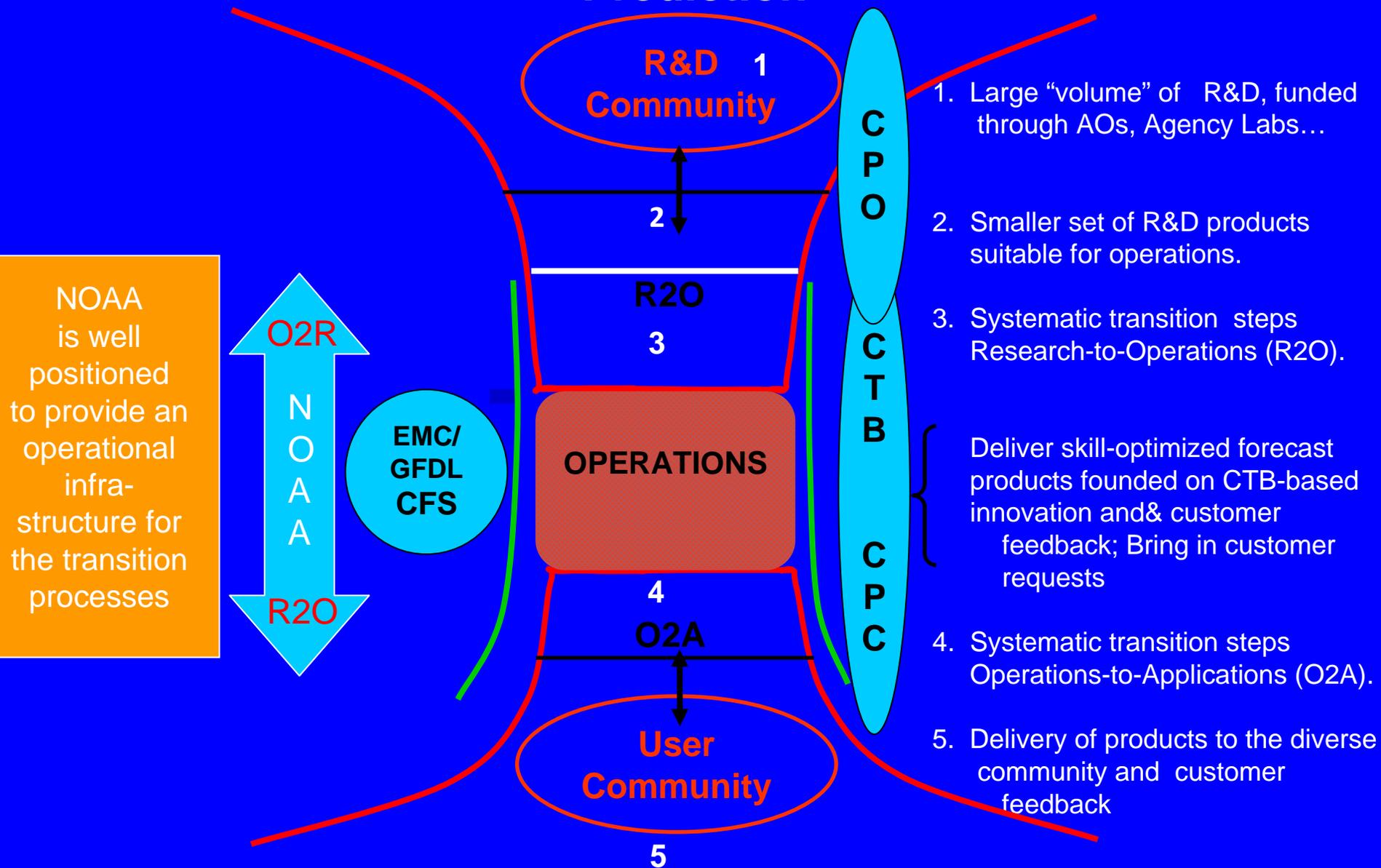


# Example of “Team NOAA” Success:

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Advancing Short-Term Climate Prediction  
through the Climate Test Bed

# Applying the "Funnel" to Advancing Seasonal Climate Prediction



CTB role: facilitate transitions for the CPC specific product range (6-10 day, week 2, monthly, seasonal)

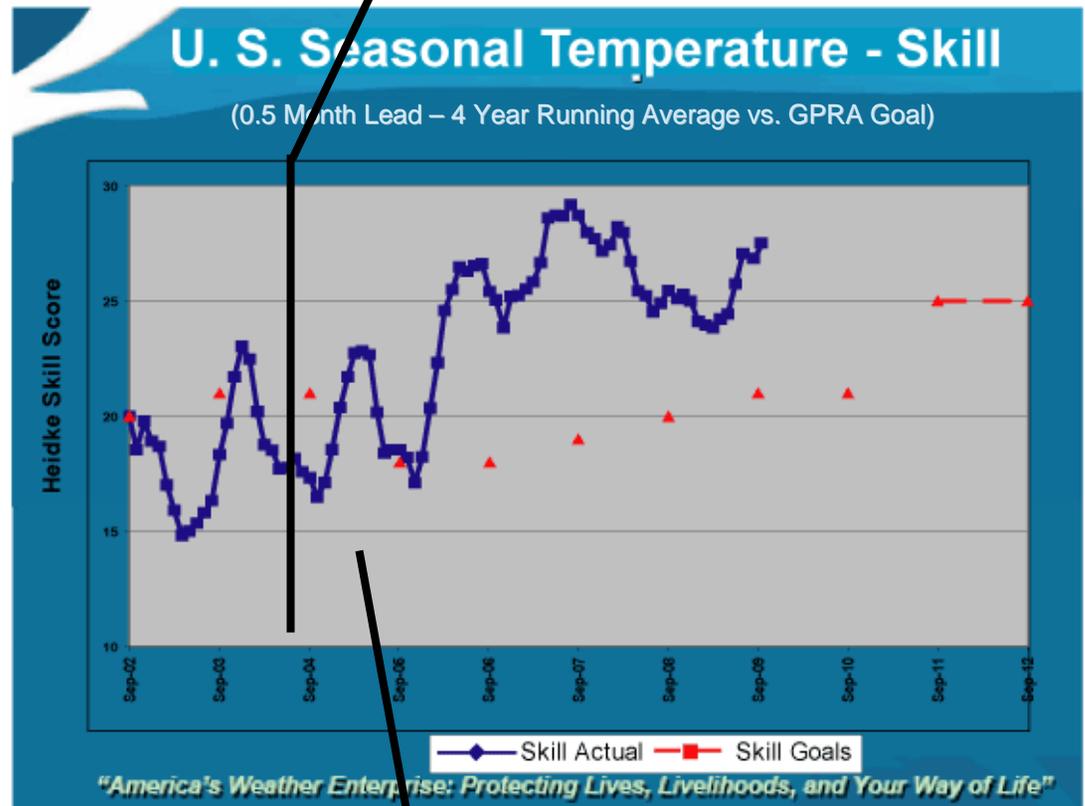
# GPRA Performance Measure

Climate Prediction Advances at NCEP (CFS / CTB) Contributed to improved Forecast Skill

Increases in skill of CPC official outlooks: 20% or more (O'Lenic et al 07)

FY09 Goal: 20  
48-mo Running Mean: 27  
FY10 Goal: 21  
Upward Adjustments planned, but depend on implementation time line for CFS v2, etc.

CFS (v1.0) implemented



CTB Spun up



# Ongoing Science/Operations Opportunities



## Environmental Modeling

### • Software

- **Interoperable and reusable within a strategically redesigned code framework**

- **Open source**

- Documented, community accessible, supported to users
- Version controlled
- Standard utilities across applications
- Portable across major available computing architectures

- **Uses available observations for assimilation and verification**

### • State of the science

- **Data assimilation**
- **Models**
- **Probabilistic product generation**
- **Dissemination**

- **Framework includes operational and research components to streamline transition to operations and promote research**

- **Multi-model ensemble systems with managed diversity**
- **Earth System approach**

- **Downscaling to regions and local scales**



# Ongoing Science-Operations Opportunities



## Science Issues

- Extending prediction/pattern assessment to decadal time frame.
- Determining the extent to which ISI-Decadal prediction is an initial value problem, given well-known planetary forcing (“forced” vs “unforced” components)
- Approaching “solutions” through a multi-model ensemble approach (running the GFDL and CFS 2.0 models in real-time – making both models and output available to the larger research community – O2R!). Has scientific and High Performance Computing implications.
- Applying Earth System based “weather” models to the climate prediction problem and vice-versa (physics components, dynamic core, fully-coupled, ESMF, air chemistry, water quality, ...).
- Downscaling climate prediction to regional scales for temperature, precipitation for ISI-Decadal time scale.
- Full utilization of “reanalysis” and “reforecast” in scientific and real-time operational forecast applications.
- Including carbon “tracking” in “weather” and “climate” domains.
- Determining the research “home” for the MME and the associated models (GFDL and CFS) in support of the Climate Test Bed.

# CFS V.1 and V.2

	V.1	V.2
Analysis Resolution	200 km	38 km
Atmosphere model	1995: 200 km/28 levels Humidity based clouds	100 km/64 levels Variable CO2 AER SW & LW radiation Prognostic clouds & liquid water Retuned mountain blocking Convective gravity wave drag
Ocean model	MOM-3: 60N-65S 1/3 x 1 deg. Assim depth 750 m	MOM-4 fully global 1/4 x 1/2 deg. Assim depth 4737 m
Land surface model (LSM) and assimilation	2-level LSM No separate land data assim.	4 level Noah model GLDAS driven by obs precip
Sea ice	Climatology	Daily analysis and Prognostic sea ice
Coupling	Daily	30 minutes
Data assimilation	Retrieved soundings, 1995 analysis, uncoupled background	Radiances assimilated, 2008 GSI, coupled background
Reforecasts	15/month seasonal output	25/month (seasonal) 124/month (week 3-6)



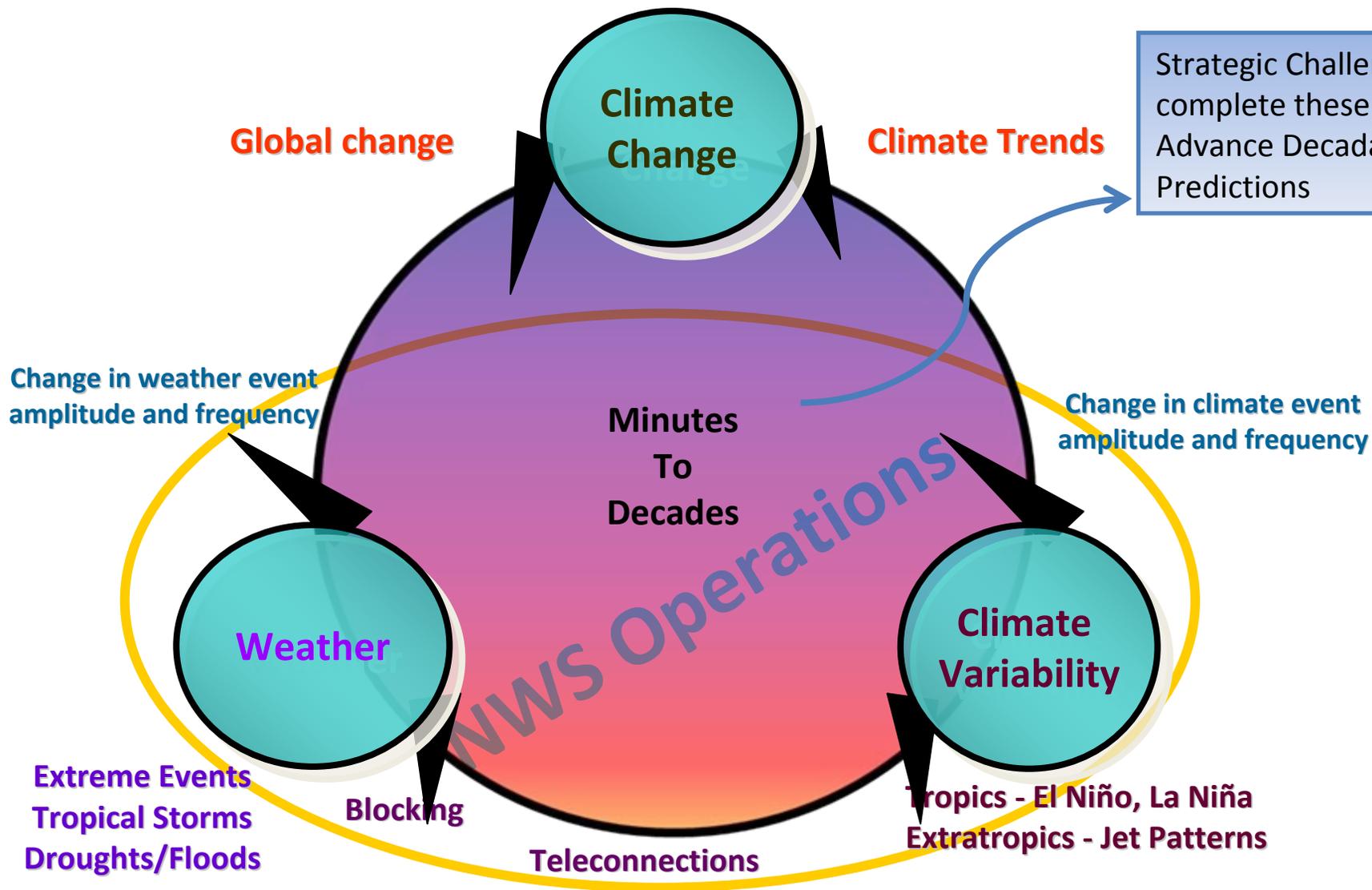
# Appendix

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# Strategic Challenge: Weather - Climate Linkage

Strategic Challenge to complete these linkages: Advance Decadal Predictions





# Top Five Research Priorities for ISI From CPC

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- **Seamless Weather to Climate Understanding, Modeling and Prediction:** Improve weather to climate understanding and prediction through analysis and modeling activities.
  - **Estimates of Predictability:** Research to understand climate predictability across timescales;
  - **Model Development Strategy:** Improve climate models (CFS) to reduce uncertainty in predictions and projections of Earth's climate across timescales;
  - **Climate Test Bed (R2O):** Accelerate improvements in CFS, develop an operational MME prediction system, and deliver climate forecast products;
  - **Model Test Facility (O2R):** Provide climate research community with enhanced access to CFS and supporting data sets to enable collaborative research for accelerated R2O.
- **Tropical Oscillations & Convection:** Address gaps in scientific understanding and ability to model and predict tropical climate phenomena.
- **Coupled Climate System Analysis:** Develop coupled climate analysis system capability. Includes ongoing reanalysis and reforecast activities for CFS.
- **Regional Prediction:** Develop capability to meet needs for regional climate information and tools (including regional downscaling) across timescales.
- **Extreme Events:** R&D for extremes; probabilistic outlooks (e.g. heat and cold waves; floods and flash drought) for gaps in the seamless suite (e.g. weeks 3 & 4)