

Towards a Five-Year Prediction of Climate

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Questions

- Is there a real need for longer-term predictions?
- What is that need?

Purpose?

- Need to be responsive to emerging needs
- Stimulate discussion on path forward for
 - Investigating predictability
 - Applied research
 - Product development
- Review of some examples

Emerging Legal Requirements

- **New York**

- Adopted Bill S6617B (Feb 14, 2014)
 - “...to ensure that state monies and permits include *consideration of the effects of climate risk and extreme weather events.*”
- Community Risk and Resiliency Act (CRRA) – signed by Governor Cuomo Sep 22, 2014
 - “...requires that New York state agencies consider *future physical climate risks caused by storm surges, sea level rise or flooding in certain permitting, funding and regulatory decisions.*”



Emerging Legal Requirements

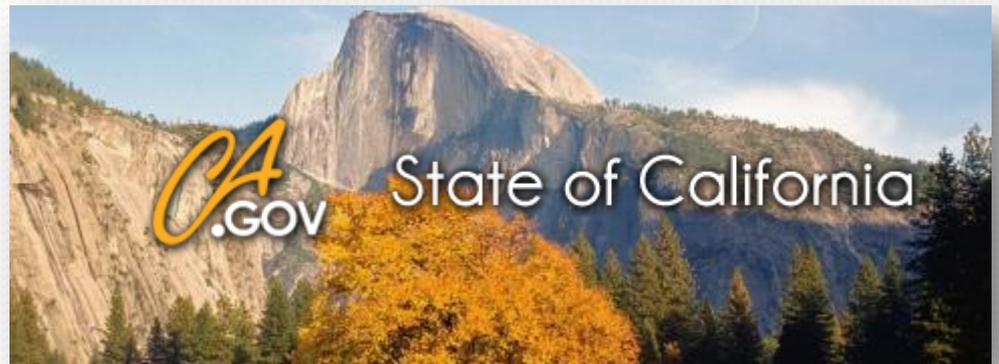
- California

- Executive Order S-3-05

- Requires reports on progress on *incorporating climate issues* into existing water resources planning

- Executive Order S-13-08

- “...directs state agencies to plan for sea level rise and *climate impacts* through coordination of the state Climate Adaptation Strategy”



Emerging Requirements

- **National Association of Insurance Commissioners (NAIC)** – Financial Condition Examiners are now required to
 - “...ensure that insurers are addressing climate related risks...”
(NAIC Climate Change and Risk Disclosure Last Updated 9/17/14)
- **Securities and Exchange Commission (SEC)**
 - Public companies must disclose issues related to climate change (17 CFR PARTS 211, 231 and 241)
- **FEMA**
 - “...be consistent in the Agency’s incorporation of climate change adaptation actions and activities into on-going plans, policies, and procedures.”
 - ***Climate predictions will help FEMA pre-position resources to high-risk areas and provide advance warnings*** (CLIMAS ongoing study: Climate and Weather Services for Disaster Management: A FEMA, NWS, and CLIMAS Collaboration)



Emerging Requirements

- Paula Brooks
 - Franklin County Commissioner (Ohio)
 - White House Task Force on Climate Preparedness and Resilience



Sustainability = Economic Resilience

- Fiscal security as well as climate resilience
 - Foreknowledge of climate conditions will enable businesses to prepare
- New infrastructure – building for impacts of anticipated changes in climate – short and longer term

Emerging Requirements

- **President's Climate Action Plan and Executive Order - Preparing the United States for the Impacts of Climate Change**
 - *...provide useful climate preparedness tools and actionable information ...*
- **President's remarks at U.N. Climate Change Summit, September 23, 2014**
 - “Today, I'm directing our federal agencies to begin *factoring climate resilience into our international development programs and investments*. And I'm announcing a new effort to deploy the unique scientific and technological capabilities of the United States, from *climate data to early-warning systems*.”



Emerging Requirements

- Alex Thompson, Mershon Center for International Security Studies
 - Potential sources of tension with a changing climate
 - Fisheries
 - Seabed: oil, gas, minerals
 - Navigation
 - military, commercial, tourism
 - Maritime boundary disputes
 - Environmental protection
 - Militarization of the region



NOAA FISHERIES
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

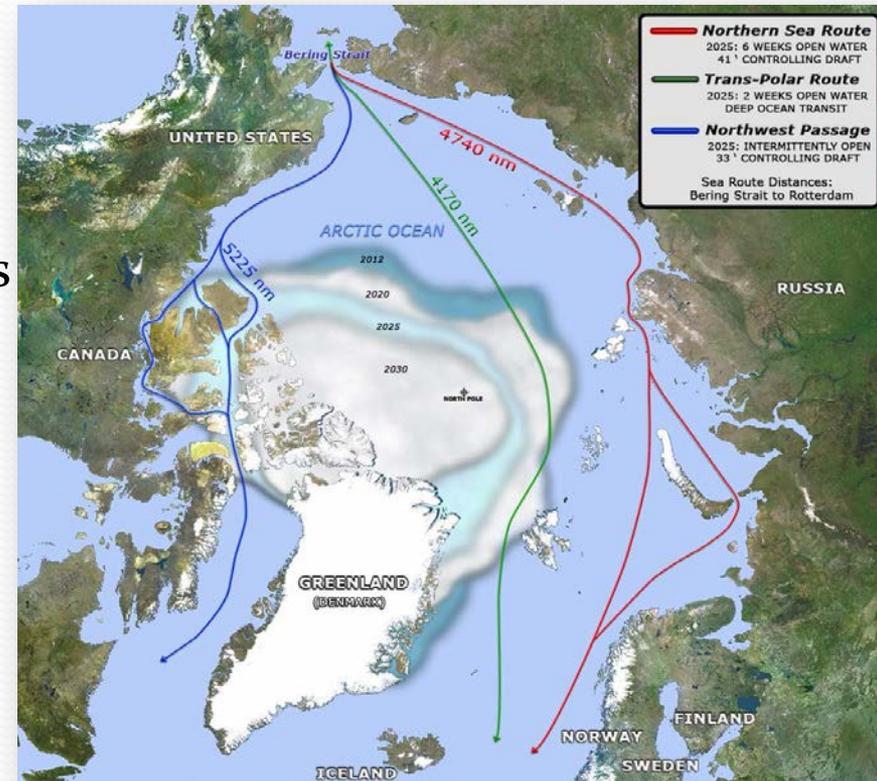


National Seafood Month
Fresh Facts, Smart Seafood
#seafoodmonth



Emerging Requirements

- Rear Admiral Jonathan White
US Navy
 - Need better forecasts and warnings to make sure bad things don't happen
 - Support forecasting and prediction of Arctic conditions
 - Military planning for home-field advantages in Arctic region
 - Beefing up their forecast capabilities
 - But forecasts should not be limited to Navy
 - NOAA has responsibilities to the American Public



Anticipate opening up of sea ice routes

Requirements for National Security

- Outcomes of Climate Prediction Applications Science Workshop (CPASW 2012) – serving the needs of the national security community*
 - Develop longer lead climate forecasts
 - Importance to National Security
 - Disruptions to DoD's built and natural infrastructure that is basis for sustaining military readiness
 - Cost and availability of energy
 - Foreknowledge of potential destabilization of regions and humanitarian crises due to changes in climate

** Climate: Opportunities for Improving Engagement Between NOAA and the US National Security Community. Jonassen and Acorn, 2012*

Emerging Legal Requirements

- EO 13653 (2013)
- FEMA Flood Zone Guidance (2011)
- ICCATF (2011)
- NEPA EIS/EA Guidance (2010)
- EO 13514 (2009)

Class A – existing products

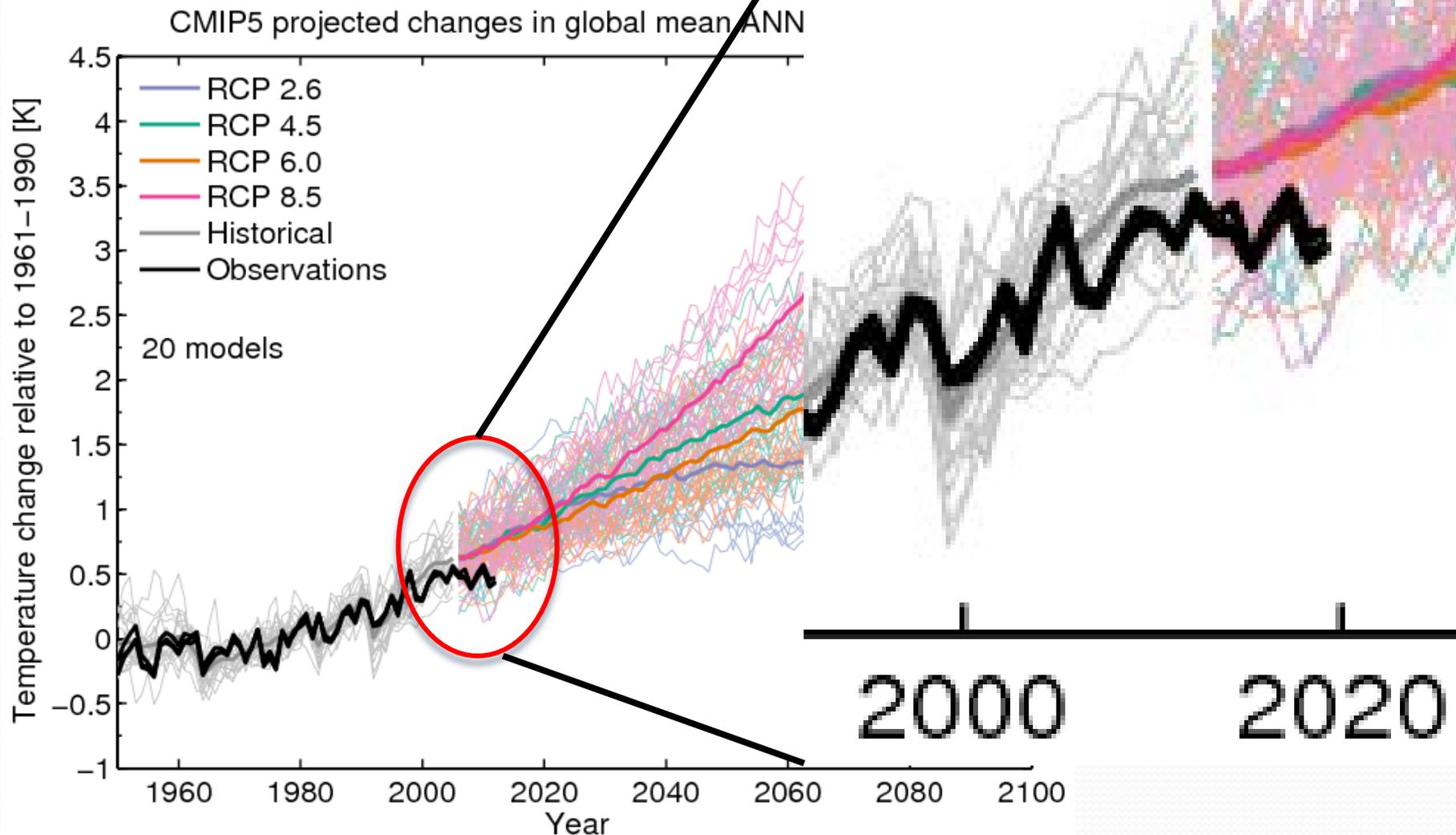
- Forecasts products out to one year
- Assume global energy balance within earth's surface layers remains constant throughout the forecast period
- Statistical and dynamical
- Diurnal and annual solar radiation with latitude
- Geothermal heat flux is not considered
- Albedo varies seasonally and with latitude

Class B – Ready for exploration to help with decision making

- Solar flux
- Geothermal flux (drives subglacial melting)
- Deep oceanic exchange
- Albedo
- Phase changes of water
- Sea level change
- Variable SST
- Atmospheric composition
- Atmospheric radiative elements (including volcanic activity)
- Ocean pH and related chemistry
- Global average mean annual surface temperature
- Global air-to-surface water flux
- Global precipitation

Each has predictable characteristics at multiple time scales and comprise basis for potentially skillful climate prediction – even with current understanding

Are Projections (5 - 2013) 12



What's next?

- Need to be responsive to emerging needs
- Stimulate discussion on path forward for
 - Investigating predictability
 - Applied research
 - Product development