

# Abrupt Impacts of Climate Change: Anticipating Surprises

**James White**

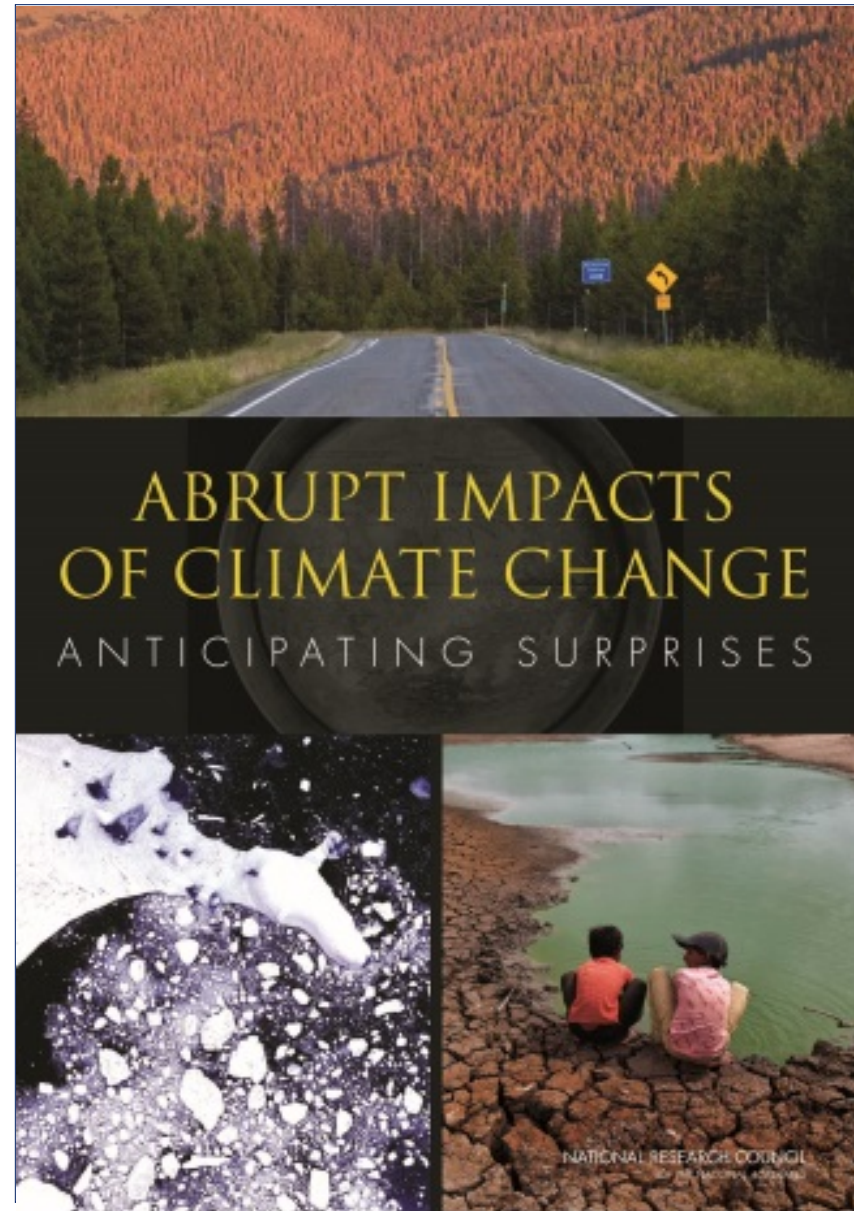
*University of Colorado (Chair)*

**Anthony Barnosky**

*University of California, Berkeley*

**Richard Alley**

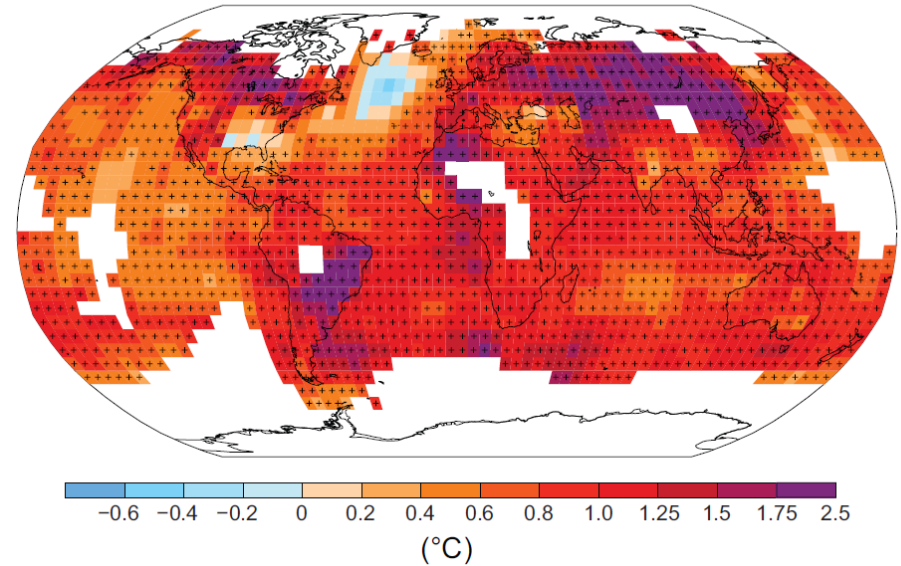
*Penn State University (remote)*



# The Changing Climate

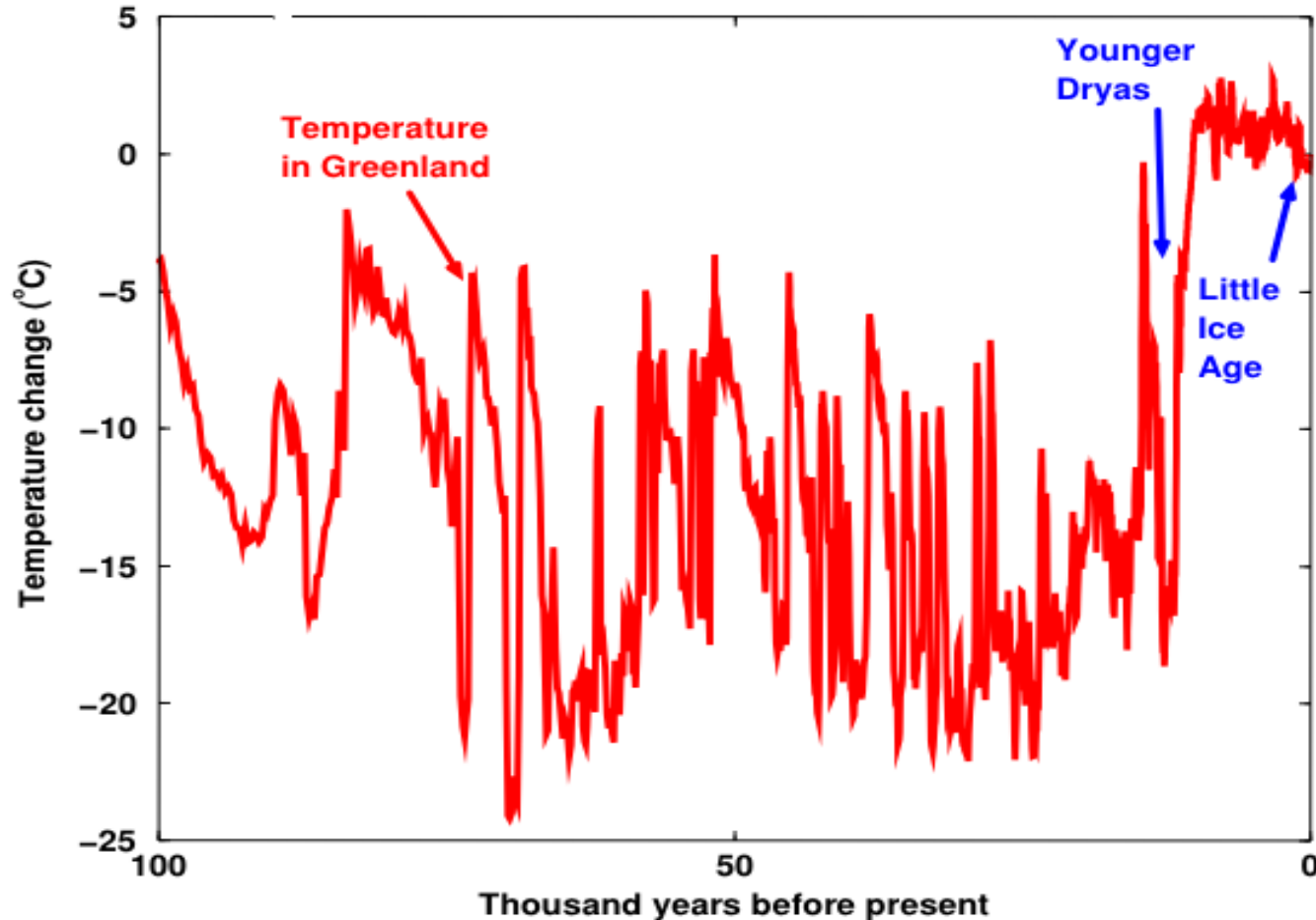
Observed Change in Surface Temperature

- Earth's climate changing at an accelerating rate
- Impacts on human systems and ecosystems



# How Will the Climate Change?

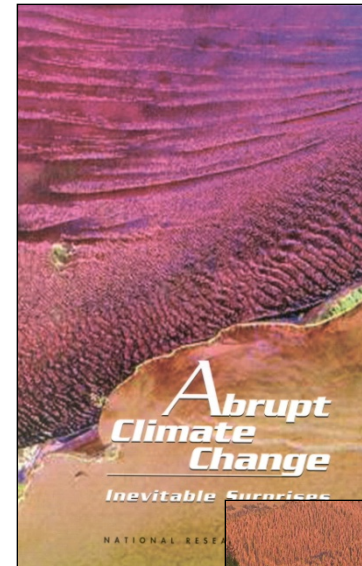
Abrupt climate changes have occurred in Earth's past



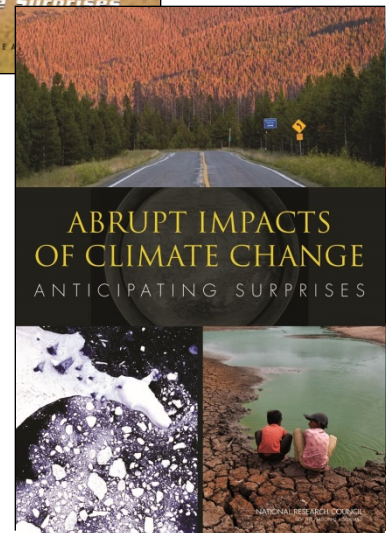
# Abrupt Climate Changes Today?

New report intended to:

- Assess current knowledge about potential abrupt changes
- Discuss need for an abrupt change early warning system
- Identify gaps in the scientific understanding and monitoring capabilities



2002



2013

# What is Abrupt Climate Change?

Large and rapid changes  
in the physical climate system

- Changes take place within years to decades
- Unfold faster than expected, planned for, or budgeted for
- Leave little time for society and ecosystems to adapt



# Abrupt Climate Impacts

This report also considers *abrupt climate impacts*:

Steady changes in climate that trigger abrupt shifts in related human and natural systems

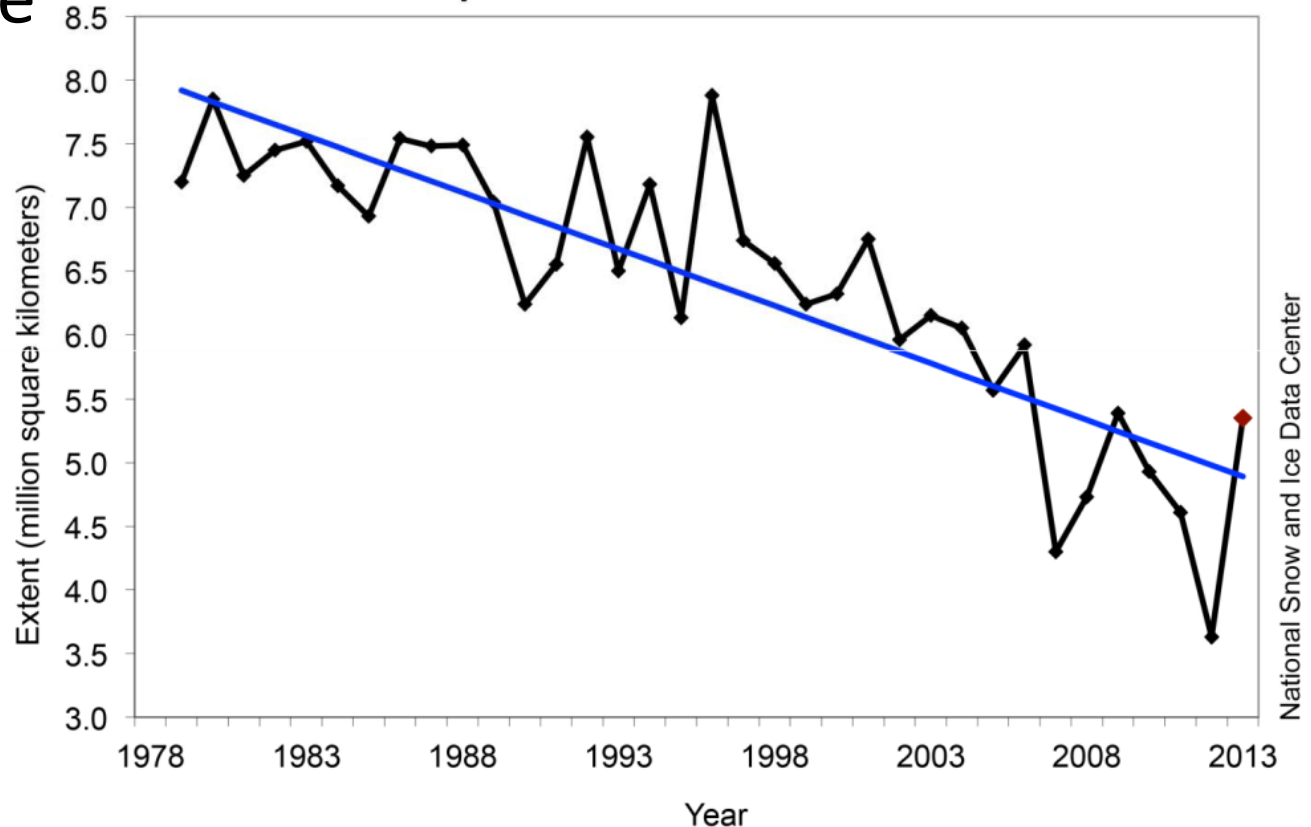


# Abrupt Changes Already Underway

Disappearance  
of summer time  
Arctic sea ice

— Faster than  
anticipated

Average Monthly Arctic Sea Ice Extent  
September 1979 - 2013



# Abrupt Changes Already Underway

Disappearance of  
summer time  
Arctic sea ice

- Impacts on Arctic ecosystems, changes to shipping, coastal erosion





# Abrupt Changes Already Underway

Increased extinction pressure

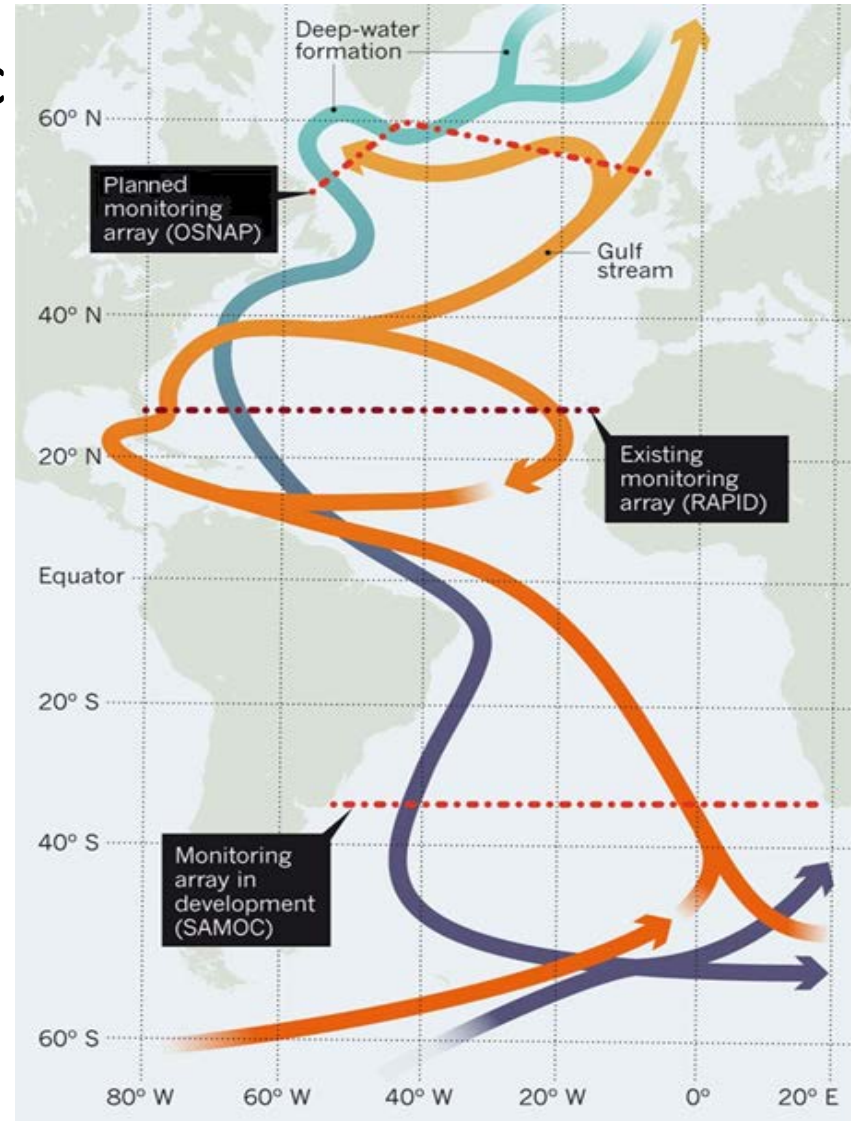
- Multiple ecosystem stressors
- Climate change can push species over threshold to extinction



# Abrupt Changes Unlikely This Century

## Possible shutdown of Atlantic Meridional Overturning Circulation (AMOC)

- Abrupt AMOC shutdown this century considered unlikely based on best available model simulations
- Still a concern: Further research and continued monitoring needed



# Abrupt Changes Unlikely This Century

Possible release of methane from large stores of carbon at high latitudes

- Abrupt methane release considered unlikely based on current understanding of potential release mechanisms
- Still a concern: Further research and continued monitoring needed



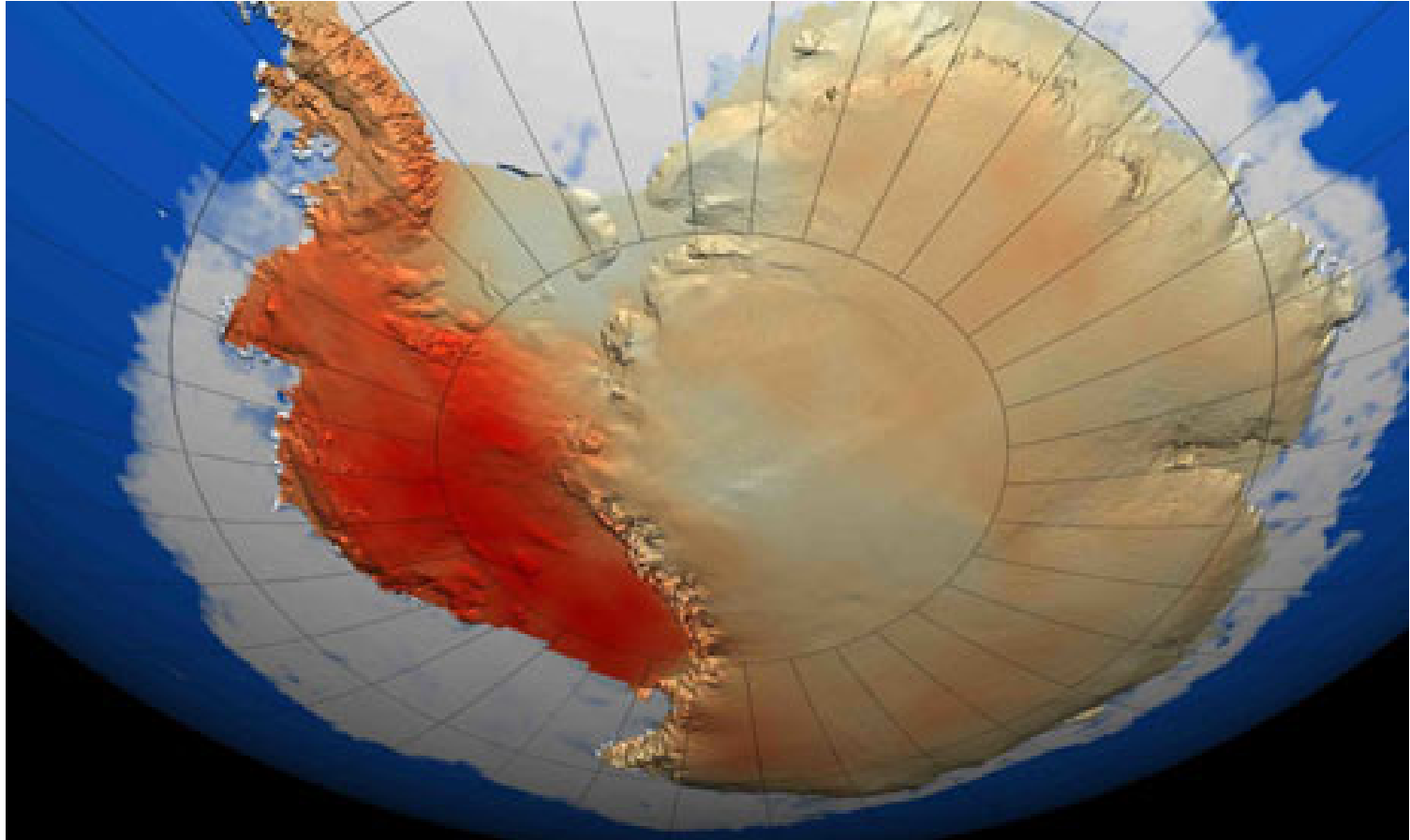
Permafrost



Methane Hydrates

# More Research Needed

Possible rapid disintegration of West Antarctic Ice Sheet (WAIS)



# More Research Needed

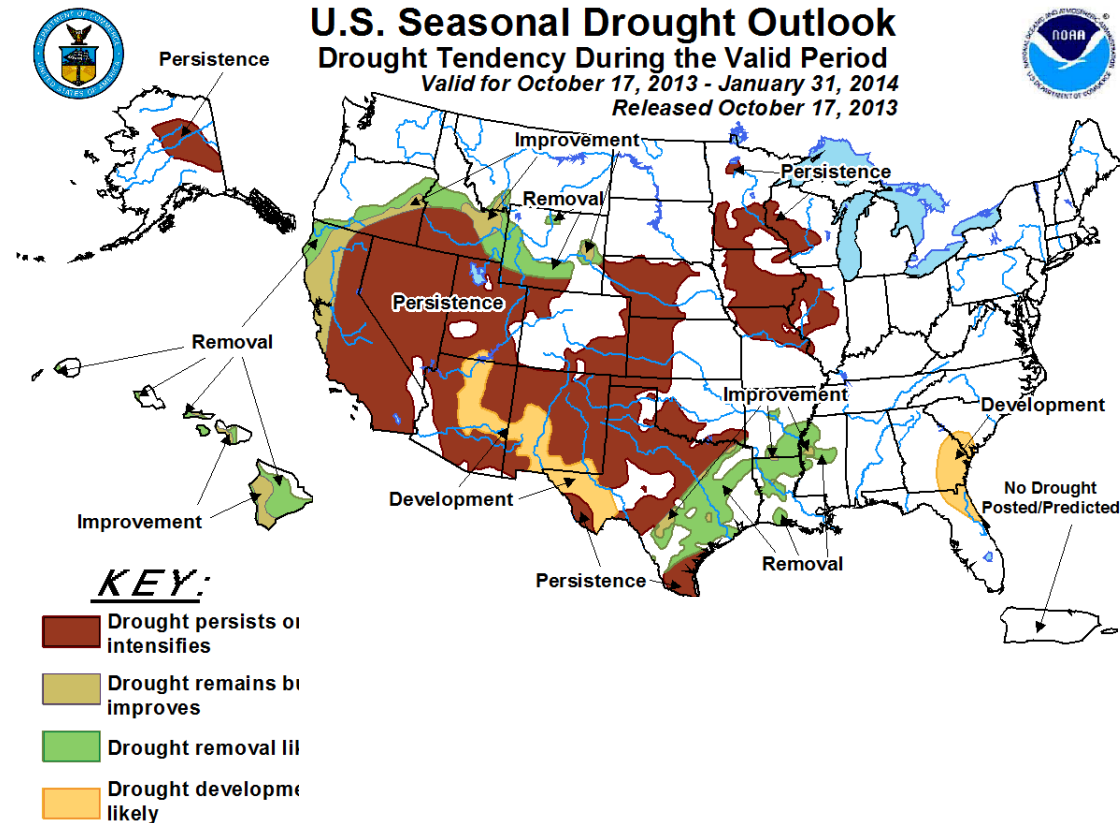
Disintegration of WAIS would result in rapid sea level rise

Probability of WAIS disintegration during this century is unknown, but probably low



# Abrupt Change Early Warning System

- Need for an ACEWS
  - Monitoring
  - Modeling
  - Synthesis
- Build upon existing systems
- Requires further planning
  - Communication
  - Research on vulnerabilities



# Need For Action

- Report should be viewed as call for an early warning system to be designed
- Time is here to be serious about threat of tipping points so as to better anticipate and better prepare ourselves for inevitable surprises
- To gain the benefits that science can offer on this topic, action is needed now

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[AmericasClimateChoices.org](http://AmericasClimateChoices.org)

Twitter #abruptchange

