‘CWEX’: a new mechanism to facilitate US interagency research to enhance our predictive understanding of the water cycle and energy fluxes of the changing Earth and global climate system

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Climate, Water Energy Exchanges Subgroup: Jared Entin (NASA, Vice Chair), Jin Huang (NOAA), Renu Joseph (DOE, Vice Chair), Sally McFarlane (DOE), Jielun Sun (NSF), Raha Hakimdavar (USDA), Tanya Spero (US EPA)

Outline

- Who: About the Program
- Why: Motivation from our Science and Assessment
- How: Interagency Working Groups – the Program Engine
- What & When: Some Recent Interagency Activities and Looking Ahead

U.S. Global Change Research Program

USGCRP comprises **13 Federal agencies** that conduct or use research on global change and its impacts on society

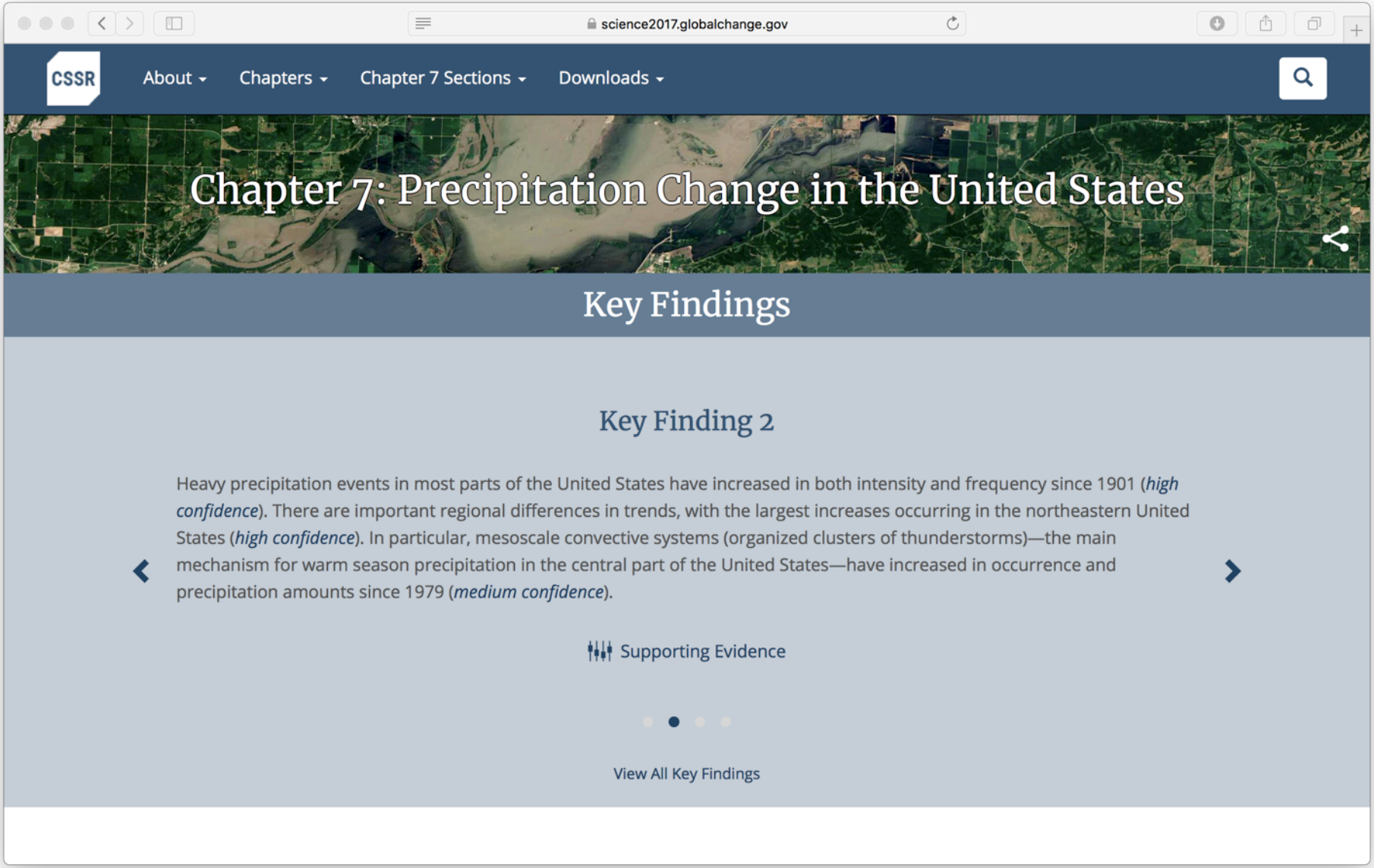
*"... assist the Nation and the world to **understand**, **assess**, **predict** and **respond** to human-induced and natural process of global change."*

Global Change Research Act, 1990

Through USGCRP, agencies:

- Coordinate global change research and **advance science** across the U.S. government
- Use research results and products to **inform decisions and responses** to a changing climate
- **Deliver mandated products**, including the quadrennial National Climate Assessment (NCA)
- **Promote international cooperation** on global change research and coordinate U.S. activities with the programs of other nations and international organizations

WHY: Key Messages from latest US National Climate Assessment (Vol 1 & Vol II)



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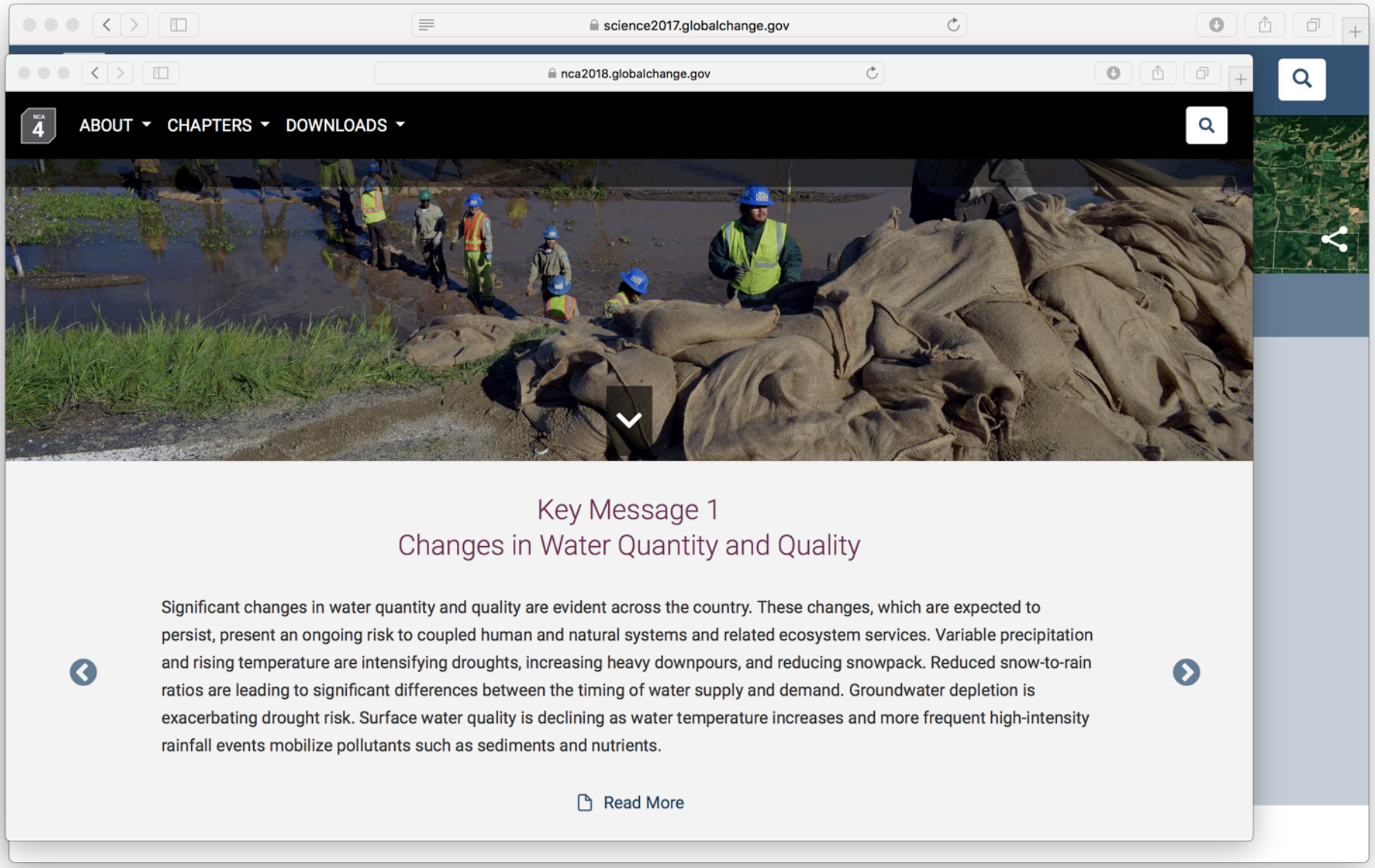


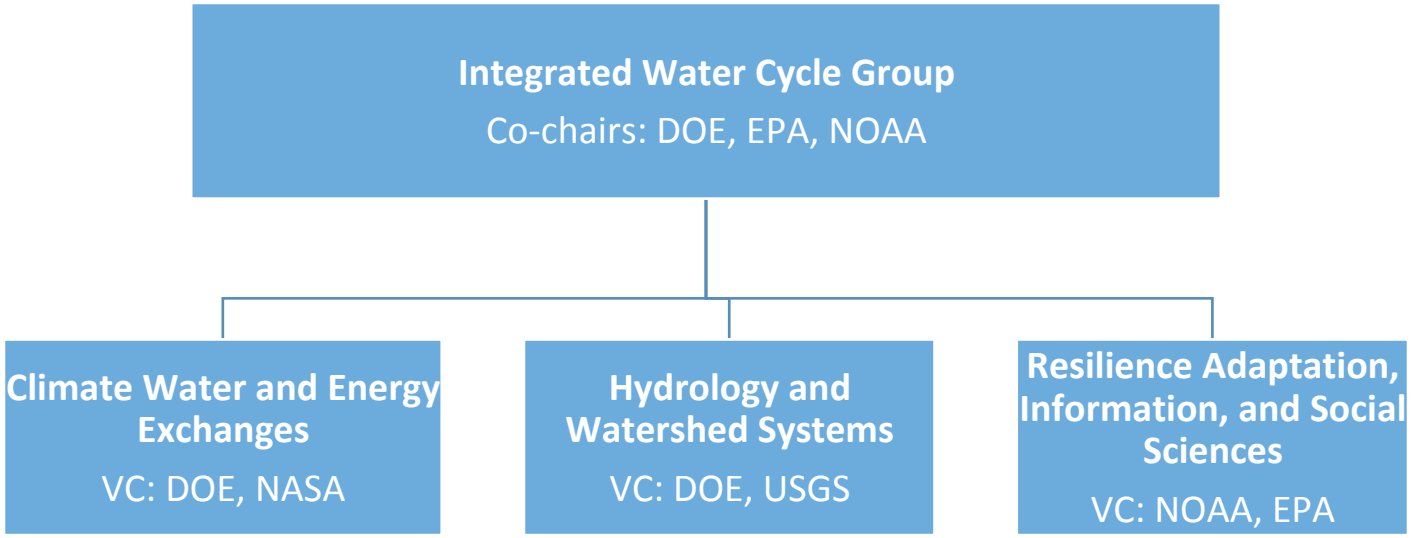
Water Cycle Extremes and Impacts

Some Motivating Questions

- How do we advance our understanding of the relationships between **global climate change, continental and regional water cycles,** and the interdependent human and natural systems that rely on them?
- How do we better **predict and characterize extreme events how they are changing,** particularly on decadal and longer timescales?
- How do we better **assess and anticipate the ecological and societal impacts** of water-cycle extremes on key sectors, such as energy, agriculture, infrastructure, and health?

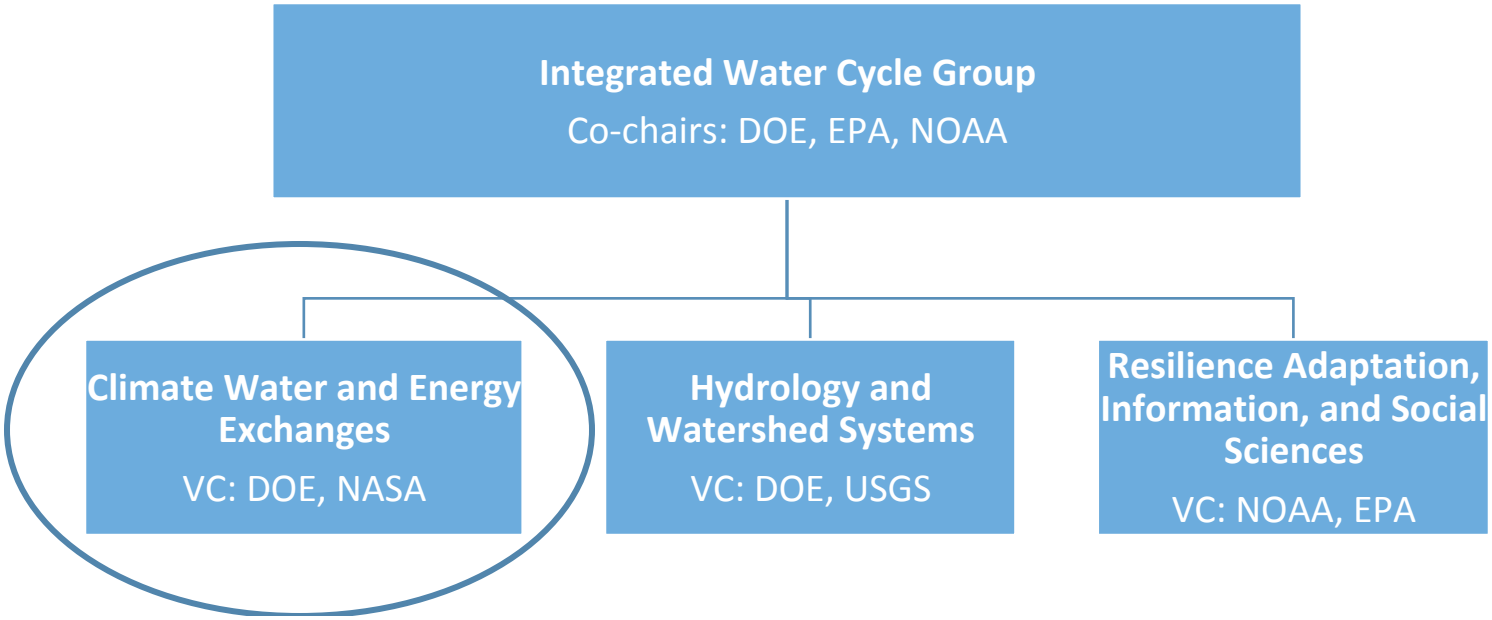
FEMA's Urban Search and Rescue Teams go through neighborhoods with the National Guard to look for residents that may be stranded in a neighborhood that was flooded following Hurricane Matthew. (Source: Jocelyn Augustino, FEMA, as published in Our Changing Planet FY17)

Integrated Water Cycle Group (IWCG)



- **Coordinates and integrates global-change relevant water cycle research;**
- **Advances capabilities and infrastructure** that support water cycle observation, modeling and predictability at a range of scales;
- **Develops approaches to apply and translate** our understanding and inform decisions surrounding preparedness and resilience;
- Pursues **interagency and end-to-end approaches** across the Program.

Integrated Water Cycle Group (IWCG)

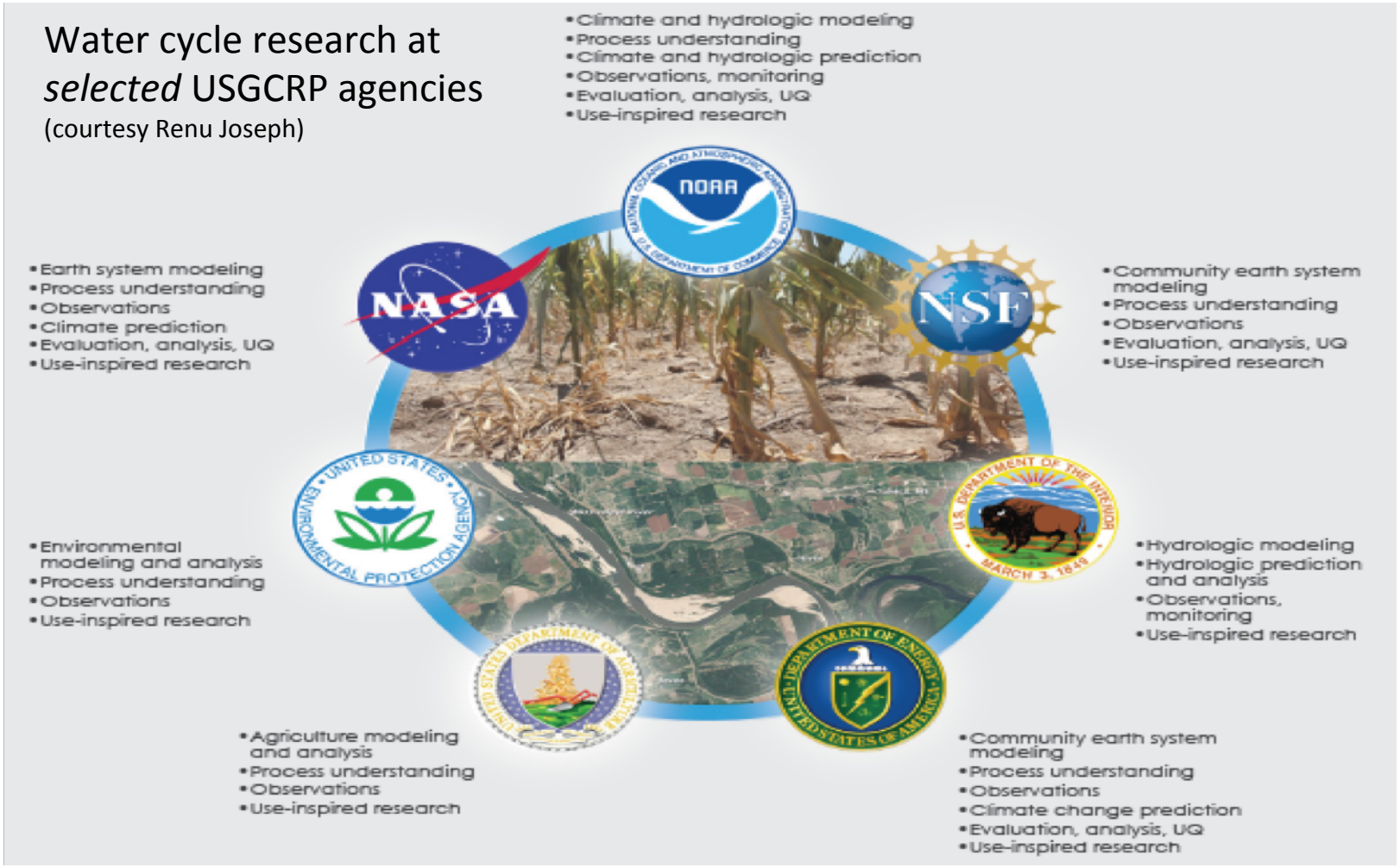


Climate, Water, and Energy Exchanges (CWEX)

- Vice Chairs: Jared Entin (NASA), Renu Joseph (DOE)
- Provides a focal point for coordinating interagency collaborative research on **water's and energy's coupled roles in a changing global climate system**
- Provides a space for agencies and programs to coordinate interactions with relevant efforts of the World Climate Research Program (WCRP), e.g. GEWEX

Interagency, Integrated Approaches

Water cycle research at *selected* USGCRP agencies
(courtesy Renu Joseph)



Potential Areas

- Precipitation Metrics:
  - AGU Town Hall (Tues)- **TH23K Using Observationally Based Metrics to Evaluate and Improve CWEX Earth System Model Precipitation** (DOE)
- Soil Moisture – what can agencies do together to:
  - Increase awareness and accessibility of in situ data
  - Increase understanding of utility and limitations of data
  - Create opportunities for intercomparison and provide new paths forward for improvement
- Land Atmosphere Interactions

Land Atmosphere Interactions and Extremes

- Since 2015, the Interagency Group on Integrated Modeling has held Annual US Climate Modeling Summit for US CMIP-class climate model development centers and from operational climate prediction programs
- In 2018, this included a **Land-Atmosphere Interactions and Extremes Workshop** (April 4, 2018).

2015 Summit (Courtesy Tia Biggs, USGCRP)

Land Atmosphere Interactions and Extremes

- ***Trajectory of increasing complexity and comprehensiveness*** in land surface model (LSMs) components of global climate models
- ***New and high resolution data sets are key to many improvements***
  - Recognition of the impact/opportunities of SMAP (NASA's "Soil Moisture Active Passive" satellite), and criticality of other data sets (GRACE, GFED) to improvements (globally available datasets)
  - New avenues of research into LAI are enabled by data constraints provided by co-located field and remotely sensed measurements
  - High resolution vegetation and soil datasets coupled with dynamic models drive improvements in land surface representation
- ***Recognition of the need to better represent the role of humans*** **and build the data and knowledge bases for (better) representation of**
  - Land use, fire suppression & ignition, agricultural processes and phenology, water management

Summary: Why IWC Research under USGCRP

- **Interagency and interdisciplinary approaches are required** to understand the integrated water cycle – the movement of water among ocean, atmosphere, land, biosphere, and cryosphere, as well as the interaction of these with human activities
- Science drivers require bringing together **satellite and surface-based observations, global and regional process resolving models,** and the resulting **diagnostics and data**
- To provide societally relevant research results and inform decisions around water cycle extremes calls for **a multi-scale perspective** when considering the global change effects on the integrated water cycle, including its alterations, impacts, and interactions across scales

Other Themes and Interagency Efforts

- NOAA National Water Model (http://water.noaa.gov/about/nwm)
- Thriving on our Changing Planet: NASA Decadal Survey (http://sites.nationalacademies.org/cs/groups/depssite/documents/webpage/deps_183919.pdf)
- Many agencies were involved in the process of Looking Forward: Priorities for Managing Freshwater Resources in a Changing Climate National Action Plan Update (November 2016)
- Agency and Program Strategic Plans and Updates

THANK YOU

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