NASA ENERGY AND WATER CYCLE STUDY

NEWS

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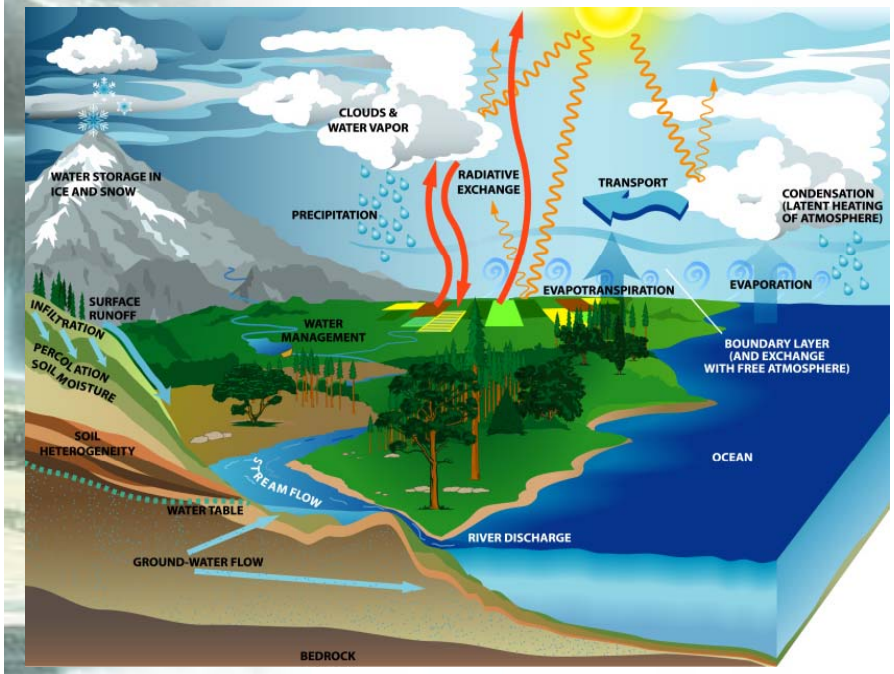
Drought & Flood Extremes: X. Dong & J. Albertson
Evaporation & Latent Heating: K. Hilburn & J. Famiglietti
Energy & Water Cycle Climatology: M. Rodell & T. L'Ecuyer
Modeling & Water Cycle Prediction: M. Bosilovich & Y. Hu

NEWS Challenge:
Document and enable improved, observationally-based, predictions of water and energy cycle consequences of Earth system variability and change.

The Water and Energy Cycle

Is the water cycle accelerating?



Why NEWS?

Need the collective of NASA & community information and expertise to ask (and define) the larger questions

(aka) Need the whole to be more than the sum of the parts

Why study the water & Energy cycle?

1. *Water exists in all three phases in the climate system and the phase transitions are a significant factor in the regulation of the global and regional energy balances*
2. *Water vapor in the atmosphere is the principal greenhouse gas and clouds at various levels and composition in the atmosphere represent both positive and negative feedback in climate system response*
3. *Water is the ultimate solvent and global biogeochemical and element cycles are mediated by the dynamics of the water cycle*
4. *Water is the element of the Earth system that most directly impacts and constraint human society and its well-being.*

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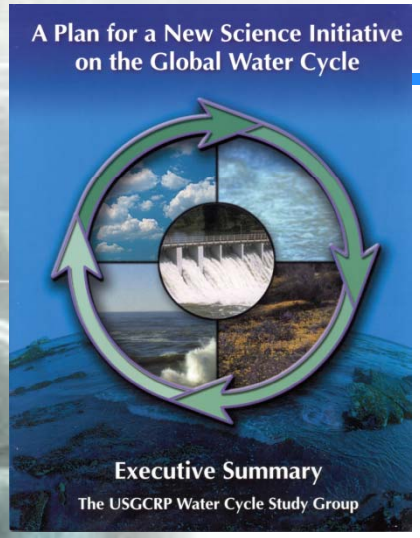

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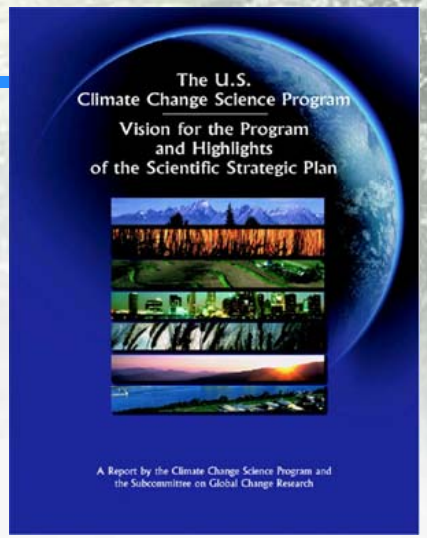
What are the causes of water cycle variations?

Are variations in the global and regional water cycle predictable?

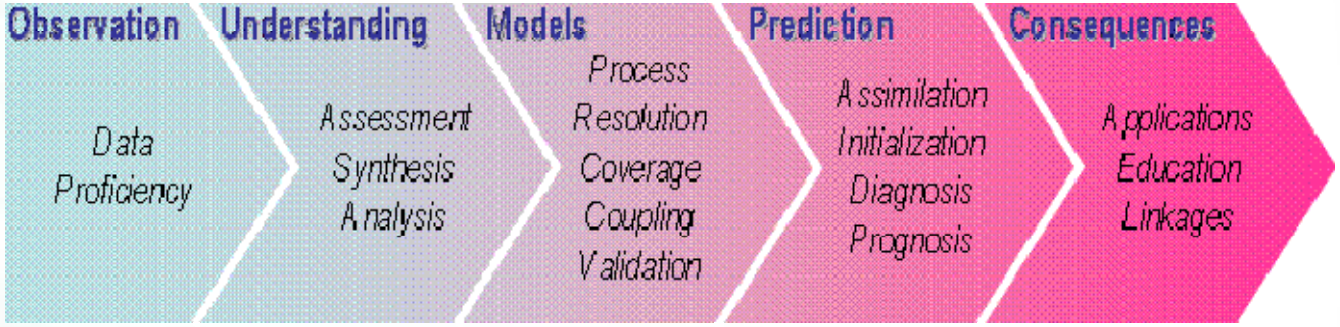
How are water and nutrient cycles linked?



NEWS Integrated Water and Energy Cycle Research Challenge:

Document and enable improved, observationally-based, predictions of water and energy cycle consequences of Earth system variability and change.

The NEWS challenge is global in scale and requires the integration of NASA system components to make decisive progress toward the NEWS challenge in an end-to-end program



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Presentation Objectives

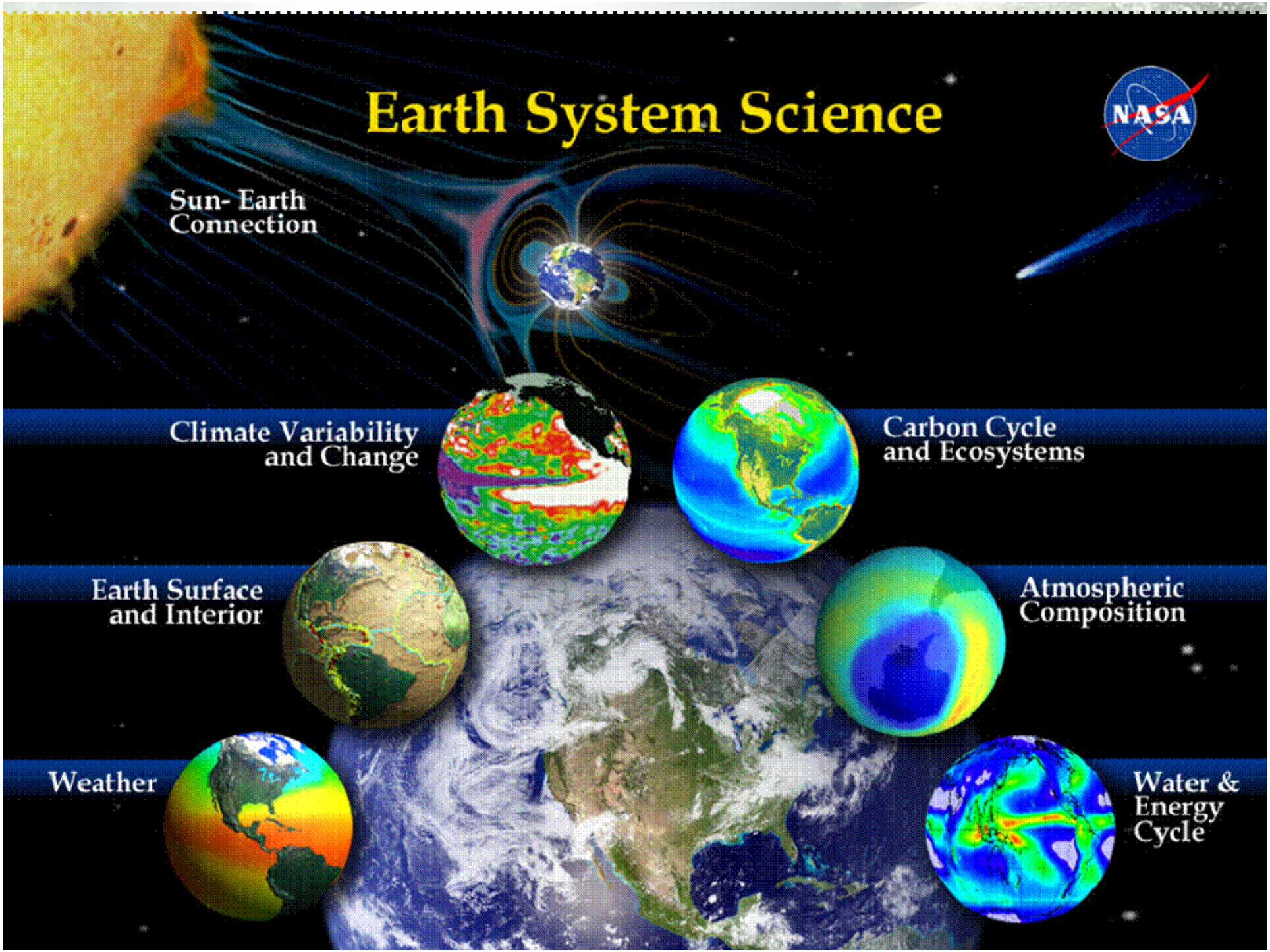
The NASA Energy and Water- Cycle Study (NEWS) long-term grand challenge:

document and enable improved, observationally-based, predictions of water and energy cycle consequences of Earth system variability and change.

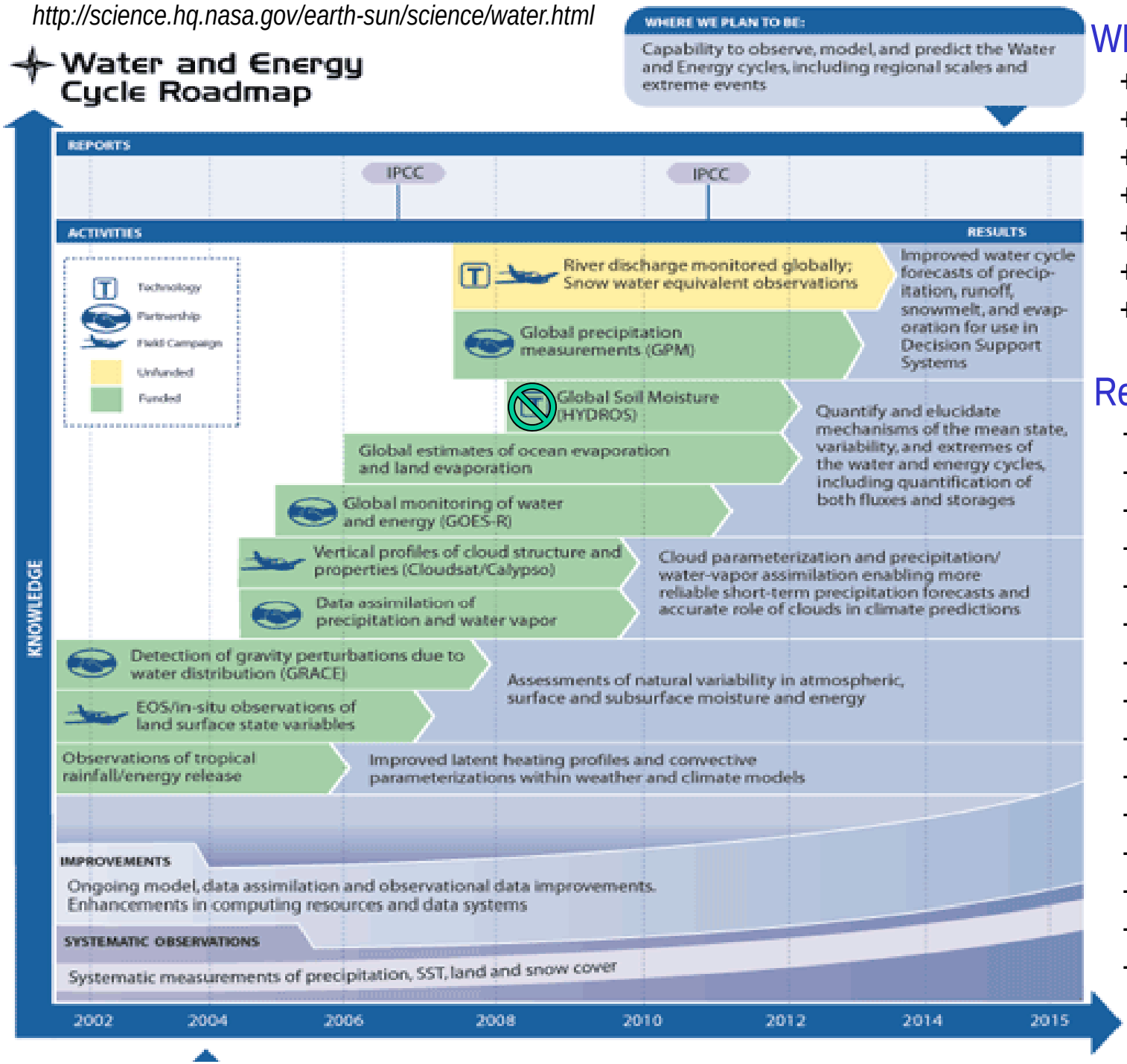
To make decisive advances in water and energy cycle prediction, we must:

- Develop a discipline of prediction and verification through the integration of water and energy cycle observations and models.
- Develop climate quality, globally complete observations of the key water- and energy-cycle rates and storages (e.g. assess and fill gaps).
- Provide an accurate accounting of the key reservoirs and fluxes associated with the global water and energy cycle, including their spatial and temporal variability.

NEWS is envisioned to make critical linkages (integration) between NASA research programs and satellite missions, other agencies, and international efforts (not just integrate amongst its members).


Earth System Science
NASA
Sun- Earth Connection
Climate Variability and Change
Carbon Cycle and Ecosystems
Earth Surface and Interior
Atmospheric Composition
Weather
Water & Energy Cycle

http://science.hq.nasa.gov/earth-sun/science/water.html



WEC Programs:

+ Terrestrial Hydrology
+ Precipitation Sciences
+ LCLUC
+ NEWS
+ Modeling (MAP)
+ Cloud Modeling
+ Water Management

Related Missions:

+ ACRIMSAT
+ Aqua
+ Aquarius
+ ERBS
+ GPM
+ GRACE
+ ICESat
+ Jason-1
+ OSTM
+ SORCE
+ Terra
+ TOPEX-Poseidon
+ TRMM
+ Cloudsat & CALISPO
+ Decadal Survey

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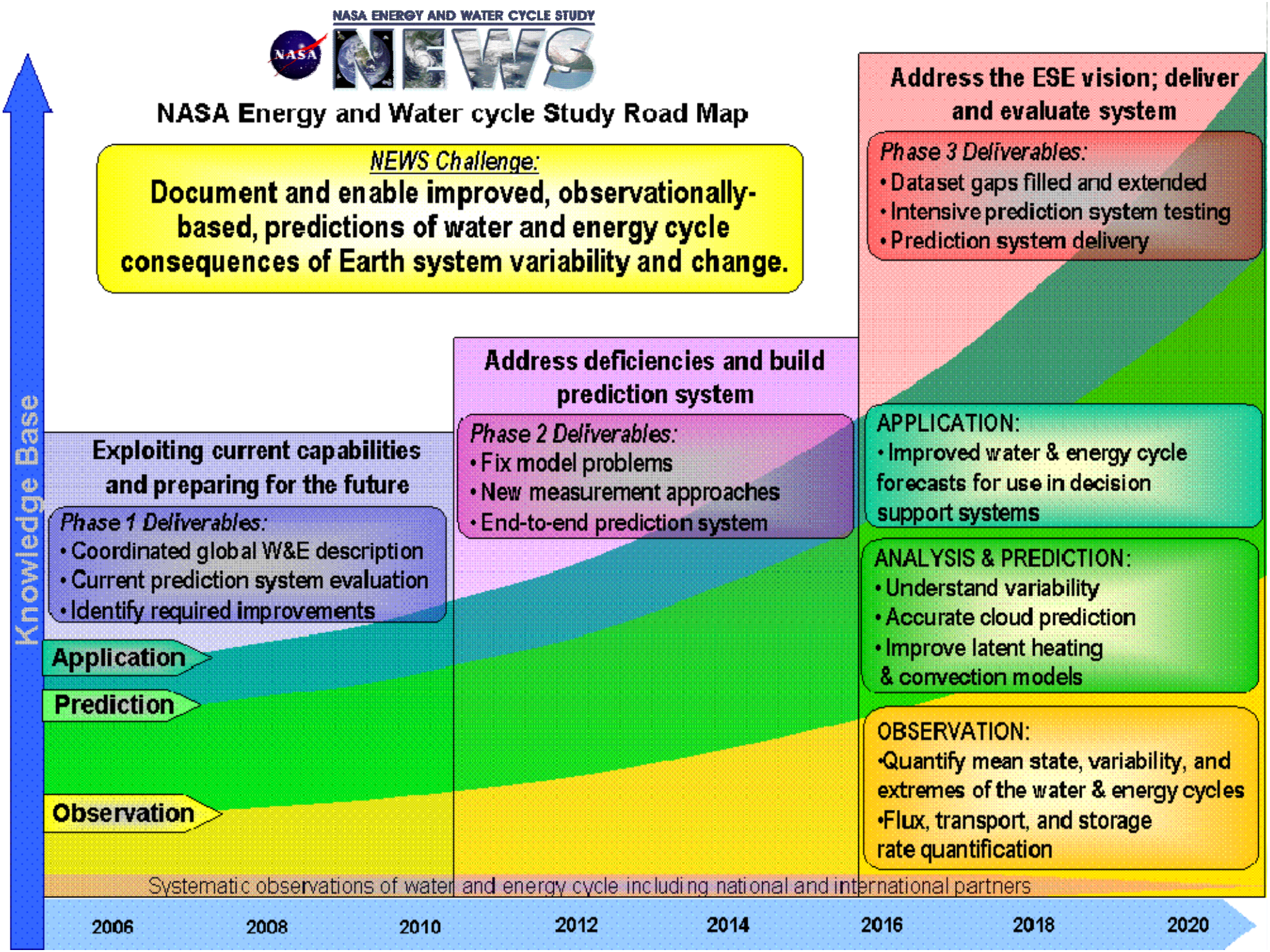
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NASA Energy and Water cycle Study Road Map
NEWS Challenge:
Document and enable improved, observationally-based, predictions of water and energy cycle consequences of Earth system variability and change.
Knowledge Base
Exploiting current capabilities and preparing for the future
Phase 1 Deliverables:
• Coordinated global W&E description
• Current prediction system evaluation
• Identify required improvements
Address deficiencies and build prediction system
Phase 2 Deliverables:
• Fix model problems
• New measurement approaches
• End-to-end prediction system
Address the ESE vision; deliver and evaluate system
Phase 3 Deliverables:
• Dataset gaps filled and extended
• Intensive prediction system testing
• Prediction system delivery
APPLICATION:
• Improved water & energy cycle forecasts for use in decision support systems
ANALYSIS & PREDICTION:
• Understand variability
• Accurate cloud prediction
• Improve latent heating & convection models
OBSERVATION:
•Quantify mean state, variability, and extremes of the water & energy cycles
•Flux, transport, and storage rate quantification
Application
Prediction
Observation
Systematic observations of water and energy cycle including national and international partners
2006
2008
2010
2012
2014
2016
2018
2020

NEWS Working Groups

A new structure has been created in the NEWS program that allows for consistency with existing NEWS activities, (aka the NEWS Implementation Plan, the NEWS integration questions, etc.), and at the same time welcomes new PIs and builds links to broader community efforts. NEWS plans to morph the NEWS questions into four co-chair-led NEWS working groups that build off all the projects and the previous NEWS question-based groups.

The four group themes are listed below with designated co-chairs:

- Drought & Flood Extremes -including water and energy aspects of abrupt climate change (co-chairs Xiquan Dong & John Albertson)
- Evaporation & Latent Heating - including both land and ocean (co-chairs Kyle Hilburn & Jay Famiglietti)
- Energy & Water Cycle Climatology - to exploit and influence evolving observing systems (co-chairs Matt Rodell & Tristan L'Ecuyer)
- Modeling & Water Cycle Prediction - foster interaction with the global modeling community (co-chairs Mike Bosilovich, Yongxiang Hu)

The principal goal of the working groups will be to propose and implement the development of papers that integrate various NEWS research within the working group topic. The working groups are expected to:

- Coordinate and integrate NEWS PI science investigations, focused on journal publications
- Liaison with relevant flight missions and NASA R&A Programs
- Implement annual assessment of progress in meeting NEWS scientific requirements
- Contribute to periodic Implementation Plan (IP) updates
- Prepare annual working group progress summaries
- Conduct regularly scheduled telecons
- Assist in planning and organization of annual Science Team meetings and sessions at national meetings (e.g. AMS, AGU)

http://www.nasa-news.org/integration/

NEWS Integration Examples

-A new surface roughness model developed by M. Bourassa of Florida State University has been combined with the Clayson/Curry surface renewal bulk turbulent flux model, a sea spray parameterization, and ocean wave data. The NEWS product better represents the observed conditions shown in hurricanes. The model is providing a 10+ year data set that can be used to evaluate coupled climate model simulations and conduct diagnostic studies to improve understanding of the water and energy cycle variability on time scales from the diurnal to the decadal.
For more information contact judith.curry@eas.gatech.edu

-Separate evaluations of the contributions by radiation, precipitation and surface sensible heat flux have revealed that the surface sensible heat flux is more important than might have been expected from the magnitude of the fluxes and that although radiation and precipitation act in concert to force the mean atmospheric circulation, they act in opposition in storms.
For more information contact wbrossow@ccnycuny.edu

-The NEWS Energy and Water Cycle Climatology project aims to synthesize a self-consistent climatology to describe the global energy and water cycles using state-of-the-art satellite information developed by NEWS scientists as well as refinements from the community-at-large. This project is now one of the four new working group projects that maintains a Google Group site and welcomes all scientists to join in the efforts to refine the global energy and water cycle.
For more information go to: http://www.nasa-news.org/integration/

Workshop Charge

This is a *NEWS science workshop*, with the charge to:

- Foster in-depth science discussions, especially at the interfaces of projects and disciplines
  - Poster session, break-outs, breaks, meals
  - Invited guests & links to other science programs
  - NSIT resources (Adam, Bing, etc.)
- Refine and plan the development of *a few papers that integrate NEWS research*
  - Use Google docs for group collaboration?
  - Each person should consider taking the lead for a integration paper topic
- Summarize papers and research highlights (Thursday afternoon) (~1hr for each group)
  - Overview of research highlights, or integration progress
  - Include future ideas and summary of brainstorm discussions
  - Outline of paper(s) including connections, implementation plan, timelines
  - Announce plans for future working group collaborations

Next steps?

- Refinement of NEWS implementation plan
- NEWS-centered sessions at AGU/AMS
- Mid-year NEWS working group sessions or topic workshops
- Suggestions for management