CCAWWG “Short Term” Science Strategy Document

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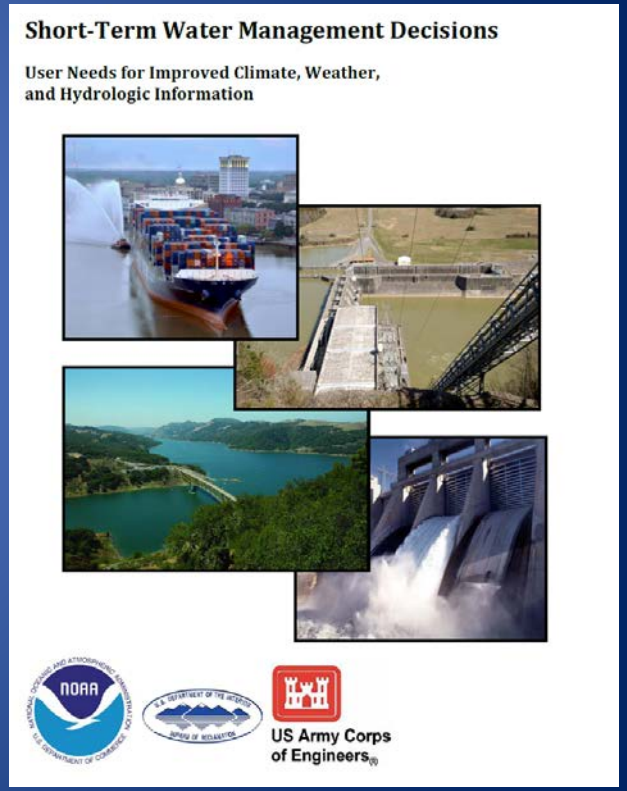
Outline

- Background: Short Term Needs Document
- Science Strategy Approach
- Status

“Short Term” Needs Document

- Described (1) short-term water management decision processes within USACE and USBR and (2) opportunities for improved short-term climate, weather, and hydrologic information to inform decision processes.
- Published January 2013
- Available online ccawwg.us



“Short Term” defined

Table 1. CCAWWG time-scale categories for identifying user needs related to climate, weather, and hydrologic information in water resources planning and management.

User need category	“Look-ahead” time scale of water resources planning	Relevant climate, weather and hydrology information
Short term	Less than (<) 5 years	Weather and hydrology during subdaily to multiweek time scales; hydrology and climate on monthly to annual time scales
Long term	Greater than (>) 5 years	Hydrology and climate on annual to multidecadal time scales; recent climate change is more relevant for look-aheads < 20 years; projected climate change is relevant for look-aheads greater > 20 years

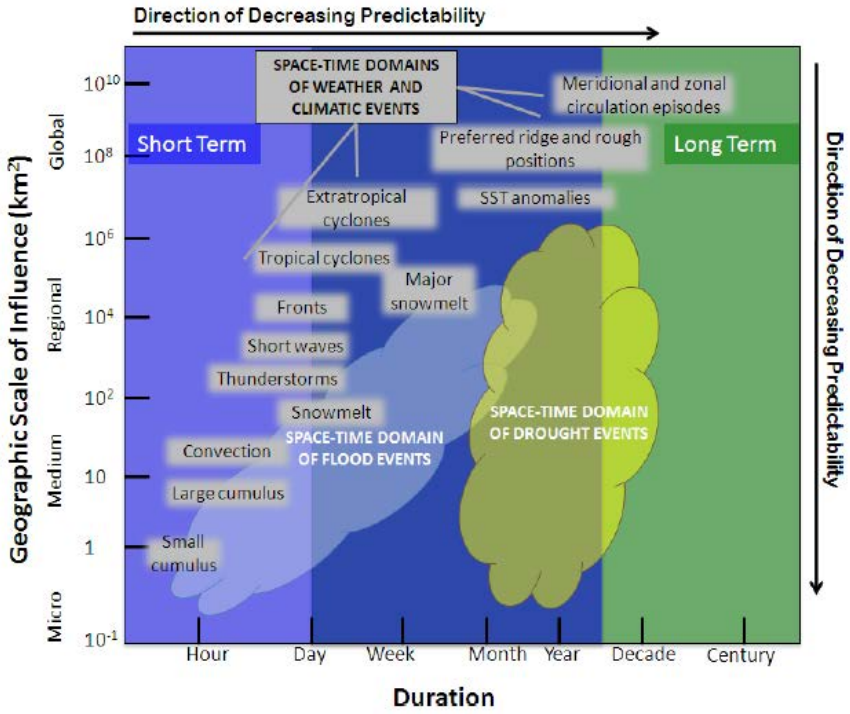


Figure 3. Space and time domains of climate and weather phenomena related to water resources management. (After Hirschboeck 1988.)

“Short Term” Needs Identified

- **Monitoring**: Includes precipitation, snowpack, streamflow, and general
- **Forecasting**: Includes precipitation, streamflow, water level, and others at various lead-times
- **Understanding and using information products in water management**: Includes synthesizing information, providing qualitative information on product development, and education on water management and forecasting methodologies and principles
- **Information services enterprise**: Includes product maintenance and formatting concerns

“Short Term” Science Strategy Approach

- Two focus areas for science strategy team:
  - Inventory existing research and development
  - Identify opportunities for science advances - In particular science gaps that are under-recognized currently but research programs could conceivably be organized around.
- Core writing team formed in March 2015
- Team identified four science areas:
  - Monitoring
  - Modeling
  - Forecasting
  - Application and communication of forecasts and information
- Within each science area, team members identify
  - Needs/Context
  - Essential Activities
  - Grand Challenges

Monitoring

1. Assemble, structure, and quality control heterogeneous **meteorological and hydrologic data** from nationwide operational networks, smaller meso-networks, research basins, and ground-based and satellite remote sensing platforms; Develop a high quality, temporally homogeneous, high resolution nationwide ensemble land surface forcing dataset, regularly updated

2. Develop high quality and high resolution **hydrologic reanalysis products** that fuse state-of-the-art nationwide hydrologic model simulations with all available station and satellite data on hydrologic states and fluxes

3. Improvements to **physical monitoring infrastructure** including remote sensing for environmental variables of hydrologic interest including soil moisture, (P)ET, snow, streamflow, and precipitation

4. Assemble, structure, and quality control **heterogeneous hydrological and land surface parameter datasets** such as vertically varying soil hydraulic, thermal, and radiative properties, land cover, land use, impervious area, topography, drainage structures (tile drains), etc

5. Monitoring **water use** (irrigation, municipal water use), reservoir operations, withdrawals, inter-basin transfers.

Modeling

1. Improve **computational infrastructure** for hydrologic modeling, including numerical implementation, ease of use, development of supporting spatial datasets, visualization, and evaluation/benchmarking.

2. Improve fidelity of **hydrologic process representation**, including incorporating processes that are currently missing or poorly represented and evaluating benefits of competing modeling approaches

3. Improve **continental-domain parameter estimates**, through improving information on geophysical attributes (bedrock depth, permeability, etc.), and further develop multivariate and multi-scale parameter estimation strategies.

4. Improve capability to **characterize hydrologic model uncertainty**, through developing large ensembles of hydrologic models and parameter sets.

5. Understand the value and **tradeoffs in applying hydrologic models of varying complexity**, in order to identify "optimal" model configurations for a myriad of applications

6. **Evaluate the information flow through models**, considering the extent to which the choice of specific process parameterizations and constraints on model parameter values limits the capabilities to simulate individual physical processes and scaling behavior.

7. Develop comprehensive multivariate and multi-scale hydrologic **data assimilation** strategies

Forecasting and Applications

1. **Understand and quantify** the influence of different **sources of** meteorological, climate and hydrologic **predictability**

2. Improve capabilities in **weather forecasts and sub-seasonal to seasonal climate prediction**, particularly for precipitation, and for weather and climate extremes.

3. **Assess potential advances in hydrologic forecasting** through improvements in meteorological forcings, improvements in ensemble weather forecasts and climate outlooks, improvements in hydrologic modeling, and improvements in forecast methods such as data assimilation and statistical post-processing

4. **Evaluate forecast advances** for improved decision making in water management, including reservoir operations models

5. **Demonstrate and evaluate alternative forecasting approaches** in an operational proving ground
    1. Strengthen connection between developers, forecasters and users to support two-way sharing of knowledge
    2. Explore alternative workflows, including greater automation and the use of supercomputing

Integration of research elements

Monitoring

Modeling

Research to support water resources planning
(narratives portraying scenarios of climate change impacts on water resources)

Research to support water resources operations and management
(development and evaluation of advanced forecasting technologies)

Next Steps

1. Complete draft report: Team will continue to develop science needs, essential activities, and grand challenges for each science area

2. Review: Report will be reviewed by CCAWWG agencies especially inviting contributions outside expertise of core writing team
   a. Volunteers welcome

3. Utilize: Report distribution will target research program managers to highlight potential areas for improving science utilized in water resources management
   a. How might this report help your program(s)?

Discussion

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