

WRF-Hydro in a Data Services Framework

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July 15-17 2015

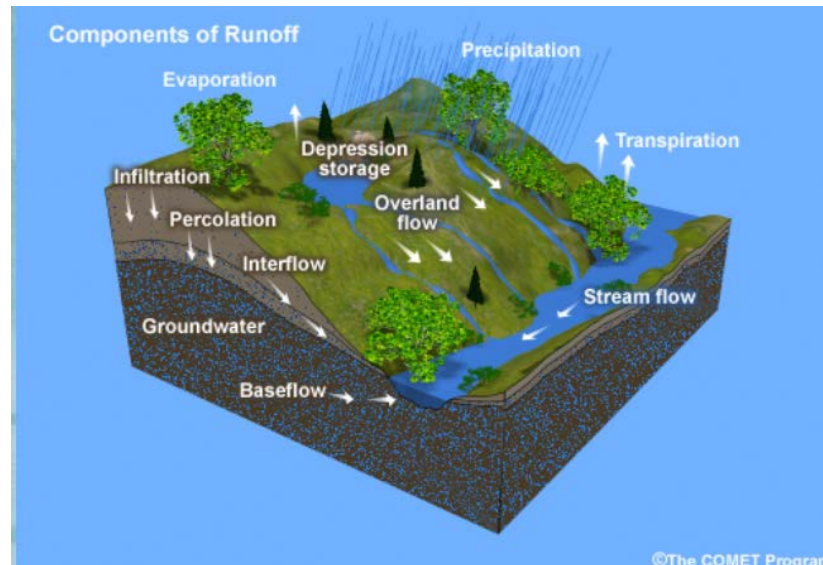
The University of Alabama – National Water Center



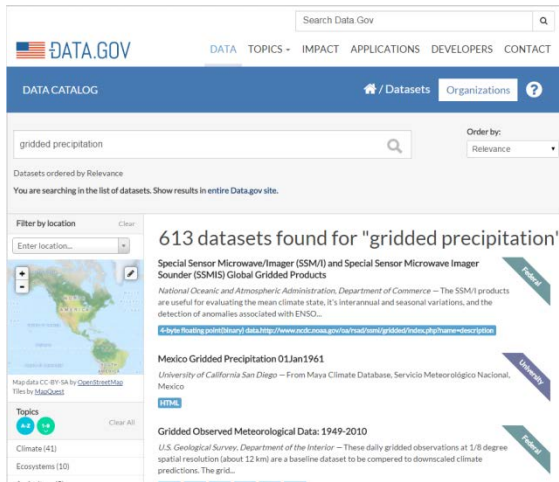
WRF-Hydro System

A community-based coupling architecture designed to provide:

- 1) An extensible multi-scale & multi-physics land-atmosphere modeling capability for conservative, coupled and uncoupled assimilation & prediction of major water cycle components
- 2) Able to estimate water flow, velocity, and water elevation across spatial and temporal scales
- 3) A robust framework for land-atmosphere coupling studies



Examples of Data Services for Water Resources



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DATA TOPICS IMPACT APPLICATIONS DEVELOPERS CONTACT

DATA CATALOG

gridded precipitation

613 datasets found for "gridded precipitation"

Special Sensor Microwave/Imager (SSM/I) and Special Sensor Microwave Imager Sounder (SSMIS) Global Gridded Products

National Oceanic and Atmospheric Administration, Department of Commerce — The SSM/I products are useful for evaluating the mean climate state, its interannual and seasonal variations, and the detection of anomalies associated with ENSO...

4-byte floating point binary data http://www.cgd.cma.gov.cn/na/had/tem/gridded/ndic.cdf?name=description

Mexico Gridded Precipitation 01Jan1961

University of California San Diego — From Maya Climate Database, Servicio Meteorológico Nacional, Mexico

Gridded Observed Meteorological Data: 1949-2010

U.S. Geological Survey, Department of the Interior — These daily gridded observations at 1/8 degree spatial resolution (about 12 km) are a baseline dataset to be compared to downscaled climate predictions. The grid...



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Standards

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- ARML2.0
- Cat: eBRIM App Profile: Earth Observation Products

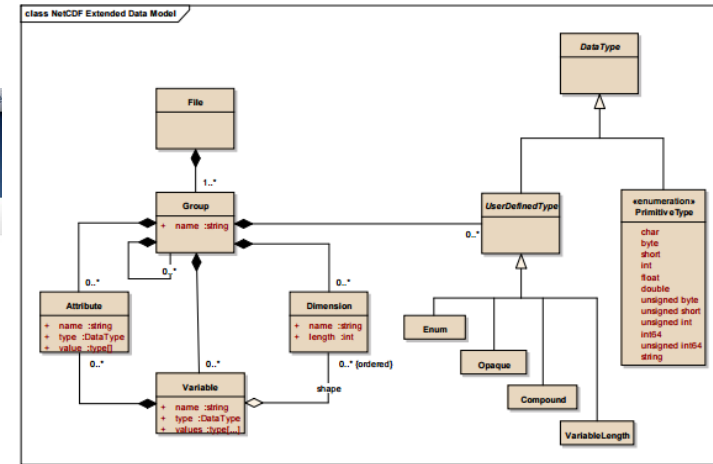
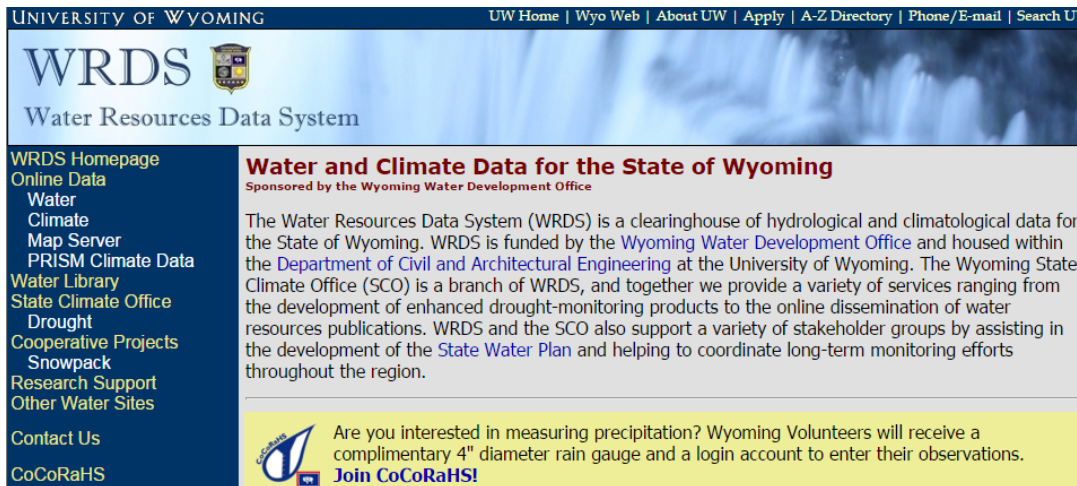


Figure 3 — Extended NetCDF Data Model



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WRDS

Water Resources Data System

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 Other Water Sites

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Water and Climate Data for the State of Wyoming

Sponsored by the Wyoming Water Development Office

The Water Resources Data System (WRDS) is a clearinghouse of hydrological and climatological data for the State of Wyoming. WRDS is funded by the Wyoming Water Development Office and housed within the Department of Civil and Architectural Engineering at the University of Wyoming. The Wyoming State Climate Office (SCO) is a branch of WRDS, and together we provide a variety of services ranging from the development of enhanced drought-monitoring products to the online dissemination of water resources publications. WRDS and the SCO also support a variety of stakeholder groups by assisting in the development of the State Water Plan and helping to coordinate long-term monitoring efforts throughout the region.

Are you interested in measuring precipitation? Wyoming Volunteers will receive a complimentary 4" diameter rain gauge and a login account to enter their observations.
Join CoCoRaHS!



NASA GHRC

Global Hydrology Resource Center

Collaboration between NASA MSFC and The University of Alabama in Huntsville

ACCESS DATA MEASUREMENTS FIELD CAMPAIGNS PROJECTS RESOURCES MULTIMEDIA ABOUT CITE US CONTACT US

SEARCH

IND DATA
 LATIT DATA
 RESEARCH ITEMS
 DOCUMENTS

NASA HURRICANE AND SEVERE STORM SENTINEL (HS3)

NASA's Hurricane and Severe Storm Sentinel (HS3) ran its field campaign phase during the summers of 2012, 2013, and 2014. Data from the HS3 mission will be archived at and available from the Global Hydrology Resource Center DMAC. Image credit: NASA.

WELCOME

GHRC's mission is to serve as NASA's Earth science data center for scientific, educational, commercial and governmental communities. The GHRC also provides knowledge management services encompassing tools, infrastructure, user support, and expertise to our stakeholders. GHRC is supported by NASA and is managed jointly by the Marshall Space Flight Center's Earth Science Department and the University of Alabama in Huntsville's Information Technology & Systems Center.

WHAT'S NEW

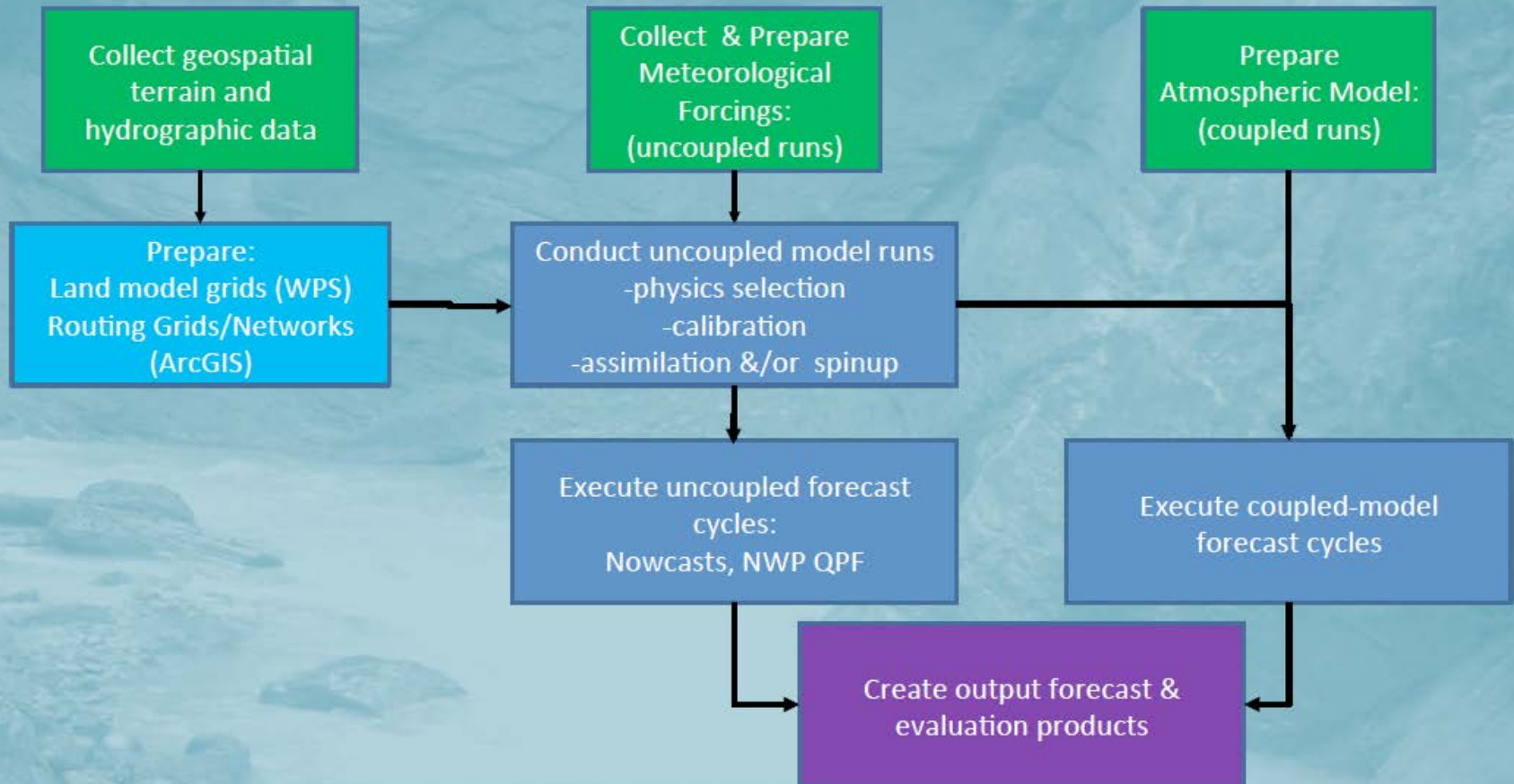
GHRC publishes seven GCFE ground-based radar datasets

SCIENCE AREAS

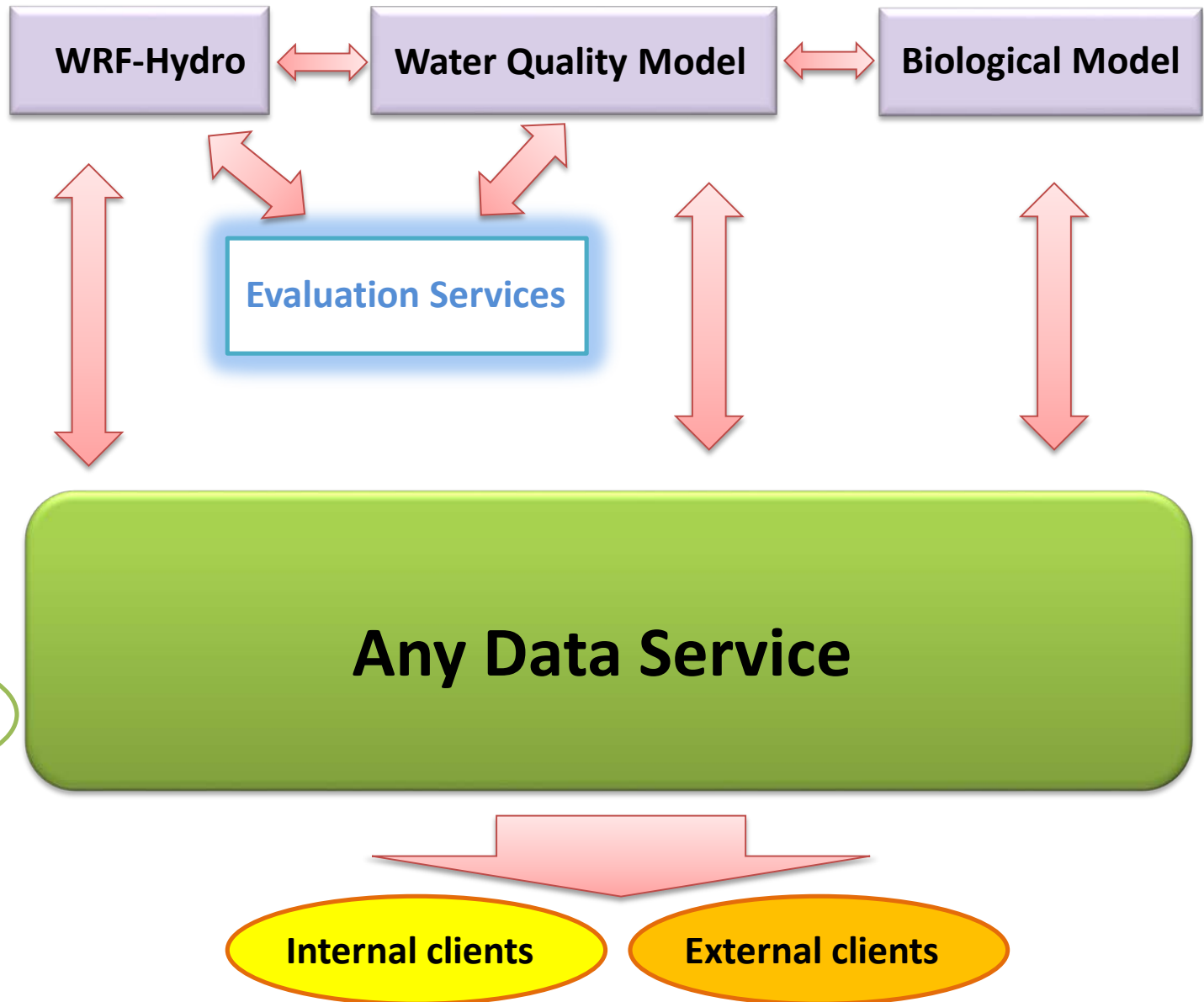
- LIGHTNING: Two space-based instruments have collected lightning data worldwide.
- HURRICANES: GHRC is the archive and distribution center for data collected during.
- WATER VAPOR & PRECIPITATION: Global hydrological parameters such as soil.

WRF and WRF-Hydro

WRF-Hydro Implementation Workflow:



Proposed Integration of WRF-Hydro with a Data Service



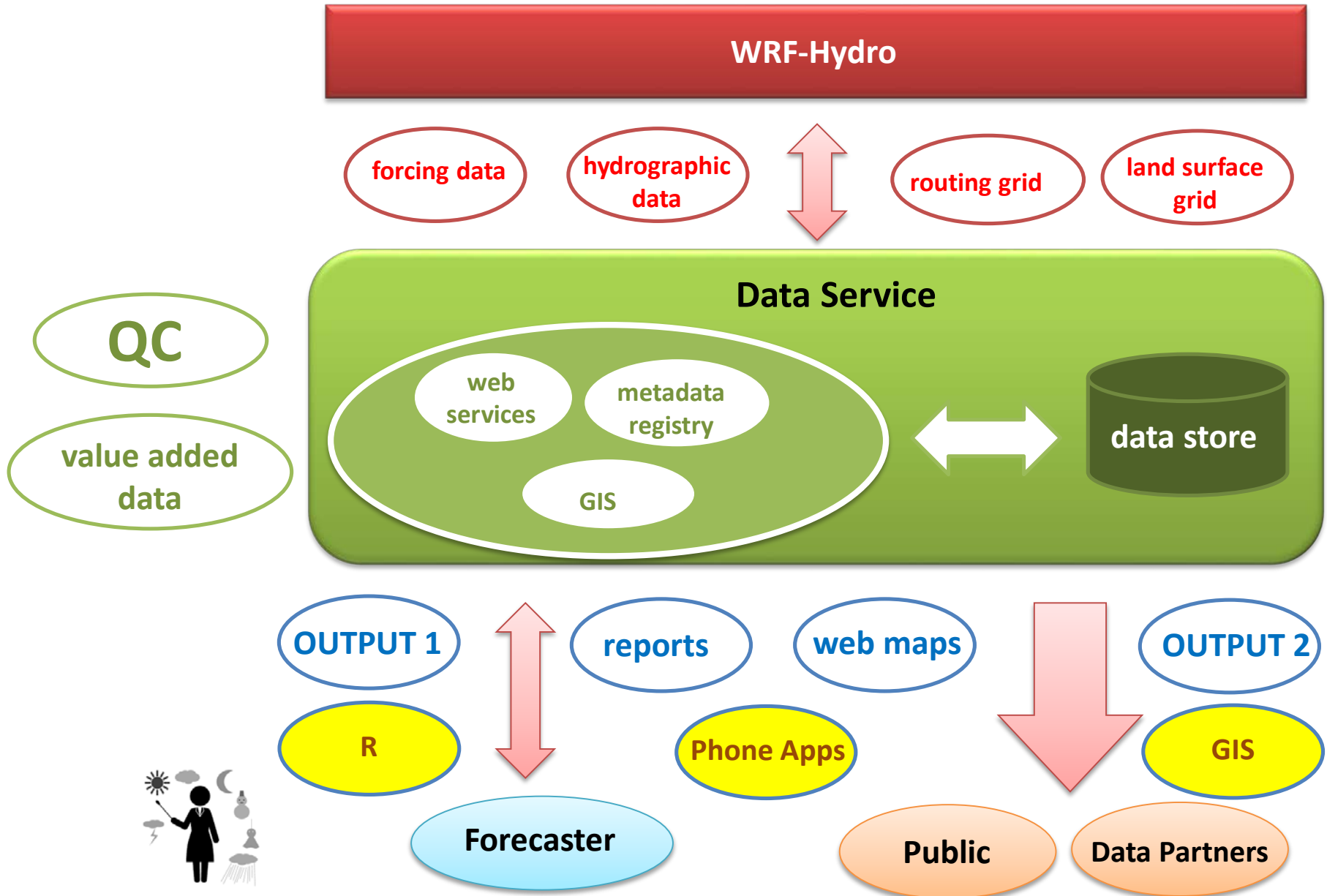
WRF-Hydro Modeling Requirements

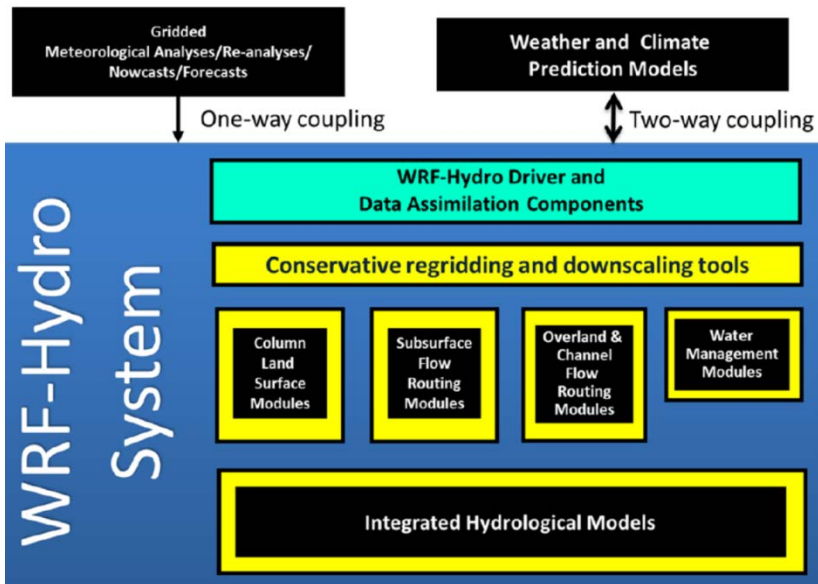
- Fast access to historical and real-time hydrologic meteorological data, metadata, and geospatial information to support forecasts and analyses
- Incorporation of a choice of useful sources and formats
- Ingestion of real-time data assimilation products
- Hydrologic ingestion of ensemble weather forecasts
- A framework designed for flexible calibration

Ideal Data Service Capabilities

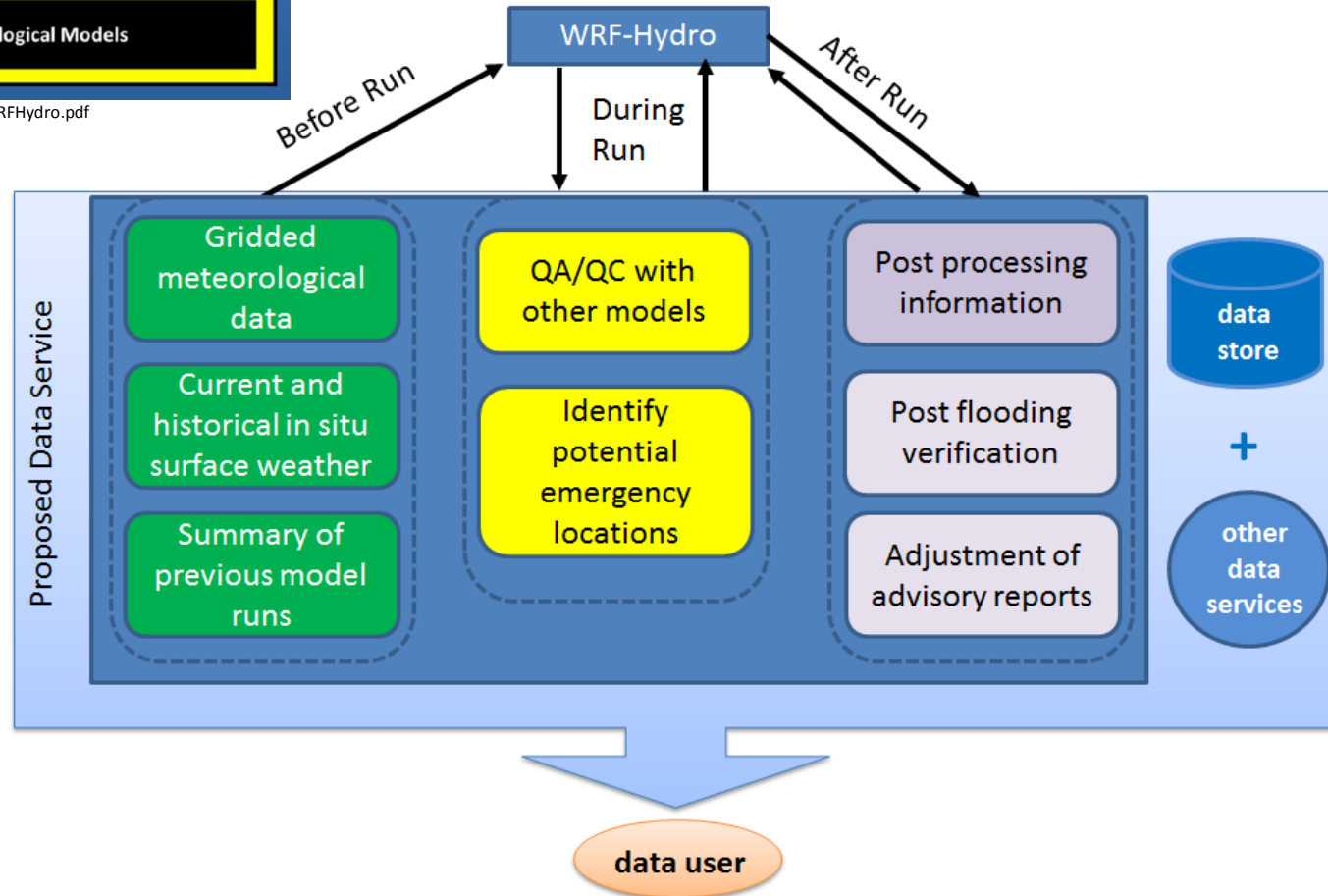
- ✓ Define and implement standard interfaces that handle the heterogeneous nature of the data
- ✓ In situ surface weather and water budget observations, hydrometric observations, and observations through surveys and networks (e.g.: snow, soil moisture, CoCoRaHS)
- ✓ Water management observations (e.g.: reservoir storage and release, diversions and consumptive-use). Able to generate numerical weather prediction models based on analysis and forecasts
- ✓ Able to handle and display geospatial information (e.g.: digital elevation models, land-use and land-cover data, hydrographic and bathymetric data, climatology data)

Generic Data Service for WRF-Hydro



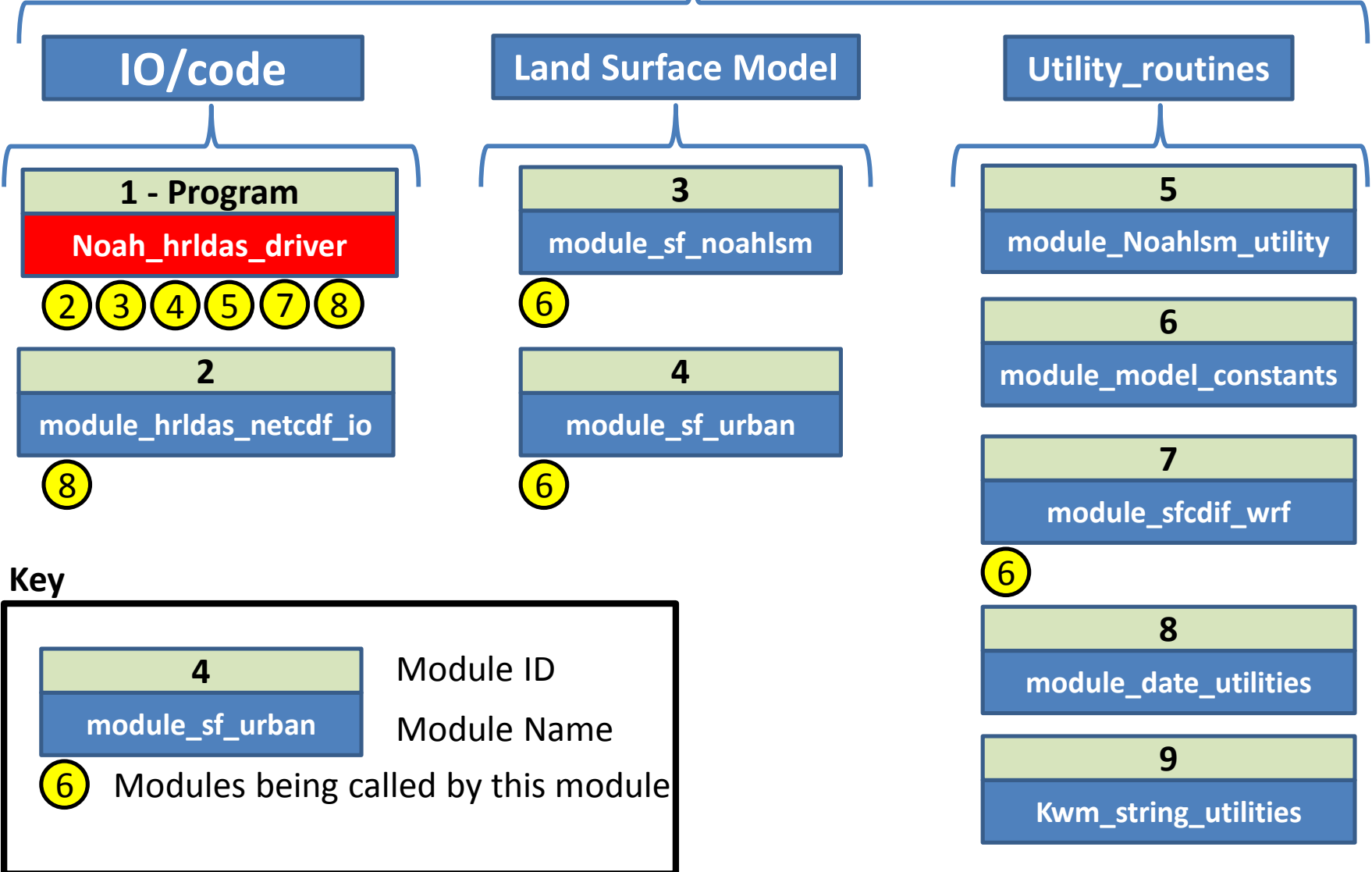


<http://www.caee.utexas.edu/prof/maidment/CE397Flood/Visual/WRFHydro.pdf>



WRF-Hydro Executable

Makefile in **Run** Folder



Key

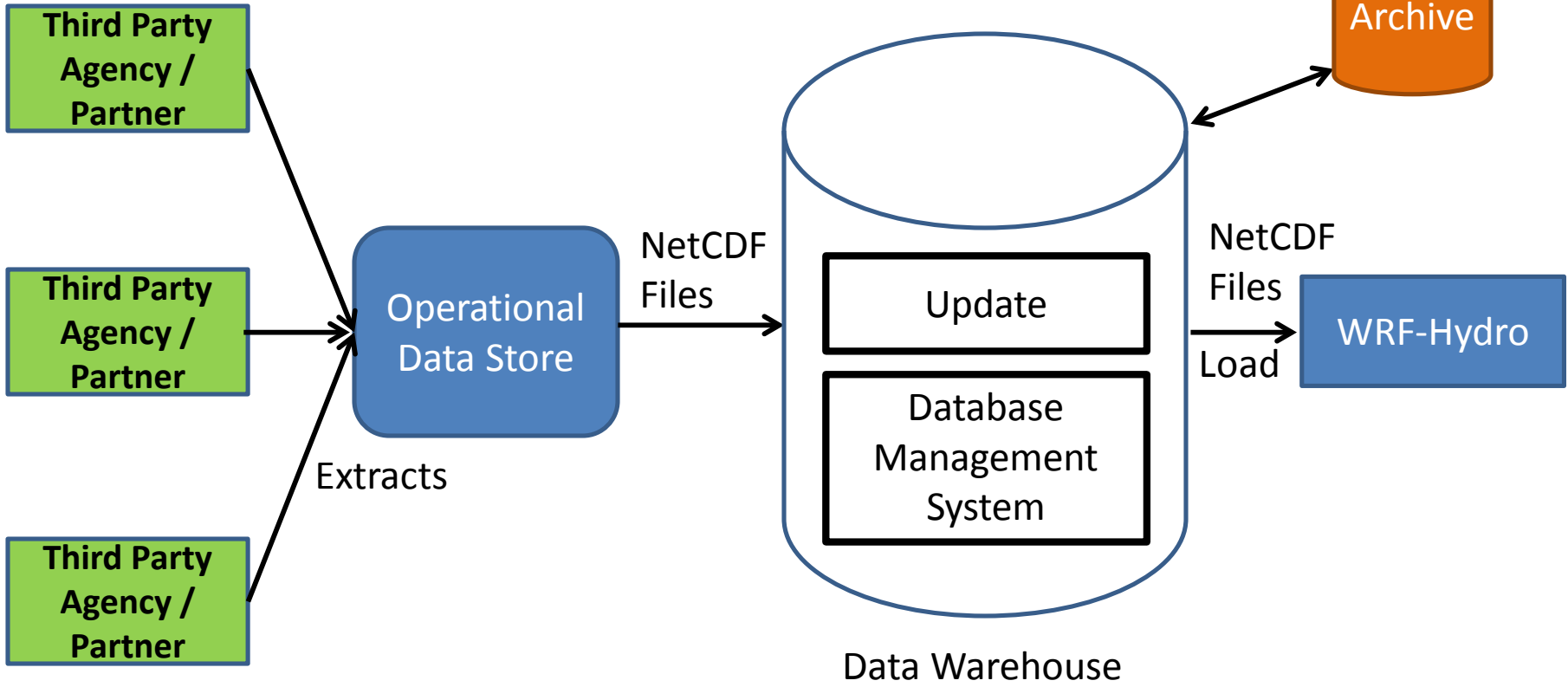
4	Module ID
module_sf_urban	Module Name
6	Modules being called by this module

Future of WRF-Hydro

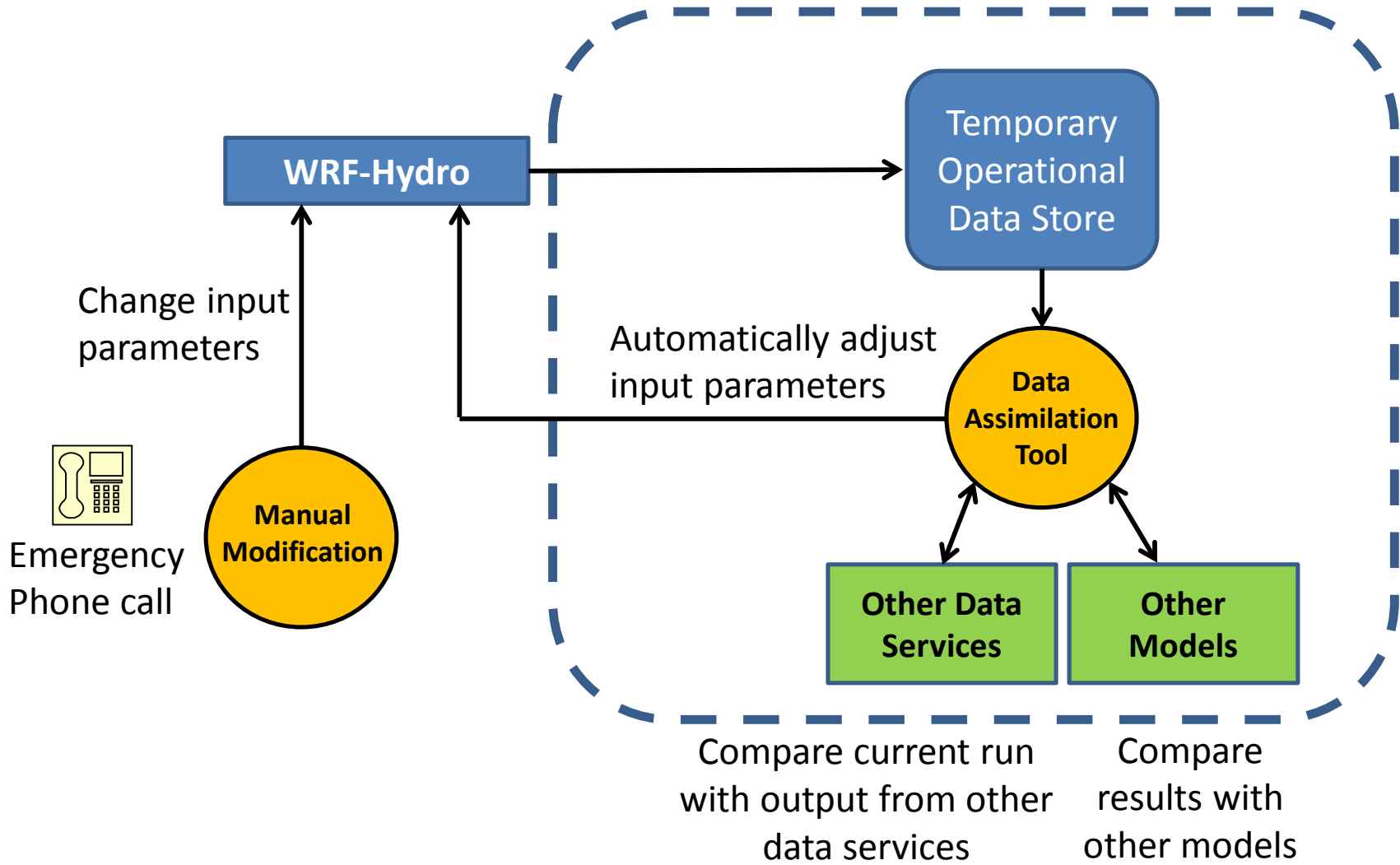
- WRF-Hydro expands the domain of hydrological models covering the CONUS and OCONUS areas of the U.S.
- Promote the development of tools for user access

Potential Data Services for WRF-Hydro
BEFORE RUN

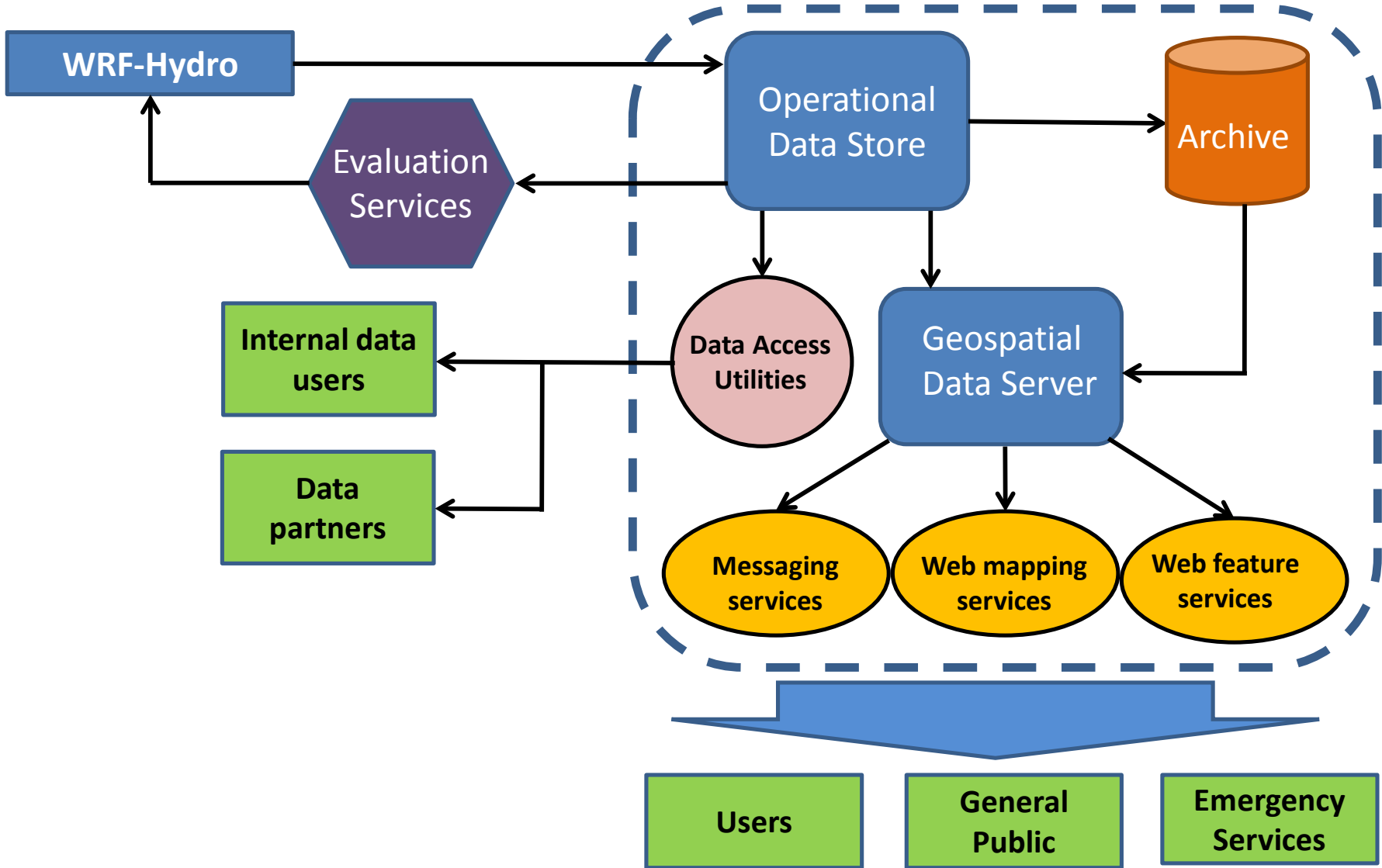
UNCOUPLED



Potential Data Services for WRF-Hydro
DURING RUN



Potential Data Services for WRF-Hydro
AFTER RUN



Conclusions

- WRF-hydro requires integration with data services in all stages including before, during, and after program runs
- Data users must be continually engaged in identifying new applications of the outputs and the technology to deliver data products
- In the first phase, the priority should be focused on generation of model inputs and tools for evaluation of results
- Future phases can integrate additional resources and technology to fully leverage WRF-Hydro data products with partners and internal users

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