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Motivation & Applications

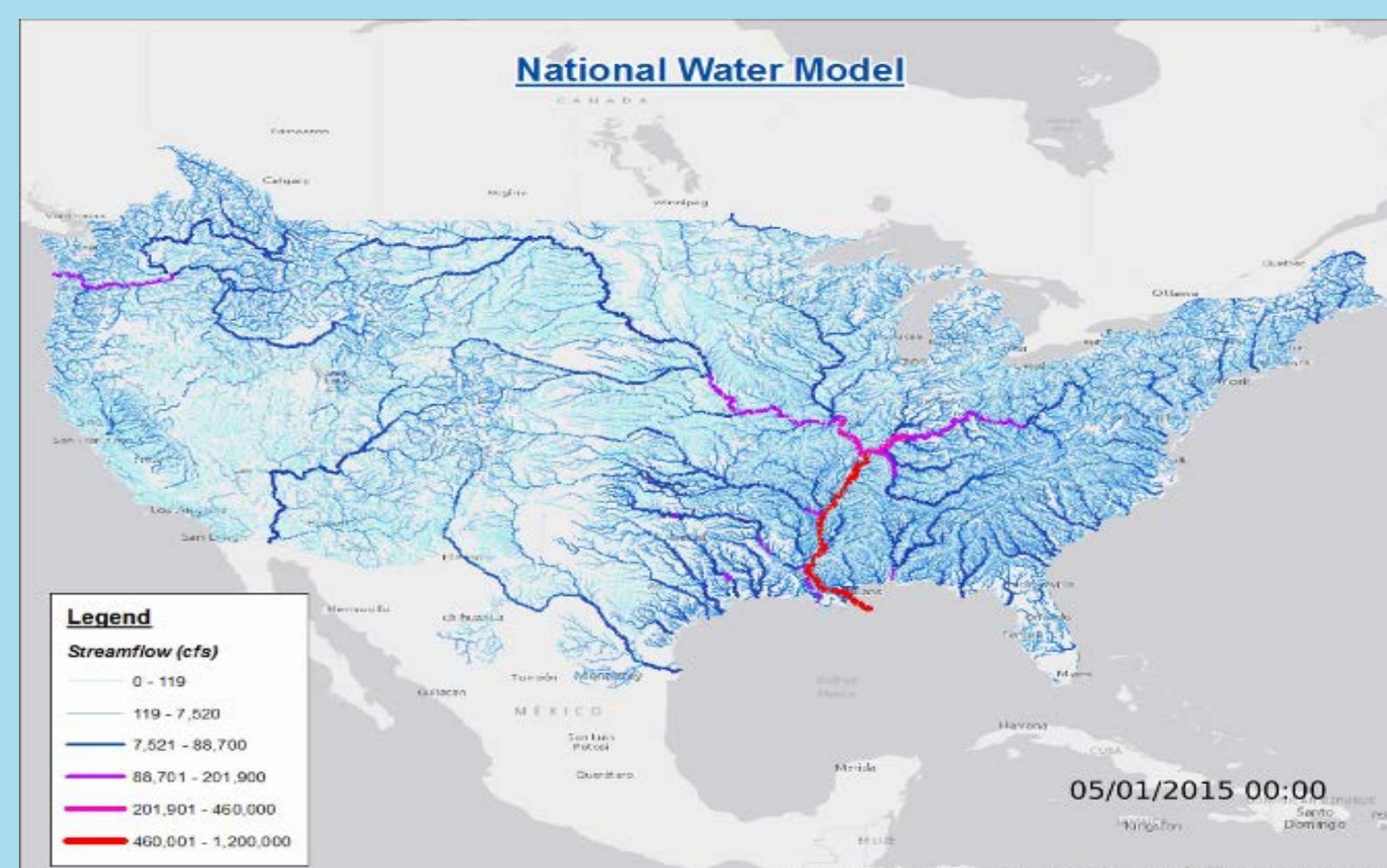
Hydrologic Impacts Across Time & Space



Scientists and society need a way to understand and predict how the complex components of the water cycle interact with the complexities of the landscape in order to provide data and information to address issues relating to water availability, water quality, hazards and impacts both in the short term and long term and across spatial scales.

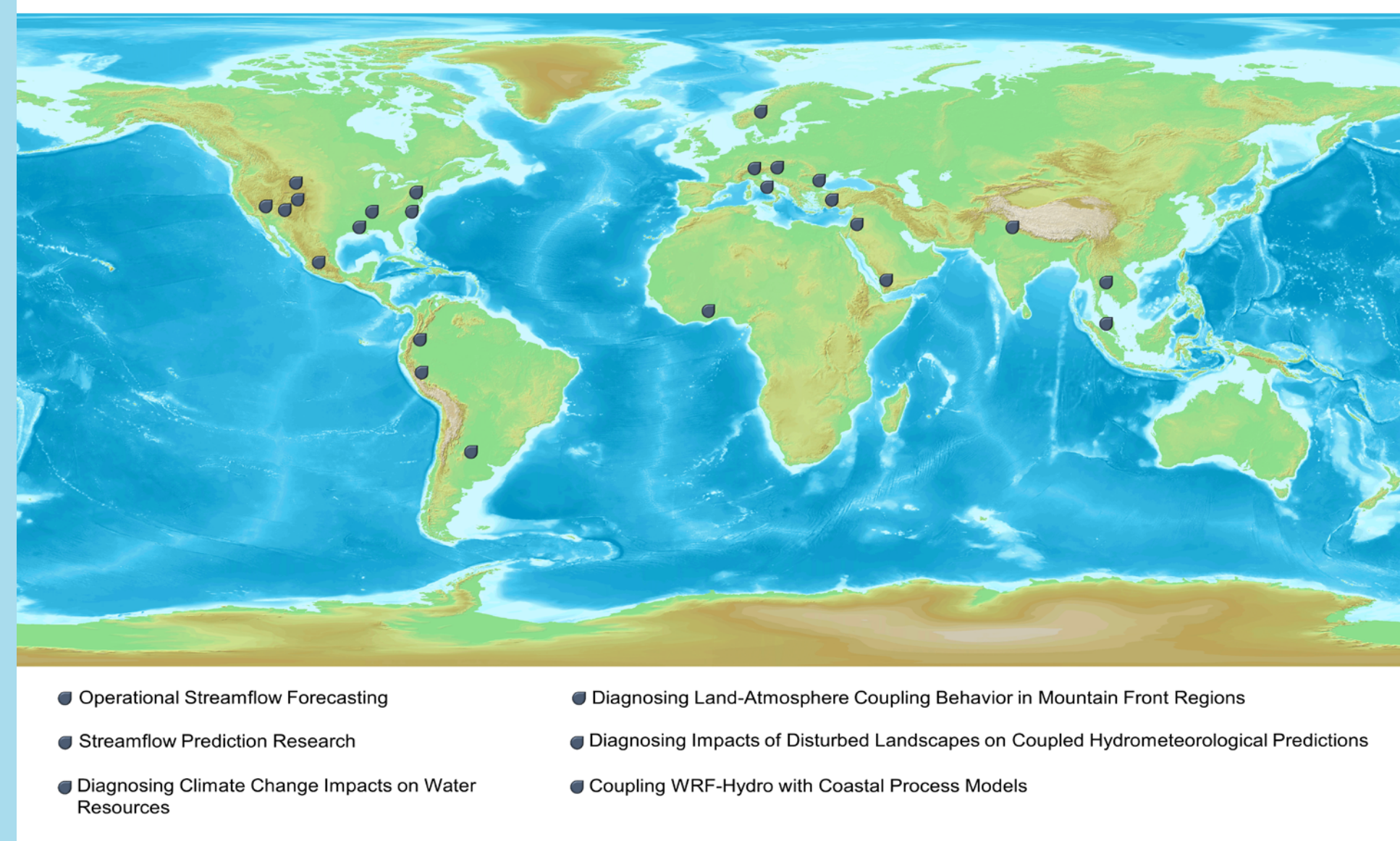
The Weather Research and Forecasting Model Hydrological modeling system (WRF-Hydro[®]) was developed as a community-based, open source, model coupling framework designed to link multi-scale process models of the atmosphere and terrestrial hydrology to provide:

- An extensible multi-scale & multi-physics land-atmosphere modeling capability for conservative, coupled and uncoupled assimilation & prediction of major water cycle components such as: precipitation, soil moisture, snow pack, ground water, streamflow, and inundation
- Accurate and reliable streamflow prediction across scales (from 0-order headwater catchments to continental river basins and from minutes to seasons)
- A research modeling testbed for evaluating and improving physical process and coupling representations

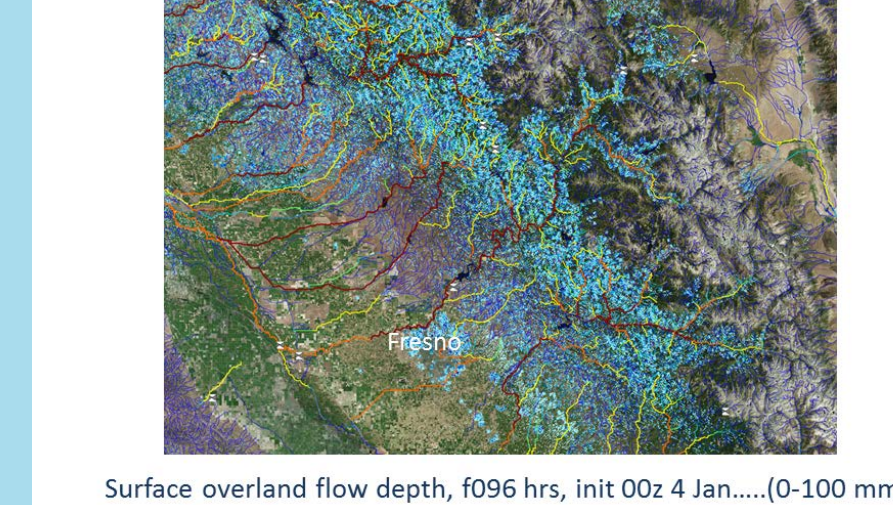


WRF-Hydro[®] model output can supply forecasters and decision makers with locations and timing of rapid river stage increase as well as the duration of high waters and inundation while accounting for landscape dynamics essential to flood risks such as land cover change as well as the control effects of infrastructure such as dams and reservoirs.

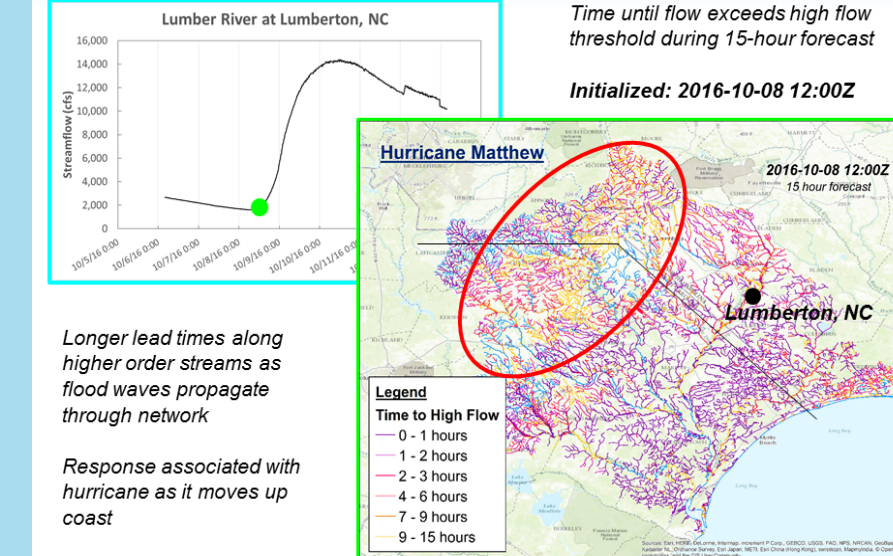
Applications Worldwide



NWM Jan. 3-7 Atmospheric River in California

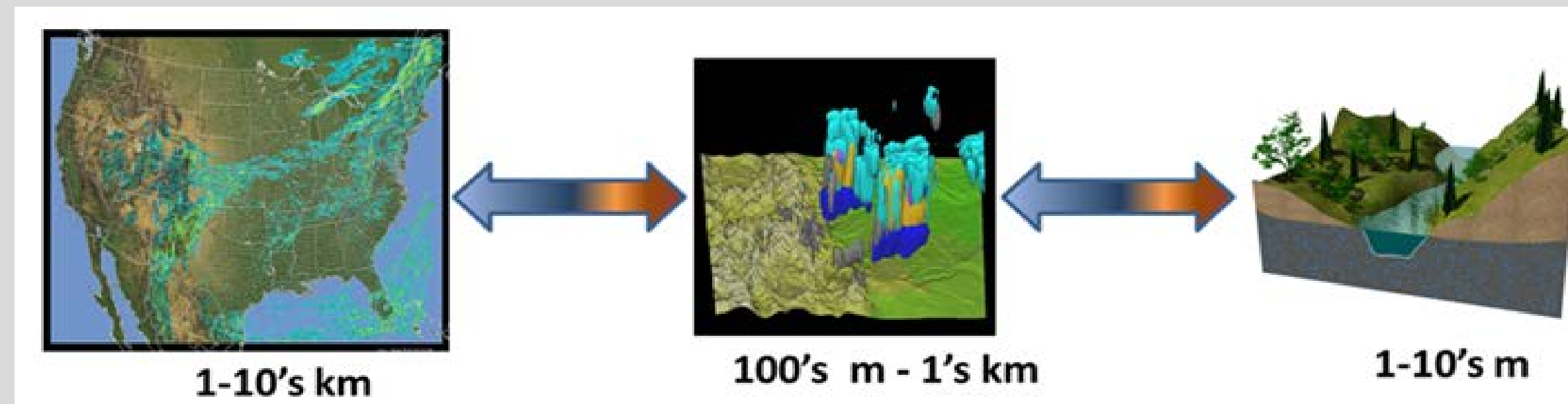


Case Study: Hurricane Matthew

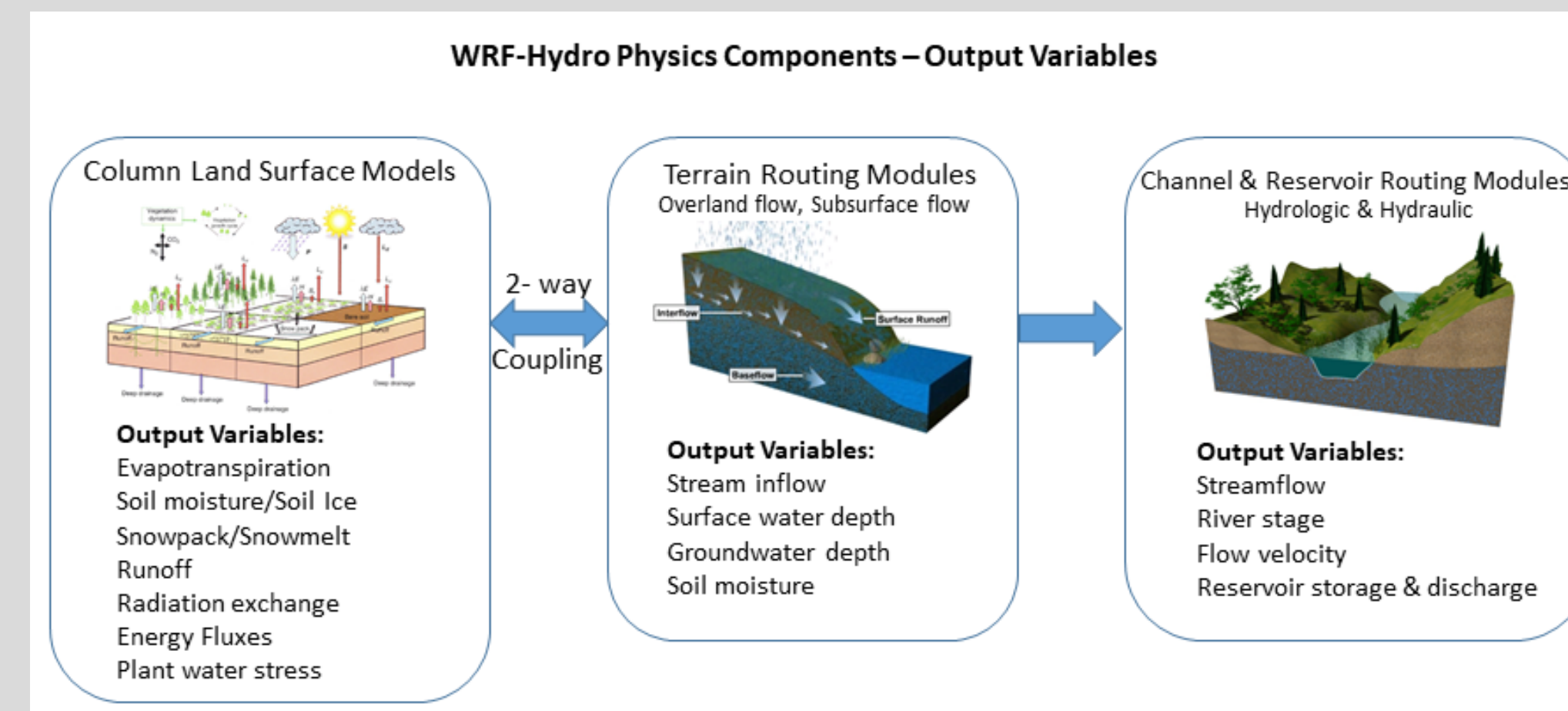


As an open source, open platform model, the Community WRF-Hydro[®] Modeling System will continue to evolve to meet global needs for water resource planning and management information while also providing a pathway for academic researchers to innovate new improvements in water prediction.

WRF-Hydro[®] Modeling System



The core WRF-Hydro[®] physics model contains very high-resolution descriptions of terrestrial hydrologic process representations such as land-atmosphere exchanges of energy and moisture, snowpack evolution, infiltration, terrain routing, channel routing, basic reservoir representation and hydrologic data assimilation.



Version 5.0.x

The WRF-Hydro[®] modeling system and supporting tools have recently been updated to Version 5 and are melding with the capabilities of the National Water Model.

The Community WRF-Hydro[®] code base has merged with the National Water Model code base. On the 'back end' we have and support one unified code base and set of model pre/post processing tools for the community. On the 'front end', the community has access to the configuration of an operational model which is rarely done and makes it available for use in research applications, providing opportunities for collaboration on model development, evaluation, and improvement.

Enhancements:

- New capability to aggregate and route flow with user-defined mapping over NHDPlus catchments and reaches
- New capability to specify key hydrologic and vegetation parameters in 2 dimensions
- New Noah-MP surface resistance formulation that improves snowpack simulation.
- Updates to Noah-MP infiltration scheme to better handle high intensity rainfall events in fast-draining soils.
- Significant improvements to model output routines, including full CF compliance, new capabilities for applying internal scale/offset and compression to reduce file sizes, and built-in coordinate information to allow outputs to be read natively in GIS environments.
- New capability for streamflow nudging data-assimilation for the Muskingum-Cunge method.
- New capability for engineering and regression testing is now available for WRF-Hydro.
- The lake level-pool scheme had a number of internal bugs fixed, which should improve lake level and outflow behavior.

WRF-Hydro Physics Permutations		
	WRF-Hydro Options	Current NWM Configuration
Column Land Surface Model	3 Up-to-date Column Land Models: Noah, NoahMP (w/ built-in multi-physics options), Sac-HTET	NoahMP
Overland Flow Module	3 Surface routing schemes: Diffusive wave, Kinematic wave, Direct basin aggregation	Diffusive wave
Shallow Lateral Subsurface Flow Module	1 Subsurface routing scheme: Boussinesq shallow saturated flow	Boussinesq shallow saturated flow
Deeper Groundwater Flow	3 Groundwater schemes: 2d aquifer model, Direct aggregation storage-release, pass-through or exponential model	Exponential model
Channel Routing/Hydraulics	5 Channel flow schemes: Diffusive wave, Kinematic wave, RABR, Custom-network, Muskingum-Cunge	Custom-network (NHDPlus), Muskingum-Cunge model
Lake/Reservoir Management	1 Lake routing scheme: Level-pool management	Level-pool management

Tools

A number of open-source and standards-based tools have been developed to accelerate implementation and use of the WRF-Hydro system. Combined these tools provide a "Geospatial Intelligence" backbone that help translate data into knowledge and actions. These tools include:

- Utilization of NetCDF data standards and web-based data acquisition scripts
- Support for common geographic information systems (e.g. ArcGIS, QGIS)
- Support for customizable visualization tools (NCAR-'HydroInspector WMS', Unidata's IDV)

Python-based WRF-Hydro GIS PreProcessing Toolkit | ESMF Forcing Data Regridding Script Packages | HydroInspector[®] Web Mapping Service



Community Support

The National Center for Atmospheric Research (NCAR), through collaborative support from the National Science Foundation and other funding partners, provides community support for the entire WRF-Hydro[®] Modeling System through a variety of mechanisms. This presentation summarizes the enhanced user support capabilities that are being developed for the community WRF-Hydro[®] modeling system. These products and services include a new website, open-source code repositories, documentation and user guides, test cases, online training materials, live, hands-on training sessions, an email list serve, and individual user support via email through a new help desk ticketing system. Contact us via email wrfhydro@ucar.edu. Visit our website https://ral.ucar.edu/projects/wrf_hydro.

What's New?

Education ~ Online Training Suite

- PDFs of Background Presentations
- Video Demo of the WRF-Hydro GIS Preprocessing Tool
- WPS Geogrid and WRFinput Preprocessing Utility
- WRF-Hydro Standalone Test Case Online Lessons
- Coupled WRF|WRF-Hydro Test Case Lesson
- Zip file of HTML files of completed lessons for reference

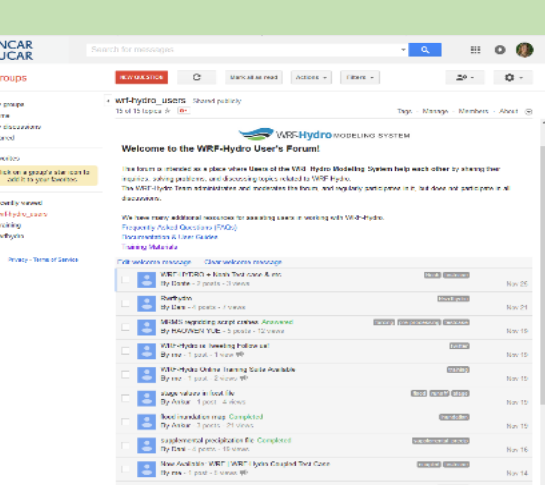
https://ral.ucar.edu/projects/wrf_hydro/training-materials



User's Forum

This forum has been set up as a place where Users of the WRF-Hydro[®] Modeling System help each other by sharing their inquiries, solving problems, and discussing topics related to WRF-Hydro

https://groups.google.com/a/ucar.edu/forum/#!/forum/wrf-hydro_users.



News

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Community Spotlight

Highlighting Users, their research, and their contribution to the WRF-Hydro[®] Community. Submit to showcase your research, collaborations, and contributions: https://ral.ucar.edu/projects/wrf_hydro/contact

Documentation in Español

Supporting technical documentation and user guides have been translated into Español to better engage and assist our Spanish speaking users and countries around the world. https://ral.ucar.edu/projects/wrf_hydro/technical-description-user-guide

GitHub Repository

WRF-Hydro[®] source code is now publicly available through a GitHub repository. Users can log issues regarding bugs and also contribute.

https://github.com/NCAR/wrf_hydro_nwm_public