

Community Training, Resources, & Support

for the **WRF-Hydro®** Modeling System and
its Configuration as the **National Water Model**



Webinar: 12 November 2019 10:00am MT

Presented by:
NCAR & CUAHSI

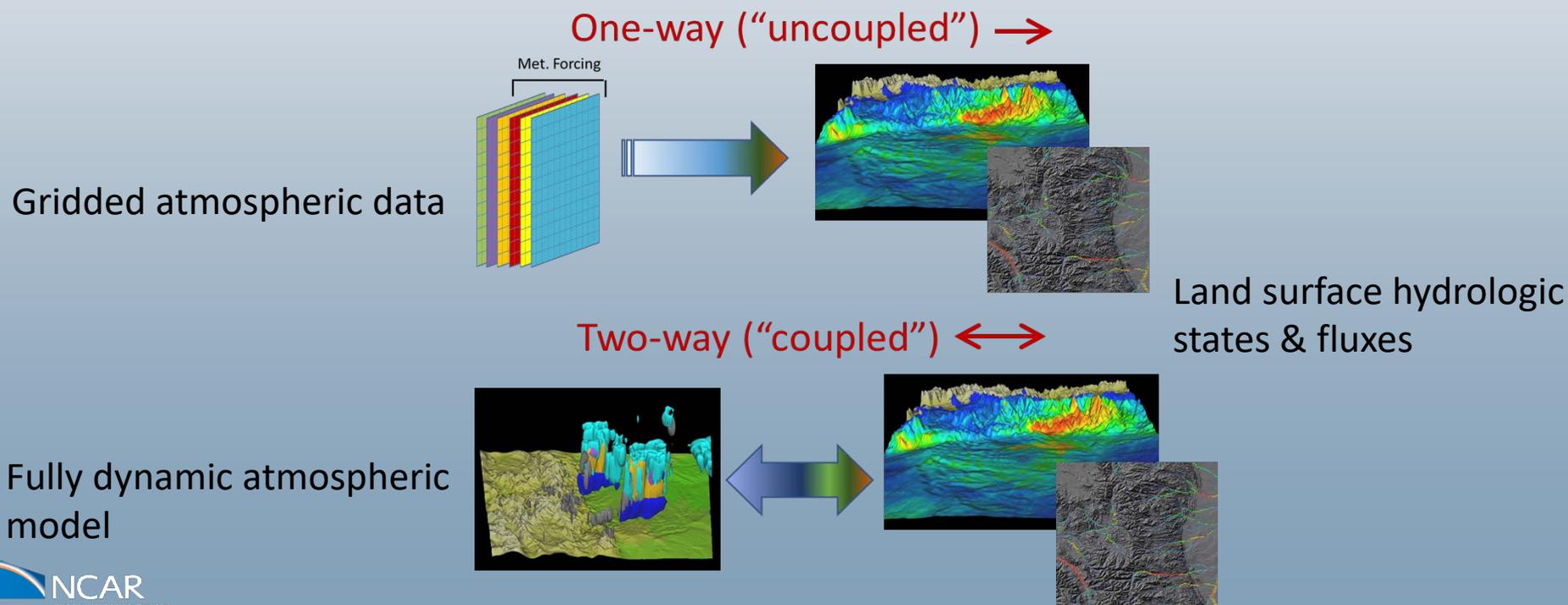


- Provide an listing of community user resources for WRF-Hydro and its configuration as the NWM
- Singular reference for code, data processing tools, training materials, user support mechanisms
- Highlight different development and use applications by user community around the world

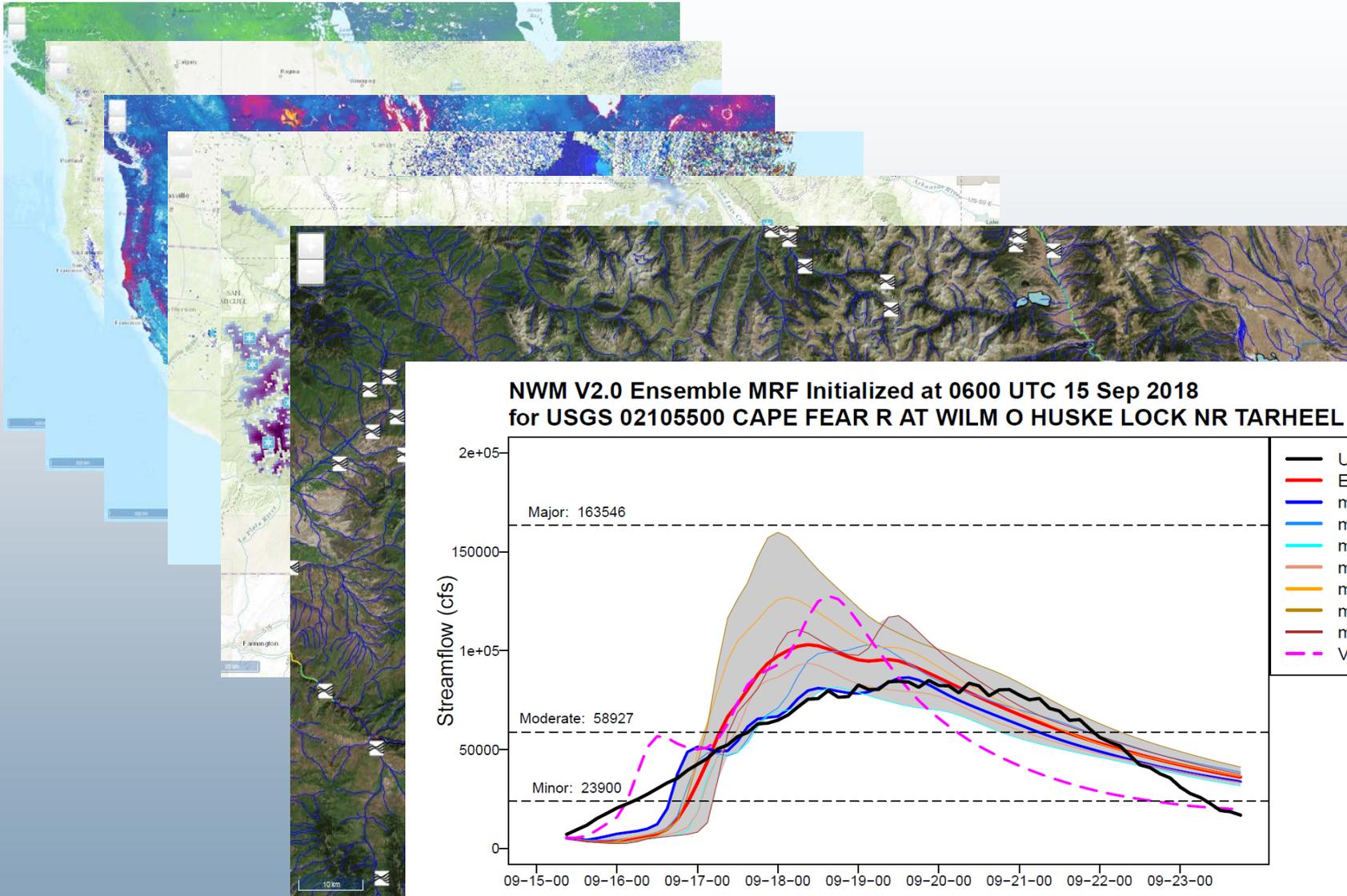


WRF-Hydro Model Overview

- WRF-Hydro began in 2003 (as ‘Noah-distributed’)
 - Originally: Hydrologically-enhanced land surface model used for land surface initialization of weather and climate prediction models
 - Evolved: Multi-scale representation of terrain and channel routing physics and multi-physics land surface thermodynamics
- Able to run with prescribed meteorological data (‘one-way’) or in a ‘two-way’ coupled mode with an atmospheric model



Model Outputs: Examples from the NWM

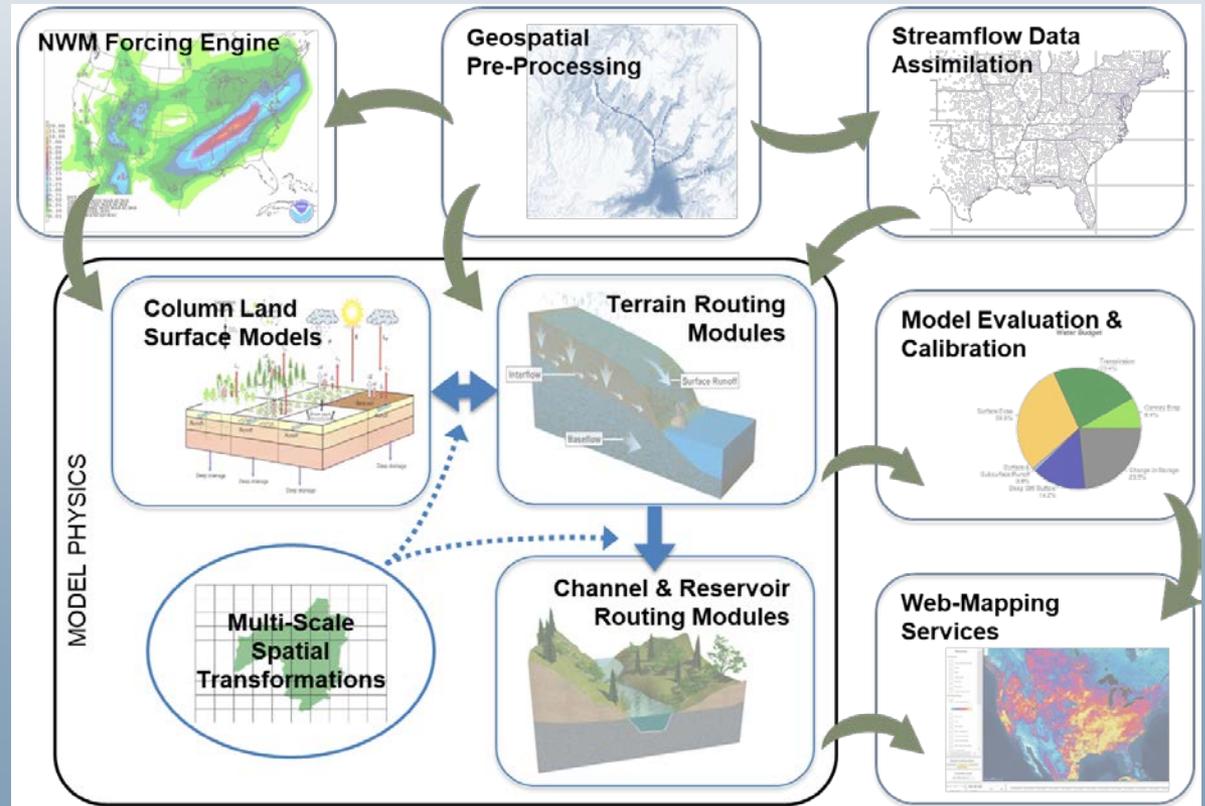




WRF-Hydro Model Overview

- The National Water Model configuration of WRF-Hydro began operations in Aug. 2016 by NOAA NWS/OWP
- NWM configuration contains a set of physics options, model element/resolution selections and data processing algorithms *tailored for operational hydrologic prediction for the CONUS*

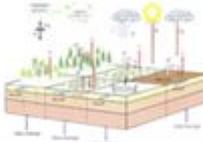
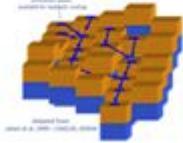
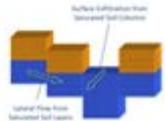
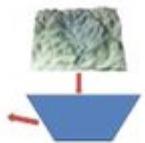
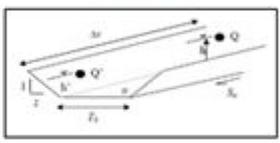
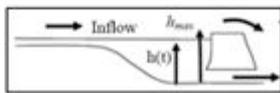
WRF-Hydro Model
'Ecosystem'





Model Overview

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, RAPID, Custom-network Muskingum Muskingum-Cunge	Custom-network (NHDPlus) Muskingum-Cunge model
Lake/Reservoir Management	 1 Lake routing scheme: Level-pool management	Level-pool management



Model Resources

https://ral.ucar.edu/projects/wrf_hydro

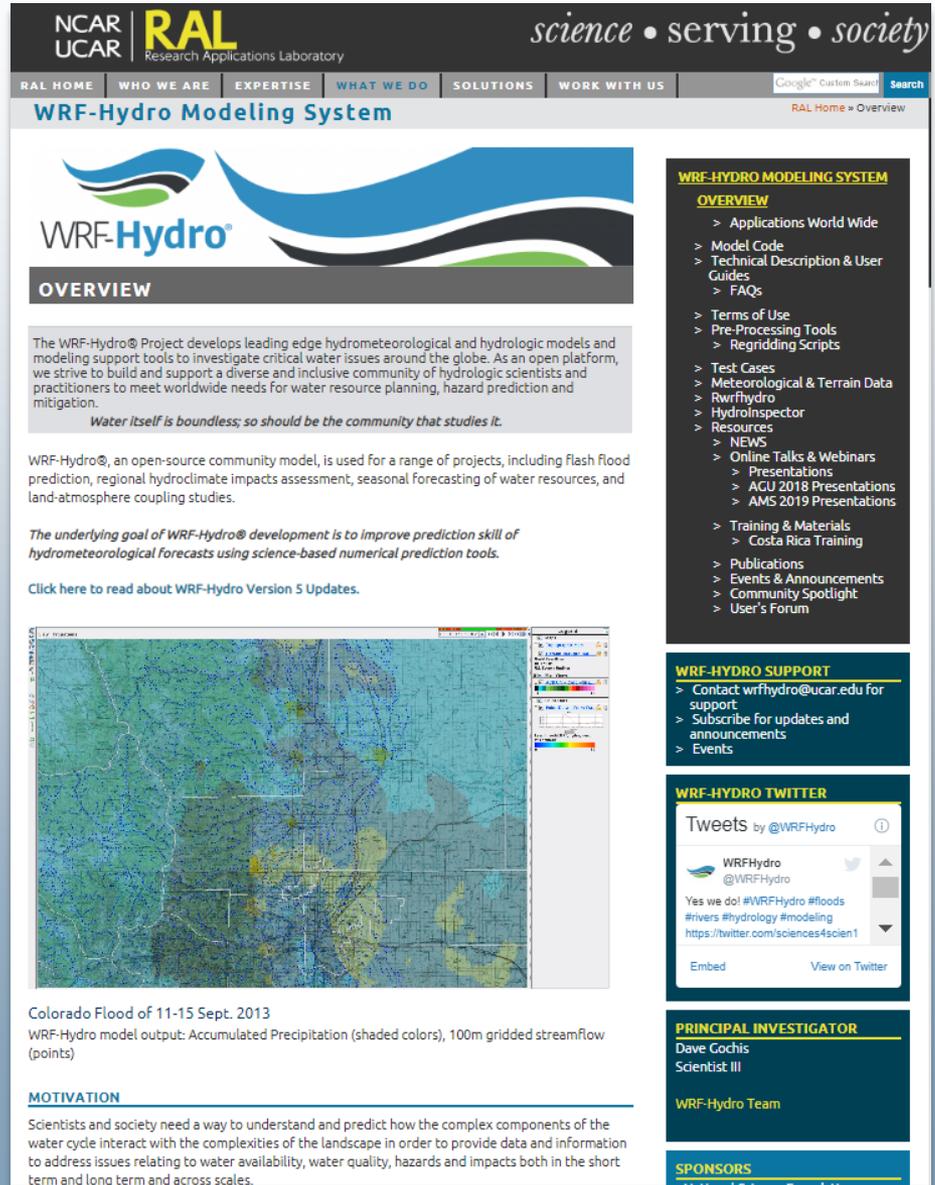
https://ral.ucar.edu/projects/wrf_hydro

One point of information
for all things WRF-Hydro®

179,843 page views by
52 countries

Provides Access to:

- Model code (via GitHub, packaged releases & Docker containers)
- Processing Tools
- Support & Training Materials
- Presentations
- Publications
- Events
- Community Profiles



The screenshot shows the website for the WRF-Hydro Modeling System. At the top, it features the NCAR UCAR logo and the RAL Research Applications Laboratory logo, along with the tagline "science • serving • society". The navigation menu includes "RAL HOME", "WHO WE ARE", "EXPERTISE", "WHAT WE DO", "SOLUTIONS", and "WORK WITH US". A search bar is located in the top right corner.

The main heading is "WRF-Hydro Modeling System". Below this is a large graphic with the WRF-Hydro logo and a stylized blue and green wave. Underneath the graphic is an "OVERVIEW" section. The text in the overview states: "The WRF-Hydro® Project develops leading edge hydrometeorological and hydrologic models and modeling support tools to investigate critical water issues around the globe. As an open platform, we strive to build and support a diverse and inclusive community of hydrologic scientists and practitioners to meet worldwide needs for water resource planning, hazard prediction and mitigation." Below this is a quote: "Water itself is boundless; so should be the community that studies it."

Further down, it says: "WRF-Hydro®, an open-source community model, is used for a range of projects, including flash flood prediction, regional hydroclimate impacts assessment, seasonal forecasting of water resources, and land-atmosphere coupling studies." Below that is another quote: "The underlying goal of WRF-Hydro® development is to improve prediction skill of hydrometeorological forecasts using science-based numerical prediction tools." A link is provided: "Click here to read about WRF-Hydro Version 5 Updates."

The central part of the page features a map of Colorado showing accumulated precipitation (shaded colors) and 100m gridded streamflow (points) for the Colorado Flood of 11-15 Sept. 2013. The map is titled "Colorado Flood of 11-15 Sept. 2013" and "WRF-Hydro model output: Accumulated Precipitation (shaded colors), 100m gridded streamflow (points)".

Below the map is a "MOTIVATION" section. The text reads: "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 scales."

On the right side of the page, there are several sidebar sections:

- WRF-HYDRO MODELING SYSTEM OVERVIEW**
 - > Applications World Wide
 - > Model Code
 - > Technical Description & User Guides
 - > FAQs
 - > Terms of Use
 - > Pre-Processing Tools
 - > Regridding Scripts
 - > Test Cases
 - > Meteorological & Terrain Data
 - > Rwrhydro
 - > HydroInspector
 - > Resources
 - > NEWS
 - > Online Talks & Webinars
 - > Presentations
 - > ACU 2018 Presentations
 - > AMS 2019 Presentations
 - > Training & Materials
 - > Costa Rica Training
 - > Publications
 - > Events & Announcements
 - > Community Spotlight
 - > User's Forum
- WRF-HYDRO SUPPORT**
 - > Contact wrfhydro@ucar.edu for support
 - > Subscribe for updates and announcements
 - > Events
- WRF-HYDRO TWITTER**

Tweets by @WRFHydro

WRFHydro @WRFHydro

Yes we do! #WRFHydro #floods #rivers #hydrology #modeling https://twitter.com/sciences4scien1

Embed View on Twitter
- PRINCIPAL INVESTIGATOR**

Dave Cochis
Scientist III

WRF-Hydro Team
- SPONSORS**

https://ral.ucar.edu/projects/wrf_hydro/model-code

MODEL CODE

WRF-HYDRO® CURRENT RELEASE

Users must build the code (i.e. executable files) on their own machines. Please refer to the *Technical Description & User Guides* for support on how to build the stand-alone WRF-Hydro® and fully-coupled WRF/WRF-Hydro® executables.

Terms of Use License Agreement

[Link to Model Code Development GitHub Repository](#)

As of June 2018 active development of the WRF-Hydro source code occurs in a public Github repository. The public repository provides an account of modern software development practices including but not limited to: versioning, issues, bug fixes, tags, testing, and guidelines for community contribution.

Version	Download	Date
5.0.3	WRF-Hydro® v5.0.3 Release Notes WRF-Hydro® v5.0.3 (Use the Technical Description for v5.0)	October 2018
5.0	WRF-Hydro® v5.0.0 Source Code DOI: 10.5065/D6J38RBJ Release Notes WRF-Hydro v5.0 Technical Description	May 2018

[Click here to read about WRF-Hydro® V5 Updates from V3.](#)

Citation for Versions 5.0 & 5.0.3

Until further notice please cite the *WRF-Hydro® Modeling System Version 5 and 5.0.3* as follows

Gochis, D.J., M. Barlage, A. Dugger, K. FitzGerald, L. Karsten, M. McAllister, J. McCreight, J. Mills, A. RaifeeiNasab, L. Read, K. Sampson, D. Yates, W. Yu, (2018). The WRF-Hydro® modeling system technical description, (Version 5.0.x). NCAR Technical Note. 107 pages. Available online at <https://ral.ucar.edu/sites/default/files/public/WRF-HydroV5TechnicalDesc...> Source Code DOI:10.5065/D6J38RBJ

Contribution Guidelines

WRF-Hydro model source code is open for contribution. See our [Contribution Guidelines](#).

PAST RELEASES

We recommend using the most current version. Support is no longer provided for past versions.

Version	Download	Date
3.0	WRF_Hydro®_v3.0.tar.gz v3.0 Change Log Technical Description & User Guide Source Code DOI: https://doi.org/10.5065/D6DN43TQ	2015
2.0.1	WRF_Hydro®_v2.0.1.tar.gz v2.0.1 major changes	
2.0	WRF_Hydro®_v2.0.tar.gz	
1.0	WRF_Hydro®_v1.0_update.tar.gz Technical Description & User Guide	2013

Publicly available since 2009

~2,000+ Downloads/Clones per Release (annually)

Public GitHub Repository:

https://github.com/NCAR/wrf_hydro_nwm_public/releases



Resources: Model Code Development

https://github.com/NCAR/wrf_hydro_nwm_public/

NCAR / wrf_hydro_nwm_public

Code Issues 69 Pull requests 7 Projects 0 Wiki Security Pulse Community

Releases Tags

Pre-release

v5.1.1-beta
0485e89
Verified

WRF-Hydro v5.1.1-beta

kafitzgerald released this on Jun 3 · 8 commits to v5.1.1 since this release

This is a beta release of WRF-Hydro v5.1.1 to support the upcoming training.

Assets 4

croton_NY_example_testcase.tar.gz	61.9 MB
front_range_CO_example_testcase_coupled.tar.gz	70.2 MB
Source code (zip)	
Source code (tar.gz)	

on Mar 21

v5.1.0-beta2

778cb96 zip tar.gz

on Nov 21, 2018

nwm-v2.0-beta1

6fe9fa3 zip tar.gz

on Nov 19, 2018

nwm-v1.2

fc6f4f9 zip tar.gz

Latest release

v5.0.3
7fcef3b

WRF-Hydro v5.0.3

kafitzgerald released this on Oct 22, 2018 · 4 commits to bugfix-5.0.x since this release

- Public Github repository since June 2018 (migrated from internal svn repo)
- Complete & open view of active development
- Contribution guidelines mark-down document
- Code of conduct

https://ral.ucar.edu/projects/wrf_hydro/technical-description-user-guide

TECHNICAL DESCRIPTION & USER GUIDES

The **WRF-Hydro V5 Technical Description** describes the WRF-Hydro model architecture and physics options, released in May 2018. Please send feedback to wrfhydro@ucar.edu

Citation: Until further notice please cite the WRF-Hydro Modeling System V5 as follows

Gochis, D.J., M. Barlage, A. Dugger, K. FitzGerald, L. Karsten, M. McAllister, J. McCreight, J. Mills, A. RafieeiNasab, L. Read, K. Sampson, D. Yates, W. Yu, (2018). The WRF-Hydro modeling system technical description, (Version 5.0). NCAR Technical Note. 107 pages. Available online at <https://ral.ucar.edu/sites/default/files/public/WRF-HydroV5TechnicalDesc...> Source Code DOI:10.5065/D6J38RBJ

Most documents listed in the table below can be viewed in a web browser or a PDF reader and have interactive tables of contents and bookmark navigation.

WRF-Hydro V5.0.x Documentation
WRF-Hydro V5 Technical Description
How To Build & Run WRF-Hydro in Standalone Mode
How To Build & Run WRF-Hydro V5 Coupled to WRF
Noah namelist.hrlidas file with description of options for use with V5
Noah-MP namelist.hrlidas file with description of options for use with V5
Noah-MP namelist Options Indicators of usage with WRFHydro v5/NWM
WRF-Hydro V5.0 hydro.namelist file with description of options
WRF-Hydro V5.0 Output Variable Matrix
WRF-Hydro V5 Standalone Test Case User Guide
Coupled WRF WRF-Hydro V5 Test Case User Guide
Using Restart Files in WRF-Hydro Simulations
Documentación WRF-Hydro V5.0 en Español
Descripción técnica del Sistema de modelado WRF-Hydro de NCAR
Cómo compilar y ejecutar WRF-Hydro V5 en modo autónomo
Guía del usuario de casos de prueba de WRF-Hydro V5
Matriz de variables de salida de WRF-Hydro V5
WRF-Hydro V3.0 Documentation
WRF-Hydro V3 Technical Description & User Guide
NoahMP namelist.hrlidas with a Description of OptionsFor use with V3
V3 Input Variables
V3 Output Variables

Spanish Docs
Released in
2018

FAQ Page
viewed 2,515
times in 2
years

FAQS

FREQUENTLY ASKED QUESTIONS

What is new in Version 5?	+
How should I cite versions of WRF-Hydro?	+
What are the software installation requirements?	+
Do you have an example installation set up?	+
Where should I start? & Best Practices	-
<ol style="list-style-type: none"> 1. We suggest you begin by downloading the model code and follow the Technical Description and User Guides. 2. Build the model and run a provided Test Case with 'idealized' forcing to assure that your set up is correct. The test case packages provide all the needed input data required for running the model over a small to moderate domain. 3. Then run the test case with one of the configurations available and compare your model output with the output files provided. 4. Next create customized geographical inputs and forcing data 5. Run the model with your customized geographical inputs, the land surface model only, and idealized forcing 6. Run the model with your customized geographical inputs, the land surface model only, and your forcing data 7. Run the model with your customized geographical inputs, your forcing data, and minimal routing physics. Turn physics options on one at a time starting with 1. Sfc/subsfc 2. CW/baseflow 3. Channel flow 4. Reservoirs 8. Once you finalize your configuration you can then move on to a full model simulation. 	
What is the workflow for creating inputs to work with WRF-Hydro in standalone mode?	+
Can I use my Version 3 inputs with Version 5 code?	+
Why NoahMP vs. Noah?	+
How can I report a bug or contribute to the model code?	+
What is the configuration of the National Water Model?	+
Where can I find NWM v1.2 Retrospective Data?	+
Which NWM Data are available through Amazon Web Services?	+
Why am I getting a "NETCDF path is not defined" error message upon set up?	+



Resources: Tools & Test Cases

https://ral.ucar.edu/projects/wrf_hydro/pre-processing-tools

https://ral.ucar.edu/projects/wrf_hydro/testcases

PRE-PROCESSING TOOLS

PRE-PROCESSING UTILITY SCRIPTS

Note Below are utility scripts that are useful in pre-processing data for input into WRF-Hydro.

- **create_wrfinput.R**: An R script to create a very basic WRF-Hydro initialization file (wrfinput) from a WRF geogrid file and a set of user-specified conditions. The script produces fields of spatially uniform initial model states of soil moisture, soil temperature, soil liquid water content and skin temperature among a few other variables necessary for model cold-start initialization. The script uses NCO commands to create this file. **This file can be used as a 'cold start' for long-term model spin-up or users can overwrite the fields in the file created.** Please refer to the script header for specific use information. Sophisticated and WRF-savvy users can bypass this script and use the WRF utility REAL.EXE to create a wrfinput file from model or reanalysis products. **Note:** This script does not currently work with the Noah LSM. This script works with both WRF-Hydro V3 and V5.0.x.
- **create_soilproperties.r** (for use with v5.0.x model code): An R script developed for the purpose of creating **OPTIONAL** spatially distributed soil and vegetation parameter files for Noah-MP and WRF-Hydro Version 5.0. These are read from the provided parameter tables (e.g., MPTABLE.TBL, HYDRO.TBL, etc.) and mapped to the appropriate soil or vegetation class map to create the 2D and 3D fields. These default parameter values can now be manipulated in 2 and 3 dimensions (e.g., via model calibration). After creating this file, use the compile option "SPATIAL_SOIL=1" to activate it, and specify the file in the namelist.hydro. If the spatial soil option is turned off, the code will default to using the traditional TBL files and this file is not required. Please refer to the script header for specific use information.
- **create_SoilProperties.R** (for use with upcoming v5.1 model code): An R script developed for the purpose of creating **OPTIONAL** spatially distributed soil and vegetation parameter files for Noah-MP and WRF-Hydro Version 5.0. These are read from the provided parameter tables (e.g., MPTABLE.TBL, HYDRO.TBL, etc.) and mapped to the appropriate soil or vegetation class map to create the 2D and 3D fields. These default parameter values can now be manipulated in 2 and 3 dimensions (e.g., via model calibration). After creating this file, use the compile option "SPATIAL_SOIL=1" to activate it, and specify the file in the namelist.hydro. If the spatial soil option is turned off, the code will default to using the traditional TBL files and this file is not required. Please refer to the script header for specific use information. **Note:** MPTABLE.TBL files from versions of WRF-Hydro 5.0.x and earlier will likely break the script. Get an updated MPTABLE.TBL file here. However, the new output files should work with both versions of the model code.
- **convert_LAKEPARAM_to_V5.sh**: The v5.0 release version of the WRF-Hydro model code has modifications to several variable names in the LAKEPARAM.nc file. This shell script will update these variables from an older (pre v5.0) version of the LAKEPARAM.nc file.

ARC-GIS TOOLS FOR PREPARING WRF-HYDRO ROUTING GRIDS

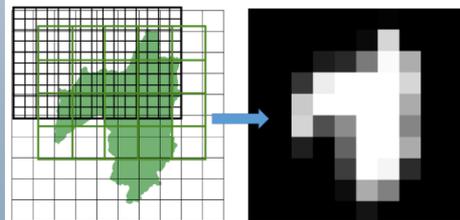
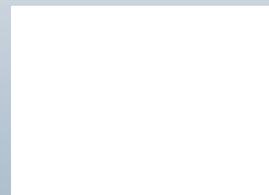
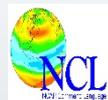
To help WRF-Hydro users create surface input data for WRF-Hydro we have created a set of tools. Presently these tools consist of scripts for use with the ArcGIS Geographical Information System. This is a stand-alone set of scripts which ArcGIS users can install and run locally on their own systems. ArcGIS is a commercial software product available from ESRI.

The purpose of the WRF Hydro GIS Pre-Processing Toolkit is to create the data layers for terrestrial overland flow, subsurface flow and channel routing processes required by WRF Hydro. The outputs from these tools are geospatial and tabular data layers for use with WRF-Hydro model code V5.1.x. This processing workflow for creating WRF-Hydro routing grids is available to users as an ArcGIS Python Toolbox.

Note WRF-Hydro GIS Pre-processing Toolkit v5.1 (1.79MB) for use with ArcGIS v10.3.1-10.7 and ArcGIS Pro 2.3. Updates in this version include the ability to put forecast points on a vector network. The output from this version are backwards compatible with WRF-Hydro model code back to v5.0.

- WRF-Hydro_GIS_Pre-processing Toolkit_v5.1.pdf Documentation
- WRF-Hydro GIS Pre-processing Toolkit Github Repository

The input files created by this toolkit should not be deemed as definitive and accurate for every application. Preparation of hydrologic network data (such as channel networks and station data) is inherently an iterative process fraught with geospatial data uncertainties. Therefore we encourage users to closely examine the outputs from the tools provided here and make their own necessary adjustments.



TEST CASES

Example Test Cases include prepared geospatial data, input files, configured namelists, and forcing data for sample regions (domains). They can be used to test your model build as well as to explore model configurations.

Version 5.0.3 Test Cases

WRF-Hydro V5 Test Case User Guide



Croton New York Test Case (for use with v 5.0.3): This example test case includes a small region (15km by 16km) encompassing the West Branch of the Croton River, NY, USA (USGS stream gage 0137462010) during hurricane Irene, 2011-08-26 to 2011-09-02. The simulation begins with a restart from a spinup period from 2010-10-01 to 2011-08-26. There are 3 basic routing configurations included in the test case, National Water Model (NWM), Gridded, and NCAR Reach.

Coupled WRF|WRF-Hydro V5 Test Case User Guide

Colorado Front Range Coupled Test Case (for use with v5.0.3): This is a test case for the coupled WRF | WRF-Hydro modeling system. It includes prepared namelists for all model components, domain and parameter files generated from the WRF-Hydro GIS preprocessing tools, and data to be used as initial and boundary conditions for the simulations period. This test case was developed with the intent for it to be able to be run on relatively small (e.g. desktop) systems for instructional purposes and used as a tool to ensure that the coupled modeling system is functioning properly. In this test case, two nested model domains (with hydro components operating on the inner domain) extend over a portion of the Colorado Front Range influenced by a large flood event in 2013. Initial and boundary conditions for the simulation are prescribed from the NAM forecast. Users should be aware that modifications have been made to the model configuration and initial conditions in order to produce a hydrologic response over a relatively small geographic domain and period of interest. Therefore namelists should not be referenced as an example of best practices for domain configuration and model physics selection. Likewise, the simulation results should not be evaluated as a real simulation.

Version 3.0 Test Cases

Support is limited for version 3 example test cases.

Boulder Creek Test Case: Example test case for a single small watershed (Boulder Creek, Colorado) using idealized forcing in standalone mode. This test case shows examples of the Noah and NoahMP LSMs driven by idealized forcing (FORC_TYP = 4). No external forcing datasets are provided or required for this test case.

Front Range Test Case: Example test case for stand-alone/uncoupled WRF-Hydro run with either the Noah or NoahMP land surface models. This test case covers the Colorado Front Range region. The Noah and NoahMP LSMs are configured on a dx=1km grid and the routing grid is configured with dx=100m. Input forcing data for this WRF-Hydro run is provided in both standard, preprocessed input format (i.e. 'LDASIN' files - FORC_TYP = 1) or in native (unmanipulated) wrf model output (i.e. 'wrfout' files - FORC_TYP = 3) in netcdf format. [Note that the time window of the different forcing data is different so users need to edit the namelists to reflect those different run times.] Users should consult the Version 3 Technical Description and User Guide for more specific descriptions of

Standalone Testcase – Gridded, NWM
Coupled Testcase - Gridded



Resources: NWM Configuration

<https://ral.ucar.edu/projects/supporting-the-noaa-national-water-model>

NCAR UCAR | **RAL** Research Applications Laboratory *science • serving • society*

RAL HOME | WHO WE ARE | EXPERTISE | WHAT WE DO | SOLUTIONS | WORK WITH US |

RAL Home » Project List » Supporting the NOAA National Water Model

SUPPORTING THE NOAA NATIONAL WATER MODEL



STREAMFLOW PREDICTION PROJECTS

- SUPPORTING THE NOAA NATIONAL WATER MODEL

CONTACT

David Cochis
Scientist III
dcochis@ucar.edu
303-497-2809

Overview | **Resources**

CONTACT

For user questions about working with the National Water Model and the WRF-Hydro® Modeling System please use our [contact form](#).

INFORMATION & DOCUMENTATION

Information about the National Water Model can be found from the NOAA Office of Water Prediction website <https://water.noaa.gov/about/nwm>

Documentation for the National Water Model configuration of the WRF-Hydro Modeling System is available from https://ral.ucar.edu/projects/wrf_hydro/technical-description-user-guide

MOTIVATION

The following talks illustrate the motivation behind the National Water Model.

- UCAR Congressional Briefing 2016: Predicting Water Resource & Hazard Risks
- Ignite NCAR 2016: NOAA's and NCAR's New National Water Model

NATIONAL WATER MODEL INPUT FILES V1.2

Below are links to input data files. As we have the resources to populate, we will post links to input files here.

- Lake & Reservoir Polygons NWM V1.2

NATIONAL WATER MODEL INPUT FILES V2.0

Below are links to input data files. As we have the resources to populate, we will post links to input files here.

- Lake & Reservoir Polygons NWM V2.0

NATIONAL WATER MODEL OUTPUT DATA AVAILABLE VIA AMAZON WEB SERVICES (AWS)

Five new datasets in the AWS Public Datasets program that are tagged for sustainability and are now available in the Registry for Open Data on AWS (<https://registry.opendata.aws/>). Those include:

- NOAA National Water Model Reanalysis (Onboarded by NOAA) <https://registry.opendata.aws/nwm-archive/>
- NOAA National Water Model Short-Range Forecast (Onboarded by NOAA) <https://registry.opendata.aws/noaa-nwm-pds/>
- NOAA Global Historical Climatology Network Daily (Onboarded by NOAA) <https://registry.opendata.aws/noaa-ghcn/>
- NOAA NDFD (National Digital Forecast Database) and NDCD (National Digital Guidance

https://ral.ucar.edu/projects/wrf_hydro/contact

WRF-HYDRO CONTACT

Name *

Email Address *

Affiliation *

Industry Sector * University Government Commerical Other

State/Province

Country *
UNITED STATES

Subject *

How can we help you? *

CAPTCHA
This question is for testing whether you are a human visitor and to prevent automated spam submissions.

I'm not a robot 

Submit

WRF-HYDRO SUPPORT

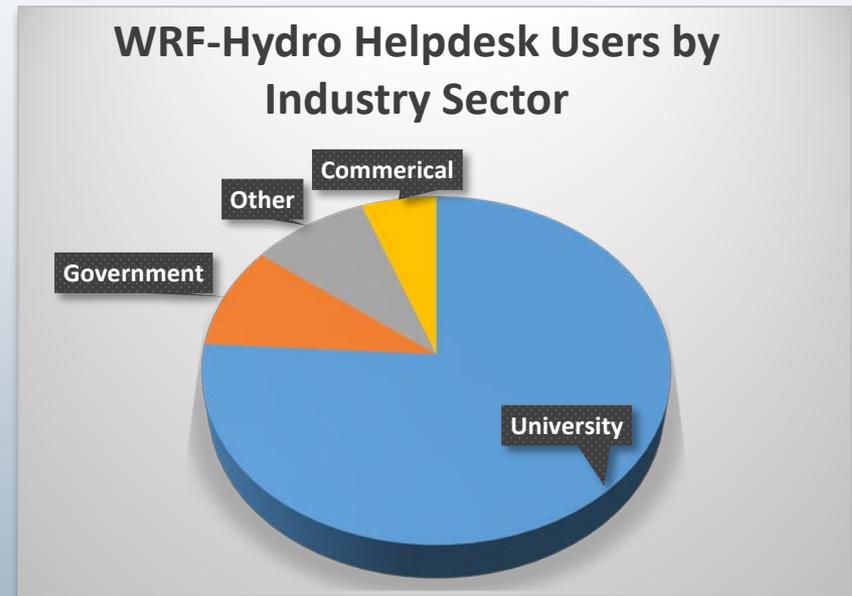
- > WRF-Hydro Modeling System
 - > Overview
 - > Applications World Wide
- > Model Code
- > Technical Description & User Guides
 - > FAQs
- > Terms of Use
- > Pre-Processing Tools
 - > Regridding Scripts
- > Test Cases
 - > Meteorological & Terrain Data
 - > Rwrhydro
 - > HydroInspector
- > Resources
 - > NEWS
 - > Online Talks & Webinars
 - > Presentations
 - > AGU 2018 Presentations
 - > AMS 2019 Presentations
 - > Training & Materials
 - > Costa Rica Training
 - > Publications
 - > Events & Announcements
 - > Community Spotlight
 - > User's Forum

WRF-HYDRO TWITTER

Tweets by @WRHydro

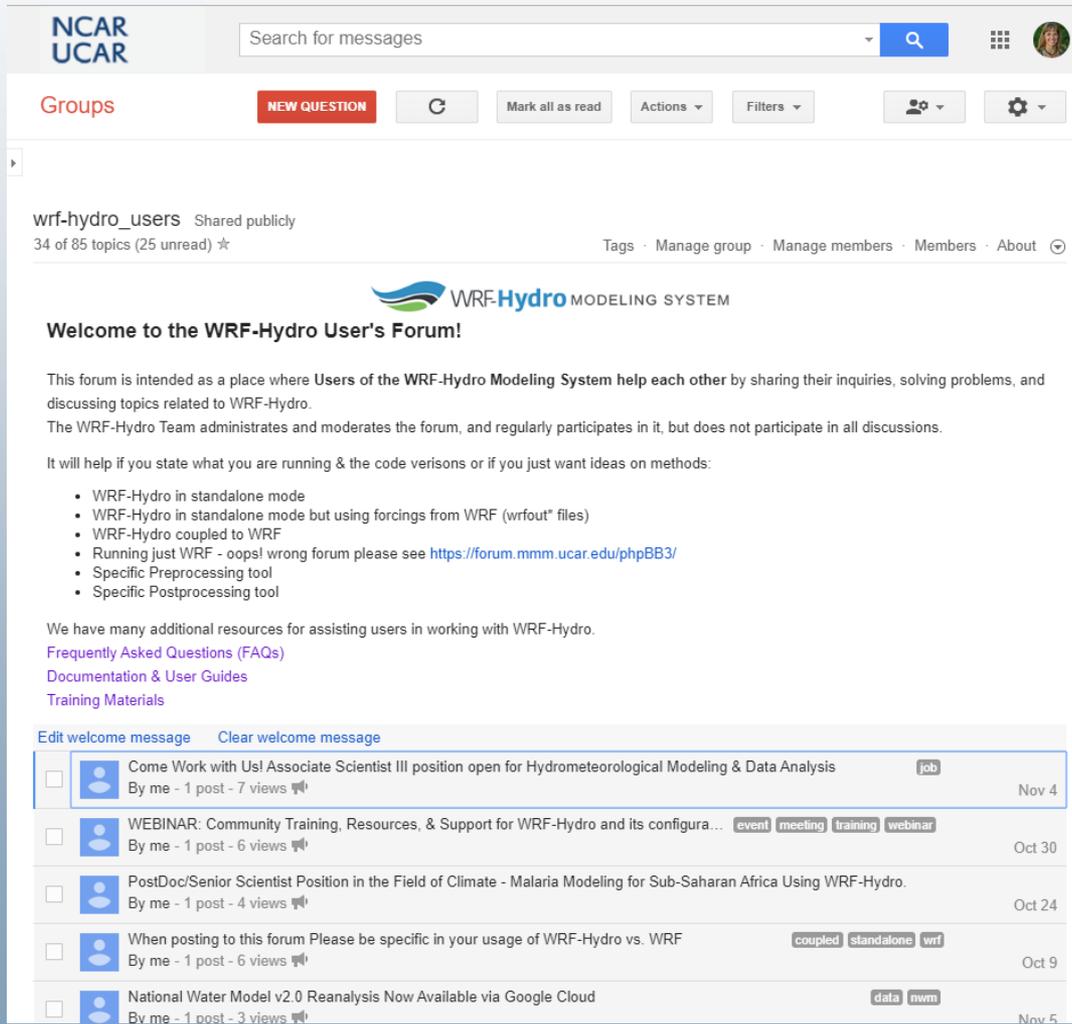
- WRFHydro Retweeted
- NCAR GIS @ncargis
- Matt Casali is talking about #wrfhydro tools in support of...

Embed View on Twitter



<http://bit.ly/wrfhydrousersforum>

Users Helping Users



The screenshot shows the NCAR UCAR forum interface. At the top, there is a search bar and navigation icons. Below that, a 'Groups' section features a 'NEW QUESTION' button and various filters. The main content area displays the 'wrf-hydro_users' group, which is shared publicly and has 34 of 85 topics (25 unread). The group's welcome message is visible, along with a list of recent posts. The posts include job openings, webinars, and technical discussions related to WRF-Hydro modeling.

NCAR UCAR Search for messages

Groups **NEW QUESTION** **Mark all as read** **Actions** **Filters**

wrf-hydro_users Shared publicly
34 of 85 topics (25 unread) ☆ [Tags](#) · [Manage group](#) · [Manage members](#) · [Members](#) · [About](#)

WRF-Hydro MODELING SYSTEM

Welcome to the WRF-Hydro User's Forum!

This forum is intended 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.

The WRF-Hydro Team administrates and moderates the forum, and regularly participates in it, but does not participate in all discussions.

It will help if you state what you are running & the code verisons or if you just want ideas on methods:

- WRF-Hydro in standalone mode
- WRF-Hydro in standalone mode but using forcings from WRF (wrfout* files)
- WRF-Hydro coupled to WRF
- Running just WRF - oops! wrong forum please see <https://forum.mmm.ucar.edu/phpBB3/>
- Specific Preprocessing tool
- Specific Postprocessing tool

We have many additional resources for assisting users in working with WRF-Hydro.

[Frequently Asked Questions \(FAQs\)](#)
[Documentation & User Guides](#)
[Training Materials](#)

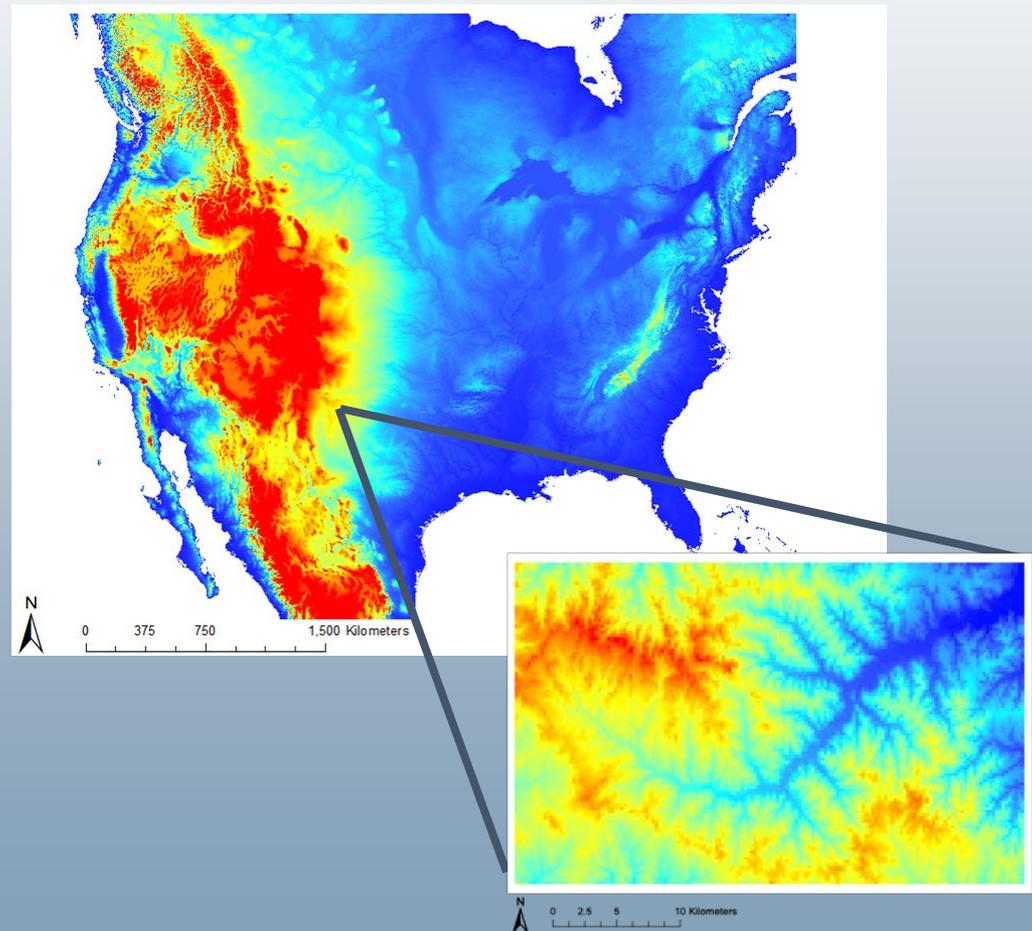
[Edit welcome message](#) [Clear welcome message](#)

<input type="checkbox"/>		Come Work with Us! Associate Scientist III position open for Hydrometeorological Modeling & Data Analysis job By me - 1 post - 7 views	Nov 4
<input type="checkbox"/>		WEBINAR: Community Training, Resources, & Support for WRF-Hydro and its configura... event meeting training webinar By me - 1 post - 6 views	Oct 30
<input type="checkbox"/>		PostDoc/Senior Scientist Position in the Field of Climate - Malaria Modeling for Sub-Saharan Africa Using WRF-Hydro. By me - 1 post - 4 views	Oct 24
<input type="checkbox"/>		When posting to this forum Please be specific in your usage of WRF-Hydro vs. WRF coupled standalone wrf By me - 1 post - 6 views	Oct 9
<input type="checkbox"/>		National Water Model v2.0 Reanalysis Now Available via Google Cloud data nwm By me - 1 post - 3 views	Nov 5

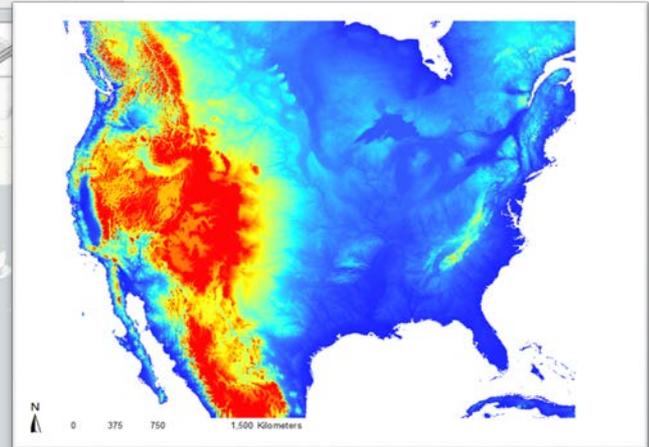
CUAHSI Subsetter

Improve community access to CONUS-scale model domains

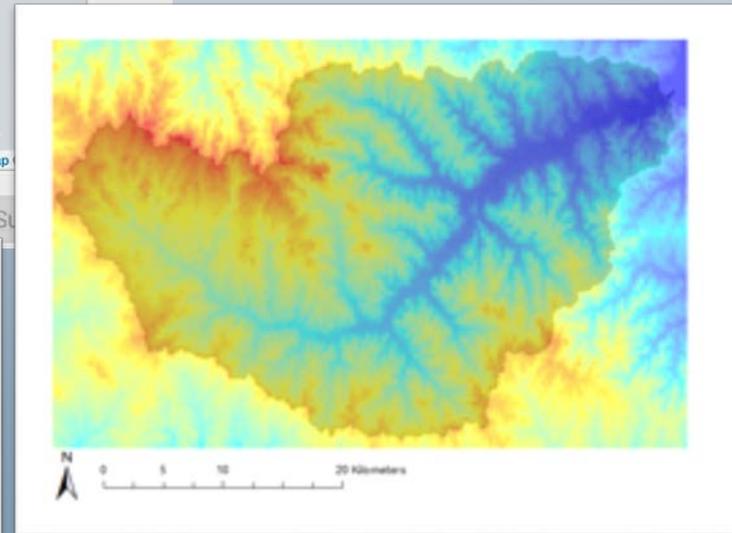
- Watershed scale data access
- Research and education
- Support multiple models



Subsetter: Web Application



(4608 km, 3840 km)
~ 30 Gb



(160 km, 104 km)
~ 70 Mb

```
/07db5e2e0045957eda4c14d44e587888a4c85db
├── Fulldom_hires.nc
├── GEOGRID_LDASOUT_Spatial_Metadata.nc
├── GWBUCKPARAM.nc
├── README.md
├── Route_Link.nc
├── geo_em.d01.nc
├── hydro2dtbl.nc
├── params.txt
├── script_forcing_subset.txt
├── soil_properties.nc
├── spatialweights.nc
├── wrfinput_d01.nc
```

<http://subset.cuahsi.org>



NWM Subsetter: Running a Simulation

- Provides static domain data
- Requires gridded FORCING data, e.g. NLDAS
- Executed using https://github.com/NCAR/wrf_hydro_nwm_public
- CUAHSI utilities and notebooks are available

```
707db5e2e0045957eda4c14d44e587888a4c85db
├── Fulldom_hires.nc
├── GEOGRID_LDASOUT_Spatial_Metadata.nc
├── GWBUCKPARAM.nc
├── README.md
├── Route_Link.nc
├── geo_em.d01.nc
├── hydro2dtbl.nc
├── params.txt
├── script_forcing_subset.txt
├── soil_properties.nc
├── spatialweights.nc
└── wrfinput_d01.nc
```

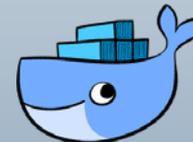
DOMAIN

```
2017120100.LDASIN_DOMAIN1
2017120101.LDASIN_DOMAIN1
2017120102.LDASIN_DOMAIN1
2017120103.LDASIN_DOMAIN1
2017120104.LDASIN_DOMAIN1
2017120105.LDASIN_DOMAIN1
2017120106.LDASIN_DOMAIN1
2017120107.LDASIN_DOMAIN1
2017120108.LDASIN_DOMAIN1
2017120109.LDASIN_DOMAIN1
2017120110.LDASIN_DOMAIN1
2017120111.LDASIN_DOMAIN1
2017120112.LDASIN_DOMAIN1
```

FORCING

```
example_run
├── CHANPARAM.TBL
├── DOMAIN
├── FORCING
├── GENPARAM.TBL
├── hydro.namelist
├── HYDRO.TBL
├── MPTABLE.TBL
├── namelist.hr
├── SOILPARAM
└── wrf_hydro
```

RUN DIR

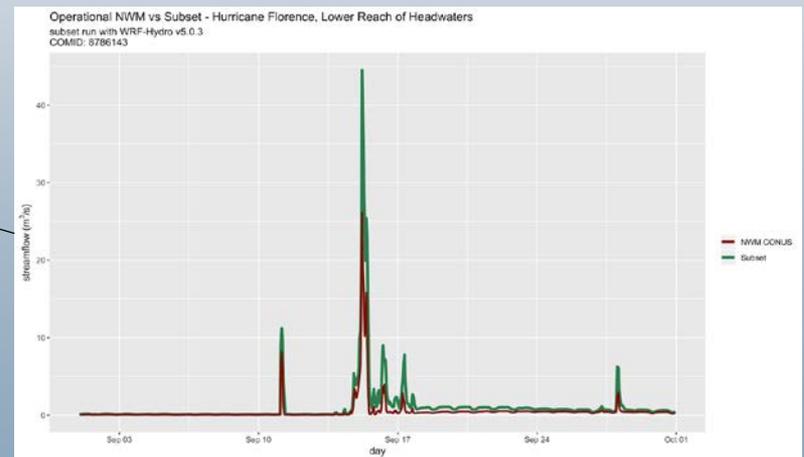
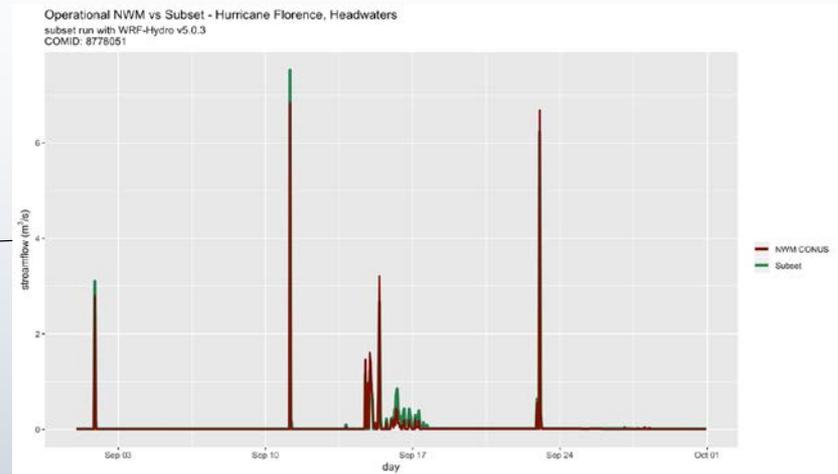
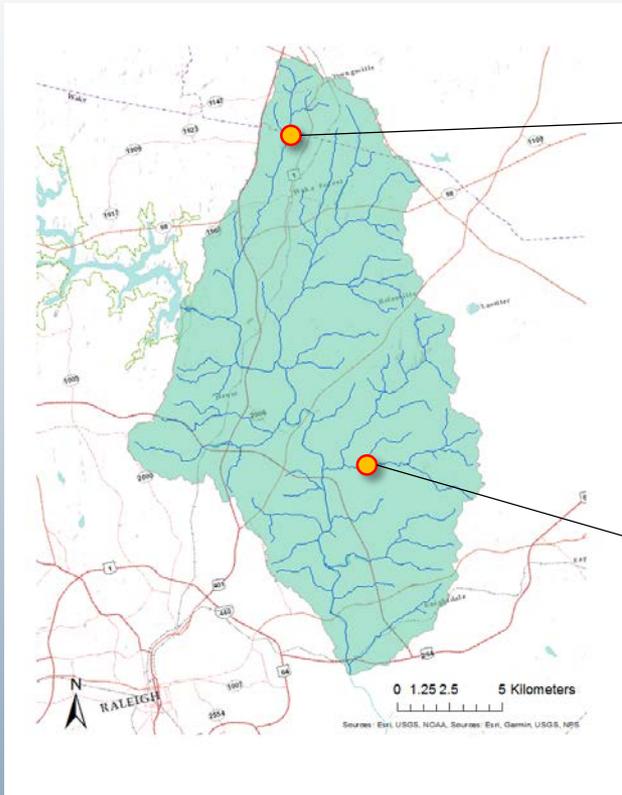


```
-----
Begin WRF-Hydro v5.0.3 Simulation
StartDate: 2018-07-01 00:00
EndDate: 2018-07-11 00:00
Docker Image: cuahsi/wrfhydro-nwm:5.0.3
-----

Running Simulation
[#-----] 7.00% - Simulation Time: 2018-07-01 17:00
```



Headwater Reaches

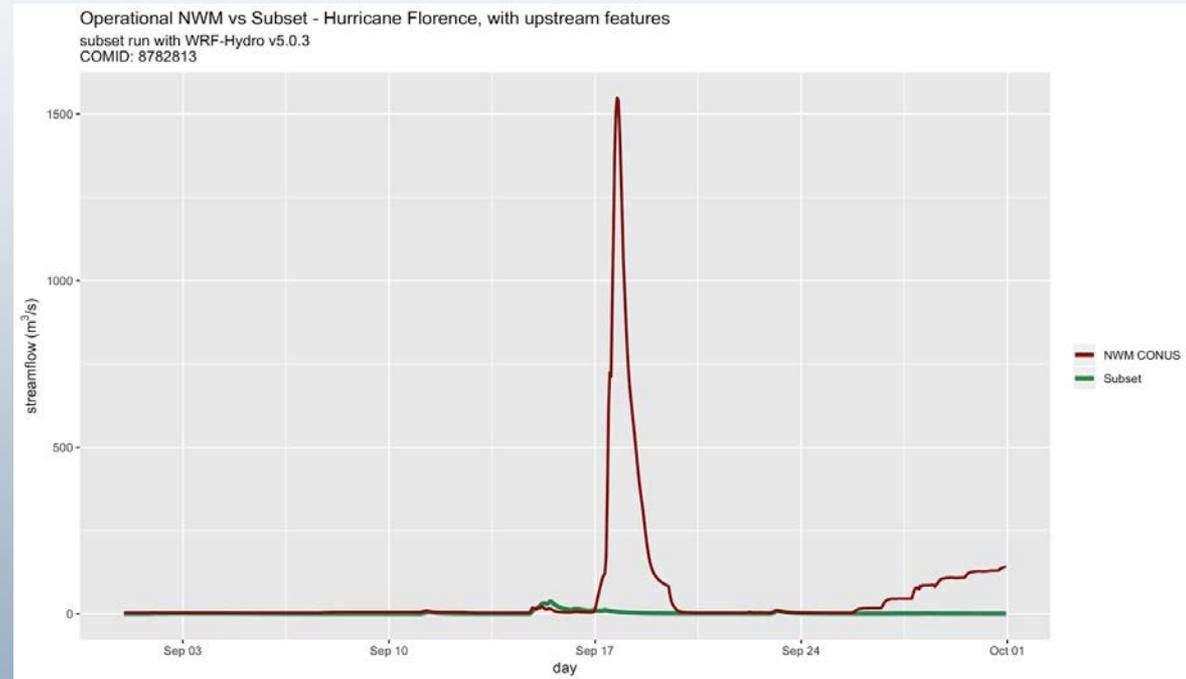
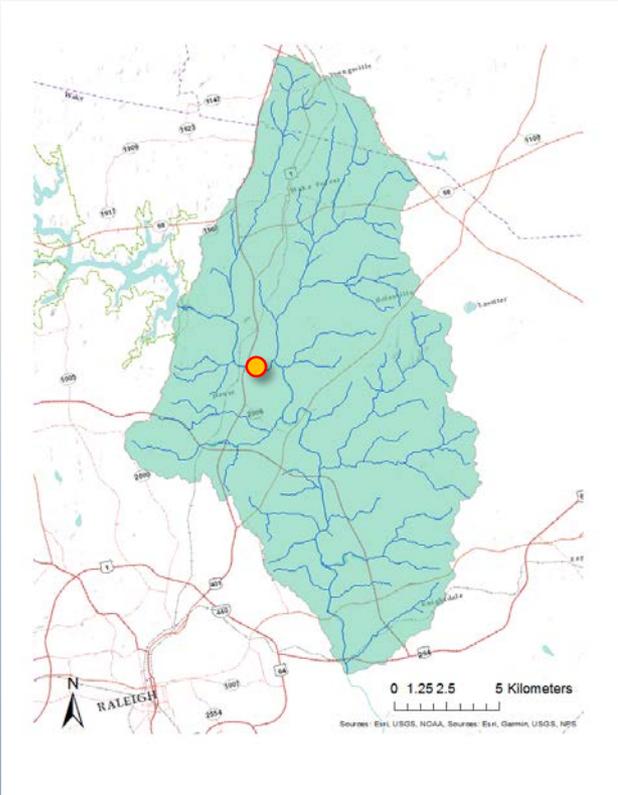


Expect differences in operational results and subset results caused by: No lakes and reservoirs*, nudging, or, restarts.

*a decision made by the NWS Office of Water Prediction



Partial Mainstem



USER BEWARE: There are NO checks to ensure that the entire upstream watershed has been subset!



NWM Subsetter: Notebook Resources

CUAHSI Domain Subsetter Workflow - NWM

Open with... →

Authors: Danielle Tijerina | Anthony Michael Castronova
Owners: Anthony Michael Castronova | Danielle Tijerina
Sharing Status: Private
Views: 30

Resource type: Composite Resource
Storage: The size of this resource is 1.5 MB
Created: Jun 18, 2019
Last updated: Jun 20, 2019
Citation: See how to cite this resource

Subsetting the National Water Model Domain

Authors: Tony Castronova acastronova@cuahsi.org
Danielle Tijerina dtijerina@cuahsi.org
Date Modified: 06/20/2019
Affiliation: CUAHSI

Abstract

The purpose of this resource is to introduce a workflow for subsetting the National Water Model (NWM) domain. This workflow introduces a set of tools and scripts that allow scientists from a diverse spectrum of disciplines to have access to the NWM domain. This work provides the following resources:

1. Objective

This notebook will walk you through the process of collecting NLDAS forcing data, regridding onto an existing WRF-Hydro domain, and running a WRF-Hydro simulation. This will include:

1. going to subset.cuahsi.org
2. selecting location of interest and requesting data
3. downloading data via `wget`
4. inspecting the content

2. Background

The purpose of this application is to introduce a workflow for sharing subsets of the National Water Model domain. The hope is that these efforts will lower the barrier to entry and engage a wide variety of scientists from a diverse spectrum of disciplines. Modern cyberinfrastructure techniques and tools allow researchers to have access to subsets of National Water Model domain computational resources. This work provides a workflow for applying to other large-scale model simulations.

3. Subsetting Exercise

```
In [ ]: # import Python libraries

import os
import wget
import glob
import shutil
import tarfile
```

Collect NLDAS Forcing Data

This notebook demonstrates the process of collecting NLDAS forcing data, regridding onto an existing WRF-Hydro domain collected in the previous notebook.

1. Objective

This notebook illustrates the process of collecting and regridding NLDAS data for a domain. This includes:

1. Subsetting NLDAS data from Earthdata.nasa.gov
2. Downloading NLDAS data
3. Regridding NLDAS using the ESMF regridding scripts

```
In [ ]: import os
import sys
import wget
import time
import glob
import shutil
import tarfile
import getpass
import urllib.parse as p
import multiprocessing as mp
from urllib.request import urlopen
from subprocess import Popen, PIPE, STDOUT, check_output, CalledProcessError
```

Make sure that the NCAR Command Language is installed. Detailed instructions are available at <https://www.cesm.ucar.edu/models/cesm1.0/nccl/>. This following cell will install `nccl` into your conda environment if it doesn't already exist.

```
In [ ]: # make sure we invoke the NCL that is installed in our conda environment
ncl_exec = os.path.join(os.path.dirname(sys.executable), 'ncl')
try:
    output = check_output([ncl_exec, '-V'])
    print('NCL is already installed :')
except Exception as e:
    !conda install -y ncl
```



Running a WRF-Hydro Simulation

This notebook demonstrates how to execute the WRF-Hydro model using the `DOMAIN` and `FORCING` data collected in the two previous notebooks. We'll be using a containerization technology called Docker to simplify this process and eliminate the need for compiling any source code.

Docker is a tool designed to make it easier to create, deploy, and run applications by using containers. Containers allow a developer to package up an application with all of the parts it needs, such as libraries and other dependencies, and ship it all out as one package. By doing so, thanks to the container, the developer can rest assured that the application will run on any other Linux machine regardless of any customized settings that machine might have that could differ from the machine used for writing and testing the code.

Please see the following link for further description of Docker:
<https://opensource.com/resources/what-docker>

Before we begin, we need to make sure that Docker is installed on your computer. If you're unsure if Docker is already installed on your computer, open a terminal and type `docker -v`. If it's installed, you should see output similar to: Docker version 18.09.2, build 6247962.

Install Docker by following the instructions at this [link](#).

```
In [ ]: # verify the docker is installed and running
!docker -v
```

Next, let's pull a precompiled version of WRF-Hydro onto our computer. This image is a slight variation from the standard NCAR WRF-Hydro image specifically designed to work with the `DOMAIN` data you prepared in the first notebook.

```
In [ ]: !docker pull cuahsi/wrfhydro-nwm:5.0.3
```

Make a directory for our simulation output.

```
In [ ]: !mkdir ./OUTPUT
```

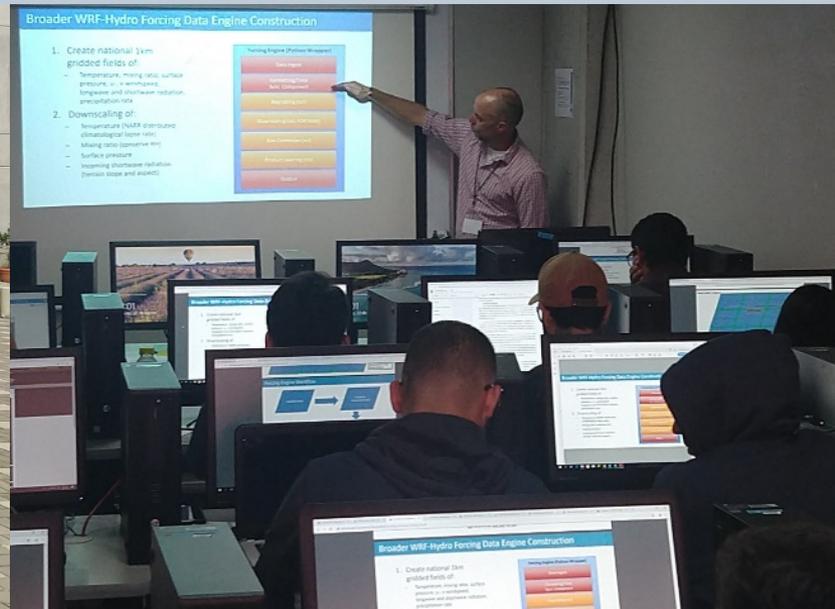




Hands-On Training: Workshops

- Taught by subject matter experts
- Provide in depth & individual support
- Face to face networking
- 2 International since 2014
- 3 NWM Federal Agency since 2017

https://ral.ucar.edu/projects/wrf_hydro/events



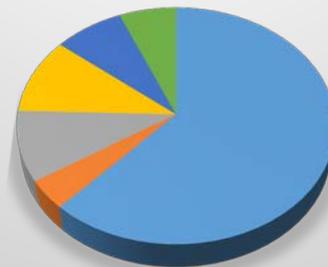


Hands-On Training: Workshops



- 7 Co-Sponsored with CUAHSI since 2015 (2 x Year)
- Application process began in 2018
- Out of 548 applicants – have served 302

**CUAHSI-NCAR Training Workshop Applicant Type
(39 Countries)**





Hands-On Training: Workshops



Next NCAR-CUAHSI Workshop:

- June 1-5, 2020
- Applications open in January
- Travel support available for graduate students

More information: cuahsi.org/education/training



Hands-on Training: Summer Institute at the National Water Center

- Partnership between CUAHSI and the National Weather Service
- Seven-week residential program at the National Water Center in Tuscaloosa, Alabama
- Eligibility: MS and PhD students enrolled in US universities
- 147 students from 77 universities have been trained on the National Water Model since 2015
- National Water Model developed from WRF-Hydro®
- Described as a “transformational educational experience”
- **Students: Apply by January 13, 2020**

cuahsi.org/education/summerinstitute



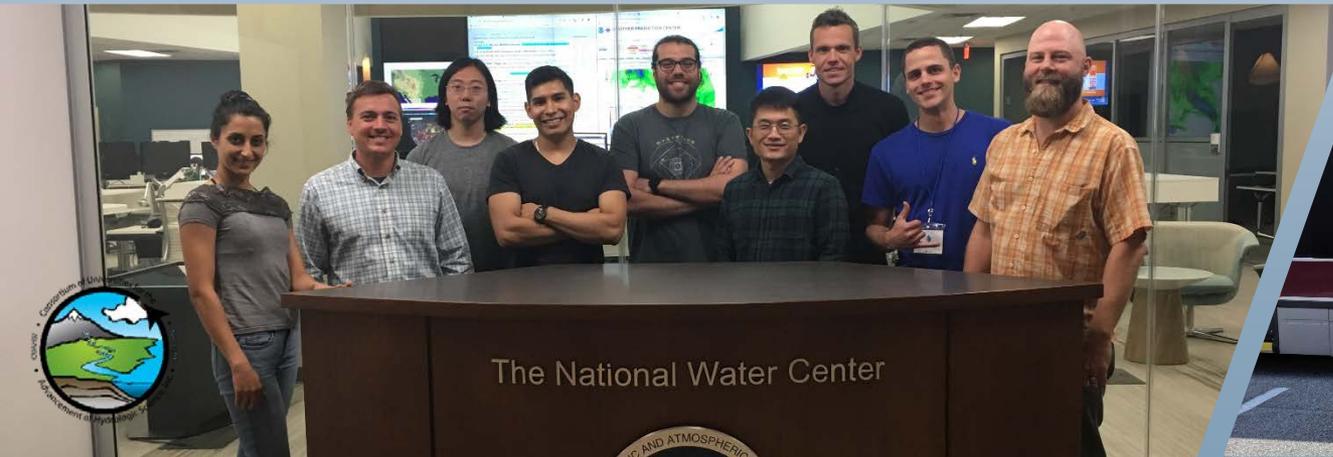


Upcoming Summer Institute Overview Webinar

Wednesday November 20th 2:00 pm EST

Fred Ogden, Visiting Senior Scientist, National Water Center, NOAA/NWS/Office of Water Prediction

Connection information: cuahsi.org/education/summerinstitute



Community: Spotlight

Highlighting Users, their research, and their contribution to the WRF-Hydro Community.



This Community Spotlight focuses on Dr. Jiali Wang and her work on the AT&T climate resiliency study for which she was the primary modeler using WRF-Hydro® and WRF.
>[Read the White Paper here](#)<

See our >[NEWS page](#)< for links to the NPR Science Friday podcast.

Dr. Jiali Wang is currently an Assistant Atmospheric Scientist in the Environmental Science Division at Argonne National Laboratory. Below is a Q&A with Dr. Wang about her background, experience on the project, and experience with using WRF-Hydro®.

What I have learned from this project is how to effectively transfer the massive dataset to much less amount yet the most important and useful information for the industry partners.

Q: What initially excited you about modeling as your chosen area of study?

A: Numerical modeling is very powerful, although it is not perfect. Using modeling can explore questions that observation data can not do. During my PhD, I investigated urbanization impact on climate (temp; precip) over mega-cities like Beijing. During my postdoc, I investigated global climate warming impact on local weather and climate extremes. For the AT&T project, we look at the global climate change impact on water cycles and wind gust and coastal flooding. Moreover, with the increased size of datasets generated by modeling, there are great opportunities to explore potentials of AI (artificial intelligence). These topics are all exciting to me.

Community: Connection



- **Social Media Outlets:**

- @WRFHydro <https://twitter.com/WRFHydro>
 - #WRFHydro
- @CUAHSI <https://twitter.com/CUAHSI>

- **User's Forum:** <http://bit.ly/wrfhydrouusersforum>

- **Email List serv:**

https://ral.ucar.edu/projects/wrf_hydro/subscribe

- **News:** https://ral.ucar.edu/projects/wrf_hydro/news

- **Community Spotlight:**

https://ral.ucar.edu/projects/wrf_hydro/communityspotlight

- **Contact Us:**

https://ral.ucar.edu/projects/wrf_hydro/contact

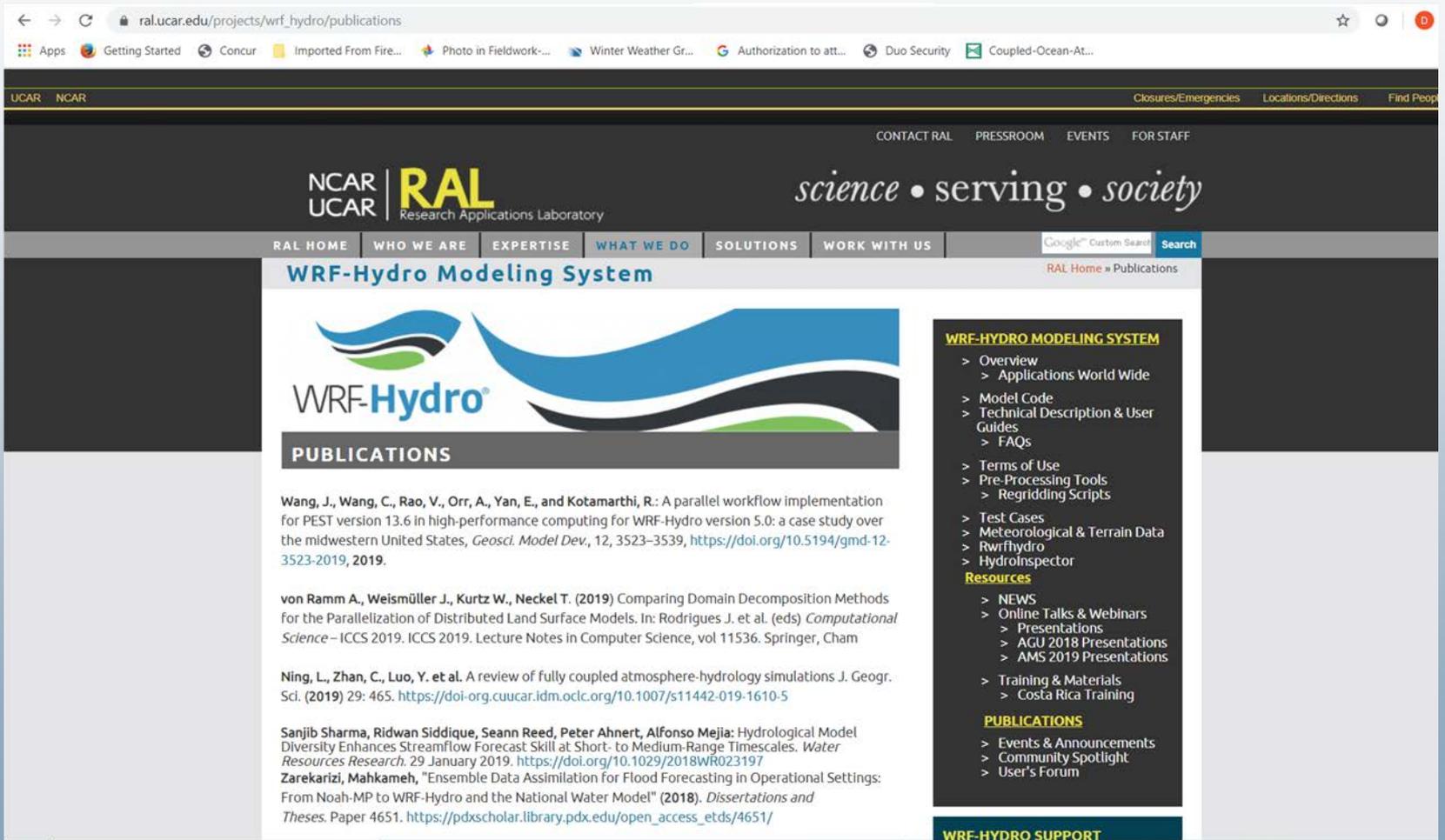
- **Events:** https://ral.ucar.edu/projects/wrf_hydro/event

- **CUAHSI:**

- Email: commgr@cuahsi.org
- Website: <https://www.cuahsi.org>

Publications

https://ral.ucar.edu/projects/wrf_hydro/publications



The screenshot shows a web browser displaying the RAL website. The address bar shows ral.ucar.edu/projects/wrf_hydro/publications. The website header includes navigation links for UCAR, NCAR, CONTACT RAL, PRESSROOM, EVENTS, and FOR STAFF. The main content area features the RAL logo and the text "science • serving • society". Below this is a navigation menu with options like RAL HOME, WHO WE ARE, EXPERTISE, WHAT WE DO, SOLUTIONS, and WORK WITH US. The main heading is "WRF-Hydro Modeling System". A large graphic of the WRF-Hydro logo is displayed. Below the logo is a "PUBLICATIONS" section with a list of articles. On the right side, there is a sidebar with a "WRF-HYDRO MODELING SYSTEM" menu containing links to Overview, Applications World Wide, Model Code, Technical Description & User Guides, FAQs, Terms of Use, Pre-Processing Tools, Regriding Scripts, Test Cases, Meteorological & Terrain Data, Rwrffhydro, and HydroInspector. Below this is a "Resources" section with links to NEWS, Online Talks & Webinars, Presentations, AGU 2018 Presentations, AMS 2019 Presentations, Training & Materials, and Costa Rica Training. At the bottom of the sidebar is a "PUBLICATIONS" section with links to Events & Announcements, Community Spotlight, and User's Forum. The footer of the page includes the NCAR logo and the text "NATIONAL CENTER FOR ENVIRONMENTAL PREDICTION RESEARCH".

UCAR NCAR

Closures/Emergencies Locations/Directions Find People

CONTACT RAL PRESSROOM EVENTS FOR STAFF

NCAR UCAR **RAL** Research Applications Laboratory

science • serving • society

RAL HOME WHO WE ARE EXPERTISE WHAT WE DO SOLUTIONS WORK WITH US

Google Custom Search Search

RAL Home » Publications

WRF-Hydro Modeling System



PUBLICATIONS

Wang, J., Wang, C., Rao, V., Orr, A., Yan, E., and Kotamarthi, R.: A parallel workflow implementation for PEST version 13.6 in high-performance computing for WRF-Hydro version 5.0: a case study over the midwestern United States, *Geosci. Model Dev.*, 12, 3523–3539, <https://doi.org/10.5194/gmd-12-3523-2019>, 2019.

von Ramm A., Weismüller J., Kurtz W., Neckel T. (2019) Comparing Domain Decomposition Methods for the Parallelization of Distributed Land Surface Models. In: Rodrigues J. et al. (eds) *Computational Science – ICCS 2019*. ICCS 2019. Lecture Notes in Computer Science, vol 11536. Springer, Cham

Ning, L., Zhan, C., Luo, Y. et al. A review of fully coupled atmosphere-hydrology simulations. *J. Geogr. Sci.* (2019) 29: 465. <https://doi-org.cuucar.idm.oclc.org/10.1007/s11442-019-1610-5>

Sanjib Sharma, Ridwan Siddique, Seann Reed, Peter Ahnert, Alfonso Mejia: Hydrological Model Diversity Enhances Streamflow Forecast Skill at Short- to Medium-Range Timescales. *Water Resources Research*. 29 January 2019. <https://doi.org/10.1029/2018WR023197>

Zarekarizi, Mahkameh, "Ensemble Data Assimilation for Flood Forecasting in Operational Settings: From Noah-MP to WRF-Hydro and the National Water Model" (2018). *Dissertations and Theses*. Paper 4651. https://pdxscholar.library.pdx.edu/open_access_etds/4651/

WRF-HYDRO MODELING SYSTEM

- > Overview
- > Applications World Wide
- > Model Code
- > Technical Description & User Guides
 - > FAQs
- > Terms of Use
- > Pre-Processing Tools
 - > Regriding Scripts
- > Test Cases
- > Meteorological & Terrain Data
- > Rwrffhydro
- > HydroInspector

Resources

- > NEWS
- > Online Talks & Webinars
- > Presentations
- > AGU 2018 Presentations
- > AMS 2019 Presentations
- > Training & Materials
- > Costa Rica Training

PUBLICATIONS

- > Events & Announcements
- > Community Spotlight
- > User's Forum

WRF-HYDRO SUPPORT

Presentations

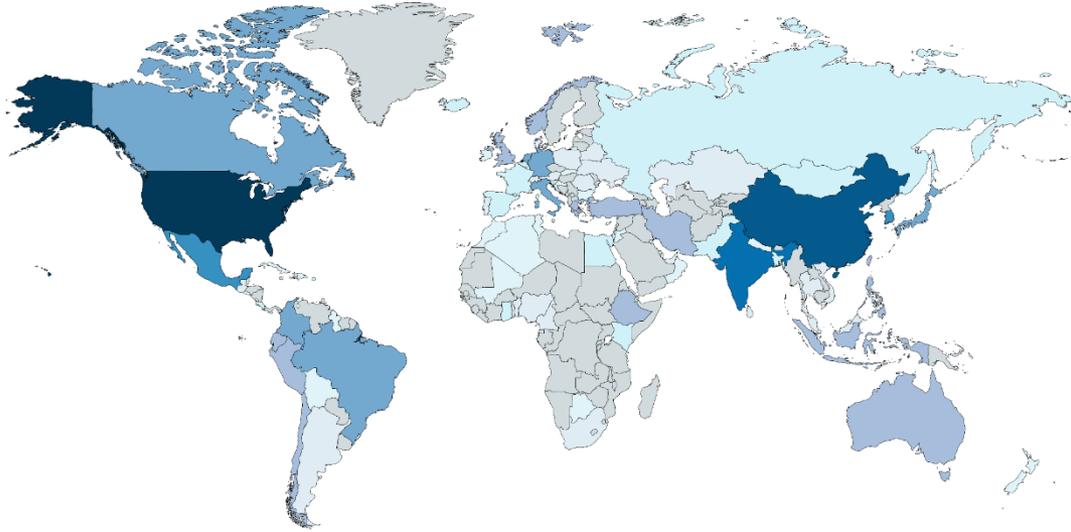
https://ral.ucar.edu/projects/wrf_hydro/presentations

The screenshot shows a web browser window displaying the RAL website. The URL in the address bar is ral.ucar.edu/projects/wrf_hydro/AMSPresentations. The page features the RAL logo (Research Applications Laboratory) and the tagline "science • serving • society". A navigation menu includes links for RAL HOME, WHO WE ARE, EXPERTISE, WHAT WE DO, SOLUTIONS, and WORK WITH US. The main content area is titled "WRF-Hydro Modeling System" and "AMS 2019 PRESENTATIONS". A specific presentation is highlighted: "WRF-HYDRO® @ AMS ANNUAL MEETING 2019". A note states: "Note: Those presentations listed with an * will not be presented due to the current federal government shutdown." The presentation is scheduled for Monday 07 January 2019. Under "Talks:", two presentations are listed: "1.1 Coupling the National Water Model to the Coastal Ocean for Predicting Water Hazards" by Brian Blanton, and "2A.4 Insights into Hydrometeorological Factors Constraining Flood Prediction Skill during the May and October 2015 Texas Hill Country Flood Events" by Larry J. Hopper Jr. A sidebar on the right contains a "WRF-HYDRO MODELING SYSTEM" menu with links to Overview, Model Code, Terms of Use, Test Cases, and Resources.

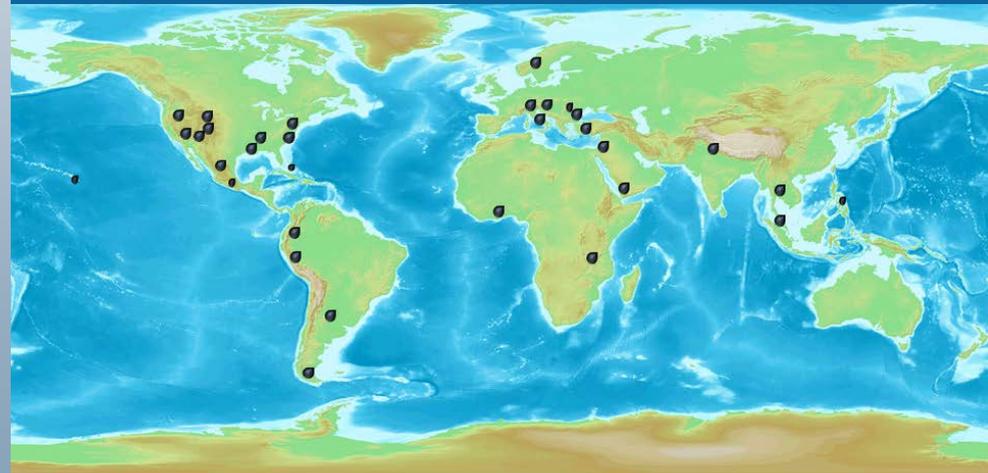


Community: Users World Wide

Usage by Country of WRF-Hydro[®] Online Resources



Ongoing Collaborations & Applications



- Operational Streamflow Forecasting
- Streamflow Prediction Research
- Diagnosing Climate Change Impacts on Water Resources
- Diagnosing Land-Atmosphere Coupling Behavior in Mountain Front Regions
- Diagnosing Impacts of Disturbed Landscapes on Coupled Hydrometeorological Predictions
- Coupling WRF-Hydro with Coastal Process Models

Online Resources:

- https://ral.ucar.edu/projects/wrf_hydro
 - Contact: wrfhydro@ucar.edu
- <https://www.cuahsi.org>
 - Contact: commgr@cuahsi.org

Presenters:

- David Gochis – gochis@ucar.edu
- Anthony Castronova - acastronova@cuahsi.org
- Julia Masterman - jmasterman@cuahsi.org

Organizers:

- Molly McAllister – mollymca@ucar.edu
- David Gochis – gochis@ucar.edu
- Julia Masterman - jmasterman@cuahsi.org
- Anthony Castronova - acastronova@cuahsi.org
- Emily Clark - eclark@cuahsi.org