

OWP | OFFICE OF
WATER
PREDICTION

AGU Fall Presentation 2021



H54G: Next-Generation Water Resources Modeling: Innovation
at the Intersection of Domain, Computer, and Data Sciences

Next Generation National Water Model: Strategy and Preliminary Performance of Initial Model Formulations

Presenter: Luciana Cunha (luciana.kindl.da.Cunha@noaa.gov)

Keith Jennings, Andy Wood, Naoki Mizukami, Xia Feng, Fred L. Ogden, Jessica Garrett, Jonathan Frame, Mike Johnson, Scott Peckham, Shengting Cui, Rachel McDaniel, Matthew Williamson, Brian Avant, John Mattern, Donald Johnson, Nels Frazier, Robert Bartel, Yuquiong Liu



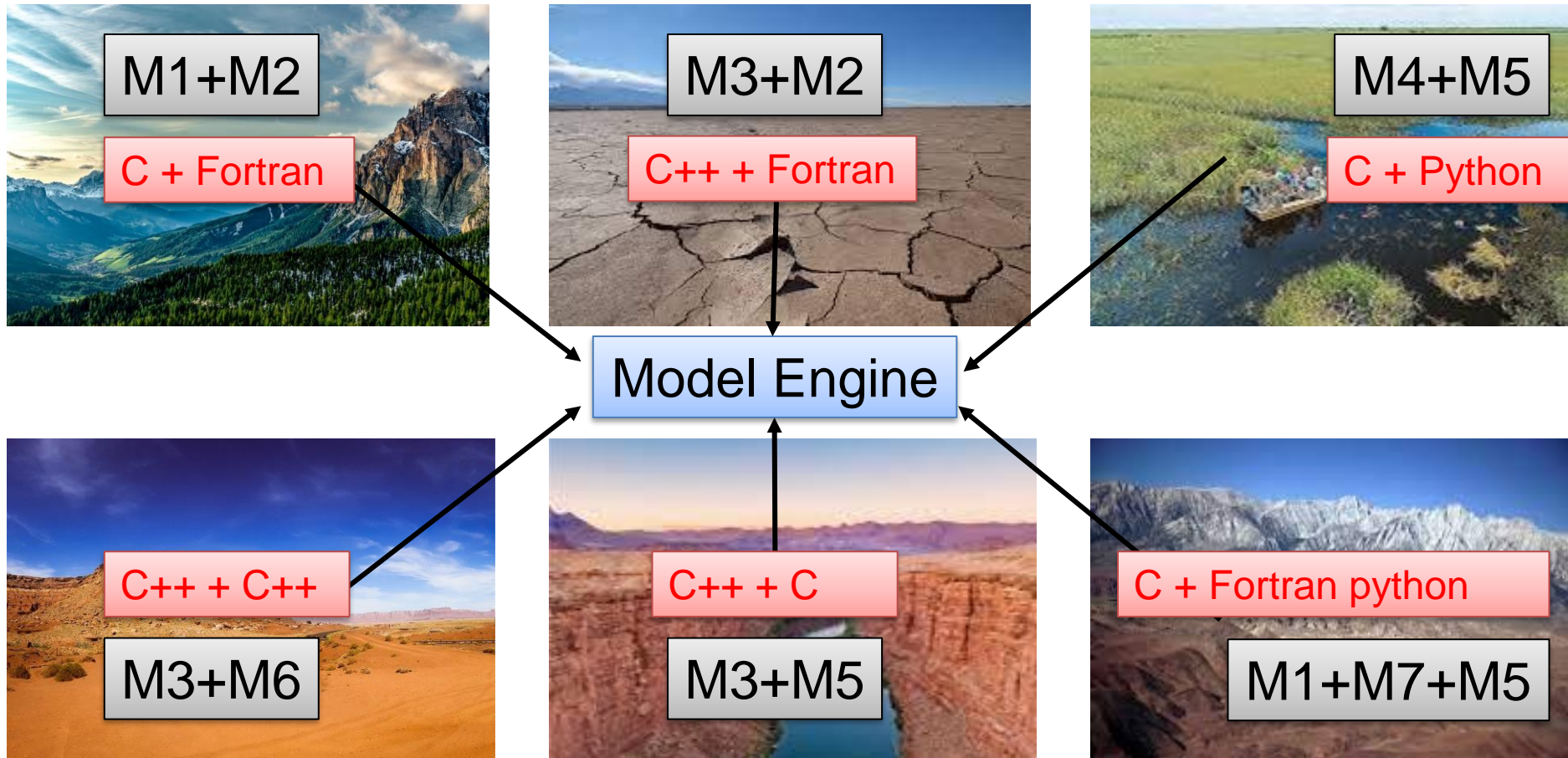
NWM 1.0 to 3.0



NOAH-MP



Nextgen: inviting the community



Why do we need a model engine?

Any models,
modules,
combination

Legacy code
Any language,
structure,...

Exchange
of
information

BMI
Basic Model Interface

Community
standard

Open source
Best practice
Reproducibility

Methods
may vary in
space and
time

From floods to
droughts

Model Engine

<https://github.com/NOAA-OWP/ngen>



Facilitate model intercomparison

Model intercomparison - An analogy

Car Review and Test Drives

Different roads



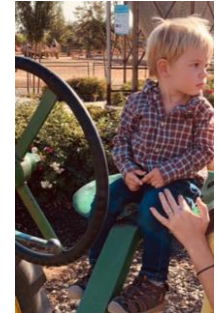
Different conditions



Different fuels



Different drivers



Purpose

Evaluation criteria

“Crash tests for a standardized evaluation of hydrological models”

Andreassian et al 2009

Previous model intercomparison projects

Evaluation of five hydrological models across Europe and their suitability for making projections under climate change

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Technologies, Energy and Sustainable Economic Development (ENE), Lungotevere Thaon di Revel, 76 –

OHD/HL/DMIP2 - Distributed Hydrologic Model Intercomparison Project (Phase 2)

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Note: March 22, 2010 Restart of DMIP 2 - New Data Available for Western Basins

Distributed Hydrologic Model Intercomparison Project - Phase 2 (DMIP 2)

The Hydrology Laboratory (HL) of NOAA's National Weather Service (NWS) proposes the second phase of the Distributed Model Intercomparison Project. The intent of DMIP 2 is to invite the academic community and other researchers to help guide the NOAA/NWS's distributed modeling research by comparison of distributed models applied to test data sets in two vastly different geographic regions.

DMIP 2 contains two scientific thrusts. First, we propose to continue the experiments in the DMIP 1 basins, capitalizing on nearly 4 more years of experiments in these areas are designed as well to explore new issues not covered in DMIP 1. Second, DMIP 2 will contain experiments in two basins in the Nevada mountains, allowing researchers to test their models in areas of complex hydrology.

As in DMIP 1, HL will provide data sets for several basins. Participants will download the data sets and run their models in continuous simulation. The simulations will be compared to observed streamflow data as well as simulations generated from a lumped application of the Sacramento Soil Moisture Accounting (SAC-SMA) model. Participants will be invited to meet in an HL-sponsored workshop to discuss results and future directions. Results of DMIP 2 will be used to guide future HL's distributed modeling research and applications.

Main Link Categories:
[Home](#) | [HL](#) | [OHD](#) | [NWS](#)

Snow Models intercomparison project (SnowMIP)

Contact: [Eric Martin](#) and [Richard Essery](#)

Because of their importance in hydrological modelling, numerical weather forecasting, climate prediction and remote-sensing, many land-surface models contain a snow model. SnowMIP1 showed that models can produce widely differing results even for the comparatively simple case of simulating snow accumulation and ablation at sites without exposed vegetation, and equally good snow mass simulations from different models can partition the surface energy balance very differently. SnowMIP2 was devoted to intercomparison in forested areas, with additional uncertainty arising from energy and mass partitioning in the canopy and at the ground surface. To evaluate and interpret the performance of models, SnowMIP2 simulations were compared with observations of a range of variables, including snow mass at paired forested and clear sites, surface temperatures, and radiative and turbulent fluxes above and below canopies.

Nexgen: testbed for standard intercomparison

Hydrological model intercomparison

The road -> Hydrofabrics

The fuel -> Forcing, parameters, physical attributes,...

The conditions -> Wherever, whenever

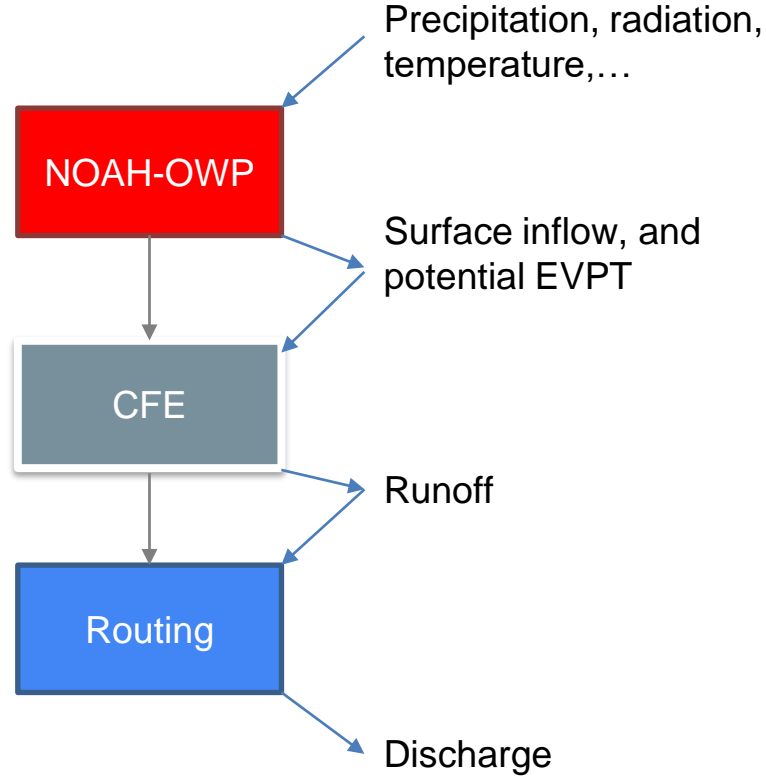
The machine -> any module, models or combinations

The criteria -> depends on simulation goals (floods, droughts,...)

The client -> the community

Initial Model Formulations

- NOAH-OWP-Modular (Fortran)
- CFE (C)
- TOPMODEL (C)
- LSTM (python)
- Potential ET routines (C)
- Soil Freeze Thaw model
- **Next: your favorite model**



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*“Comprehensive,
reproduceable, cost efficient
model intercomparison
capabilities across multiple
hydro-climates and landscapes,
temporal and spatial scales, and
dominant processes”*

Github



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Thank You!



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<https://water.noaa.gov>