WRF-Hydro on HPC

What is WRF-Hydro?

WRF-Hydro is a community hydrologic model designed for both research and operational applications. It is an extension of the Weather Research and Forecasting (WRF) model and is designed to simulate the terrestrial component of the water cycle.

The software is designed to simulate a wide range of hydrologic processes, including surface and subsurface runoff, evapotranspiration, groundwater recharge, and streamflow routing. WRF-Hydro uses a grid-based approach and can simulate hydrologic processes at high spatial resolutions (from meters to tens of kilometers).

WRF-Hydro is an open-source software package that is actively maintained by a community of developers and users. It is designed to be modular, allowing users to choose which components they want to use and to modify the code to suit their needs. WRF-Hydro also includes a data assimilation framework that allows users to incorporate observational data into the model.

Links:

Official Website

Manual

Versions Available:

The following versions are available on the cluster:

- `physical/WRF/Hydro/3.0`
- `physical/WRF/Hydro/5.0`
- `physical/WRF/WPS/4.4`

How to load *WRF-Hydro*?

To load WRF-HYDRO, use the following commands:

```
#Load the WRF-HYDRO module
module load physical/WRF/Hydro/5.0
```

To verify if the module is loaded correctly, use the following command,

```
# List all the module loaded in the environment
module list
```

How to use *WRF-Hydro*?

Here are few steps to use WRF-Hydro in HPC,

1. Obtain and prepare input data: To use WRF-Hydro, you will need to gather input data such as meteorological forcing data, terrain data, land use/land cover data, and soil data. These data should be in the appropriate format (e.g., netCDF, ASCII, GIS) and spatial resolution for your specific application. You may need to pre-process or interpolate these data to ensure they are compatible with the WRF-Hydro model.
2. Set up a domain and run the WRF model: WRF-Hydro requires the output from the WRF atmospheric model as input. You will need to set up a WRF domain, define the initial and boundary conditions, and run the WRF model to generate atmospheric forcing data.
3. Set up the WRF-Hydro model: Once you have the necessary input data, you can set up the WRF-Hydro model. This involves configuring the model domain, specifying model parameters, and defining the time step and simulation duration. You will also need to choose which hydrologic processes to simulate and set up the appropriate parameterization schemes.

4. Run the WRF-Hydro model: With the input data and model configuration set up, you can run the WRF-Hydro model. The model will simulate hydrologic processes over the specified time period and generate output data, including runoff, soil moisture, and streamflow, among other variables.
5. Analyze and visualize the model output: Once the simulation is complete, you can analyze and visualize the output data to gain insights into the hydrologic processes and to assess the model's performance. The output data can be stored in various file formats (e.g., netCDF, ASCII),

Here is a sample slurm script to run WRF hydro with MPI,

```
#!/bin/bash
#SBATCH --job-name=wrf_hydro_mpi
#SBATCH --partition=main
#SBATCH --qos main
#SBATCH --nodes=4
#SBATCH --ntasks-per-node=16
#SBATCH --time=24:00:00
#SBATCH --output=wrf_hydro_mpi.%j.out
#SBATCH --error=wrf_hydro_mpi.%j.err

module load physical/WRF/Hydro/5.0


# Set the path to the WRF-Hydro executable and input files
EXE_PATH=/path/to/wrf_hydro.exe
INPUT_DIR=/path/to/input/files

# Set the number of MPI tasks and the MPI command
NTASKS=$((SLURM_JOB_NUM_NODES * SLURM_NTASKS_PER_NODE))
MPI_CMD="mpiexec -n $NTASKS"

# Run WRF-Hydro
cd $INPUT_DIR
$MPI_CMD $EXE_PATH >& wrf_hydro.log
```

Where to find help?

If you are confused or need help at any point, please contact OIT at the following address.

https://ua-app01.ua.edu/researchComputingPortal/public/oitHelp