This dataset provides global-scale streamflow simulations from 1980-2020 generated with the physics-embedded, high-resolution differentiable model δHBV2δMC2-Globe2-hydroDL (https://doi.org/10.5281/zenodo.14827983) developed by the *Multi-scale Hydrology, Processes, and Intelligence* (MHPI) team at The Pennsylvania State University, led by Dr. Chaopeng Shen. This data is provided as is, and we do not assume any responsibility as a result of the use of this data.

This dataset is a direct result of Ji et al., 2025 described below, which was trained from 1980-2000 and forwarded from 1980-2020, and built upon the work in Song et al., 2025. Please cite these two papers if you find the data to be of use (* indicates MHPI group members, underline indicates corresponding author):

Ji, Haoyu*, Yalan Song*, Tadd Bindas*, Chaopeng Shen*, Yuan Yang, Ming Pan, Jiangtao Liu*, Farshid Rahmani*, Ather Abbas, Hylke Beck, Kathryn Lawson* and Yoshihide Wada (2025, Accepted). Distinct hydrologic response patterns and trends worldwide revealed by physics-embedded learning. *Nature Communications*.

Song, Yalan*, Tadd Bindas*, Chaopeng Shen*, Haoyu Ji*, Wouter J. M. Knoben, Leo Lonzarich*, Martyn P. Clark, Jiangtao Liu*, Katie van Werkhoven, Sam Lemont, Matthew Denno, Ming Pan, Yuan Yang, Jeremy Rapp, Mukesh Kumar, Farshid Rahmani*, Cyril Thébault, Richard Adkins, James Halgren, Trupesh Patel, Arpita Patel, Kamlesh Sawadekar*, and Kathryn Lawson* (2025). High-resolution national-scale water modeling is enhanced by multiscale differentiable physics-informed machine learning. *Water Resources Research*, doi: 10.1029/2024WR038928

More information on our research group and publications can be found at www.mhpi.info, and our publicly-available codes are also available on Github at www.github.com/mhpi. A wiki with summaries, benchmarks, and more information is available at https://mhpi.github.io.

To facilitate data access, the global river network has been partitioned into zones based on the MERIT Flowlines framework. The MERIT basin delineations and zones are available at https://www.reachhydro.org/home/params/merit-basins.