

National Flood Interoperability Experiment: Concepts and Definitions¹

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The five components of the conceptual framework for the National Flood Interoperability Experiment (NFIE) are shown in Figure 1.

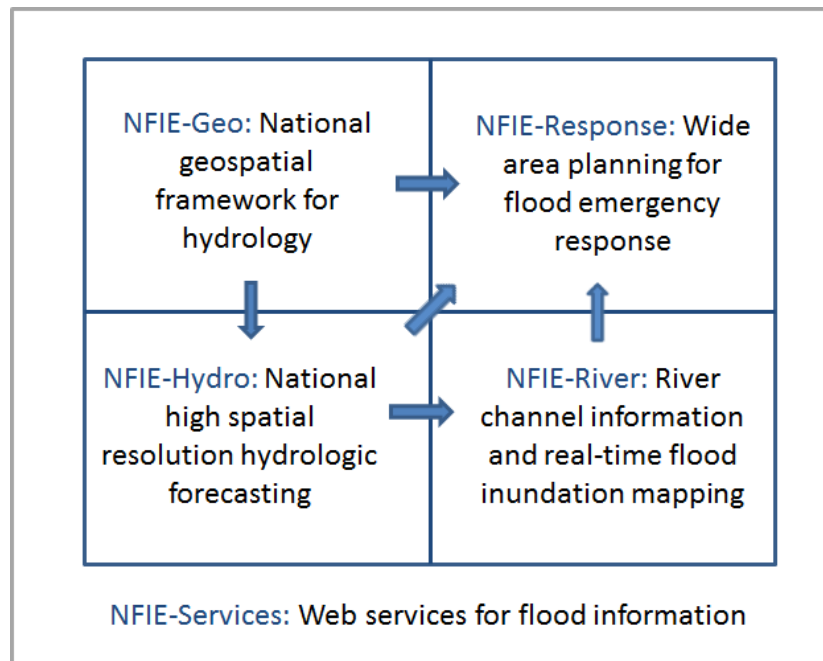


Figure 1. Components of the Conceptual Framework

Definitions: NFIE Components

National Flood Interoperability Experiment (NFIE) – a one-year collaboration, from September 2014 to August 2015, between the National Weather Service and its government partners, and the academic community and commercial partners, that is designed to demonstrate a transformational suite of science and services for the next generation of national flood hydrology and emergency response.

NFIE-Geo – a geospatial data framework to support the NFIE. This will be founded on a National Water Data Infrastructure of federal geospatial information to support simulation of streamflow at high spatial resolution at the continental scale. Specific applications of NFIE-Geo for particular states, counties and river basins will also include river channel and flood response information from those regions.

¹ This paper is a draft for review purposes only. It should not be cited or quoted.

National Water Data Infrastructure – a set of ten feature classes of geospatial information provided by federal agencies coordinated by the Subcommittee on Spatial Water Data to support the NFIE.

NFIE-Hydro – a continental scale hydrologic simulation system for that takes weather modeling and forecasting as an input, processes that through a land-atmosphere model and a river channel routing model to produce flow forecasting. Many combinations of models to perform this task will be tested during the NFIE. It is anticipated that some of the more successful of these models may later be incorporated within the WRF-Hydro framework for implementation at the National Water Center.

WRF-Hydro – the Weather Research and Forecasting – Hydro is a community-based, coupling architecture supported by the National Center for Atmospheric Research to provide an extensible, multi-scale and multi-physics framework for prediction of water cycle components including precipitation, soil, moisture, snowpack, groundwater, streamflow and flood inundation.

NFIE-River – a database of river channel information and associated flood hydraulic models that can be used to support flood inundation mapping. The flood discharge forecast from NFIE-Hydro is the input to each river reach and the output from NFIE-River is the corresponding water surface elevation and flood inundation extent. While the coverage of NFIE-Hydro will be continental, the coverage of NFIE-River will be local and regional where the required stream channel information and models exist.

NFIE-Response – a plan for flood response developed with the local emergency response community such as city fire departments to support saving lives during flood events. This includes a planning phase to identify vulnerable people and infrastructure, including flooding of roads and streets, and an action phase that uses flood forecasts from NFIE-Hydro and flood inundation mapping from NFIE-River, if available, to indicate zones of flood risk during a flood event.

Definitions: Conceptual Elements

Reach Catchment – a local drainage area that has only one flow inlet and one flow outlet. The continental United States is subdivided into a contiguous set of 2.67 million reach catchments that are each labelled with an 8-digit unique identifier. NFIE-Hydro modeling defines runoff from each reach catchment.

Reach Flowline – a single stream centerline or artificial path through a waterbody that links the inlet and outlet of a Reach Catchment. Each Reach Flowline shares the same unique identifier as the reach catchment that drains to it. NFIE-Hydro modeling routes the runoff from the reach catchment through the network of reach flowlines for the continental United States. Each reach flowline has a from-node at its upper end and a to-node at its lower end. The topological connections between the flowlines are made using these nodes.

Subwatershed – a collection of contiguous Reach Catchments that describe a drainage area. The continental United States is subdivided into approximately 86,000 Subwatersheds. These are the basic units for flood emergency response planning.

National Stream Network – a high resolution stream network for the nation that includes the reach flowlines but also additional tributary streams within the reach catchments.

Stream Cross-Section – a line drawn across a stream channel transverse to the flow direction that contains a set of points whose vertical elevation defines the bed of the stream channel and the land surface elevation of the adjacent flood plain.

Water Surface Elevation – the elevation of a water surface above geodetic datum.

Stage Height – the elevation of a water surface above a local datum, such as that established at a stream gage.

Water Depth – the height of a water surface above the lowest elevation in the cross-section.

Flood Rating Curve – a table that defines the water surface elevation, water depth and discharge at a stream cross-section for a set of specified flood frequencies.

Flood Inundation Map – a map over a spatial region of the extent of flood inundation for a specified flood frequency.

Flood Inundation Map Library – a set of flood inundation maps for a spatial region for a set of specified flood frequencies or water surface elevation increments. These are static flood inundation maps defined independently of any particular flood event. The planning phase of NFIE-Response uses a flood inundation map library to define vulnerable people, homes, bridges, culverts, and other infrastructure at risk from flooding.

Base Flood – a flood with 1% annual exceedance probability

Base Flood Elevation – the water surface elevation of a base flood

Base Flood Hazard Zone Area – the area of flood inundation if base flood conditions occur uniformly over a region

Reach Flood Response Zone – the base flood hazard zone area within a Reach Catchment. This is the anticipated area of flood risk if a flood is occurring. The flood forecast discharge for a reach catchment indicates the degree of risk in that reach during a particular flood event.

Reach Flood Risk Map – a map which colors flood response zones green, orange or red according to the degree of flood risk during a particular flood event. This can be determined directly from the output of NFIE-Hydro and does not require NFIE-River description of flood channel hydraulics. This is employed in the action phase of NFIE-Response to support deployment of emergency response resources.

Dynamic Flood Inundation Map – a flood inundation map produced from NFIE-River showing water surface elevation and inundation area varying in space and time as a flood occurs.