What is Available and When: Real-time Flood Inundation Mapping Products

PHASE 1A — ONGOING OPERATIONS (MODELING, LIBRARY BUILDING, SCENARIO DEVELOPMENT, HISTORICAL FLOODS)

PHASE 1B — ESCALATION OF THREAT

PHASE 1C — CREDIBLE THREAT

PHASE 2A — EVENT

PHASE 2B — RESPONSE

Civil Applications Committee Global Fiducials Library (GFL)
(https://gfl.usgs.gov/)
The GFL archive is dedicated to ensuring that images of environmentally significant sites around the world are collected, maintained, and made available to scientists and policy makers in support of scientific investigations into global dynamic systems and change.

Risk Mapping, Assessment and Planning (Risk MAP)
(https://www.fema.gov/risk-mapping-assessment-and-planning-risk-map)
Tailored to each community, the FEMA Risk Mapping, Assessment, and Planning (Risk MAP) program integrates information and assessment tools to help communities and individuals identify and understand their risks before a flood occurs.

Earth Science Data and Information System (ESDIS) Distributed Active Archive Centers (DAACs)
(https://earthdata.nasa.gov/eosdis/daacs)
EOSDIS DAACs process, archive, document, and distribute data from NASA's past and current Earth-observing satellites and field measurement programs.

Coastal Hazards System
(https://chswebtool.erdc.dren.mil/)
The Coastal Hazards System (CHS) provides probabilistic coastal hazards assessment (PCHA) results and statistics based on high-resolution numerical modeling of coastal storms.

Coastal Storm Modeling System (CSTORM-MS)
(https://www.erdc.usace.army.mil/Media/Fact-Sheets/Fact-Sheet-Article-View/Article/476697/coastal-storm-modeling-system/)
The Coastal Storm Modeling System (CSTORM-MS) is a comprehensive system of highly skilled and highly resolved models used to simulate coastal storms and accurately assess risk to coastal communities.

Corps Water Management System (CWMS)
(https://www.hec.usace.army.mil/cwms/cwms.aspx)
The Corps Water Management System (CWMS) is the automated information system used to evaluate and model watersheds.

National Inventory of Dams (https://nid.sec.usace.army.mil/ords/f?p=105:1::::::)
The National Inventory of Dams contains data collected in late-2018 on more than 90,000 dams nation-wide.

National Levee Database
(https://levees.sec.usace.army.mil/#/)
The National Levee Database includes data on nearly 9,000 levee structures.

National Agricultural Statistics Service (NASS) Disaster Analysis
(https://www.nass.usda.gov/Research_and_Science/Disaster-Analysis/index.php)
NASS can now monitor agricultural disasters in near real-time and provide quantitative assessments using remotely sensed data and geospatial techniques. This website provides disaster assessments in geospatial data format, reports, and metadata (as available).

Cropscape-Cropland Data Layer (CDL)
(https://nassgeodata.gmu.edu/CropScape/)
The purpose of the Cropland Data Layer Program is to use satellite imagery to provide acreage estimates for major commodities and to produce digital, crop-specific, categorized geo-referenced output products.

Dynamic Surface Water Extent Model
(https://www.usgs.gov/land-resources/nli/landsat/landsat-dynamic-surface-water-extent?qt-science_support_page_related_con=0#qt-science_support_page_related_con)
The Dynamic Surface Water Extent product provides raster layers that represent surface water inundation per-pixel in Landsat 4-8 data.

Earth Resources Observations and Science (EROS) Center
(https://www.usgs.gov/centers/eros)
The USGS EROS Center studies land changes, produces land change data products, operates the Landsat satellite program with NASA, and maintains images of the Earth's land surface.

USGS Flood Inundation Mapper (FIM)
(https://fim.wim.usgs.gov/fim/)
The FIM Mapper allows users to explore the full set of inundation maps that shows where flooding would occur given a selected stream condition.

COMING SOON

Real-Time, Event Driven Flood Inundation Mapping based on the National Water Model
This model will offer more coverage and better alignment with the USGS High-Water Marks than the traditional route and replace method.

Flood Inundation Surface Typology (FIST) Model for Rapid Flood Mapping
This model can rapidly fuse terrain derived information with imagery, hydrologic models, high water marks, or ground observations to produce flood inundation and depth grid estimates, filling a niche not covered by traditional hydrologic, hydrodynamic, and other inundation mapping methods.

FORECAST

Storm Surge Prediction Available

COASTAL

Surge Forecast Maps

Tropical Cyclone Storm Surge Probabilities (P-Surge 2.0)
(https://www.nhc.noaa.gov/surge/psurge.php)
The Tropical Cyclone Storm Surge Probabilities graphics show the overall chances that the specified storm surge height will occur at each individual location on the map during the forecast period indicated.

Extratropical Surge and Tide Operational Forecast System (ESTOFS)
(Atlantic: https://ocean.weather.gov/estofs/estofs_surge_info.php; Pacific: https://ocean.weather.gov/estofs/estofs_pacific_surge_info.php)
ESTOFS delivers predictions of (1) combined surge and tide, (2) astronomical tides, and (3) sub-tidal water level (the isolated surge).

Rainfall Prediction Available

RIVERINE

Hydro Forecast Maps

Pre-Event Depth Grids based on Forecasts
Using NOAA's Advanced Hydrologic Prediction Service (AHPS), FEMA generates an automated depth grid script tool that uses predicted instead of observed water levels.

Streamflow Prediction Tool (Outside Continental United States (OCONUS) only)
(https://streamflow-prediction-tool.readthedocs.io/en/latest/index.html)
The Streamflow Prediction Tool provides 15-day streamflow predicted estimates by using the European Center for Medium Range Weather Forecasts (ecmwf.int) runoff predictions routed with the RAPID (rapid-hub.org) program.

Advanced Hydrologic Prediction Service (AHPS) Flood Inundation Mapping
(https://water.weather.gov/ahps/inundation.php)
AHPS categories convey flood severity and risk based on the potential impact to property and public safety.

Hydrodynamic Models
(https://nauticalcharts.noaa.gov/learn/hydrodynamic-model-development.html)
NOAA's National Ocean Service develops and tests hydrodynamic modeling applications for use in operational systems and products (e.g., tide models and tidal datum products used in NOAA's VDatum vertical datum transformation software and storm surge models to provide combined tide and storm-induced surge guidance for coastal water levels and inundation).

DOCUMENTATION

Flood Documentation

Cyclone Global Navigation Satellite System (CYGNSS) Satellite Inundation Estimates
(http://clasp-research.engin.umich.edu/missions/cygnss/)
In addition to measuring tropical cyclone activity, CYGNSS has begun estimating river widths, which may lead to better monitoring of stream flow and prediction of flooding on a global scale.

Dartmouth Flood Observatory (DFO)
(http://floodobservatory.colorado.edu/)
The DFO provides space-based measurement, mapping, and modeling of surface water. (Note: In general, the DFO website may have more accurate products as experts have been involved in building the flood extent maps using available data and are thus able to edit out errors. The NASA website will have more timely products, as they are generated and posted automatically within several hours of satellite overpass, but they have not been manually examined or edited for errors.)

European Copernicus Sentinel-1 Synthetic Aperture Radar (SAR)
(https://sentinel.esa.int/web/sentinel/missions/sentinel-1)
The SENTINEL missions support emergency management by providing timely, continuous, and independent data on a near-real-time basis.

Advanced Rapid Imaging and Analysis (ARIA) Program
(https://aria.jpl.nasa.gov/)
The ARIA Program generates imaging products in near real-time that can improve situational awareness for disaster response.

NASA Earth Science Disasters Team
(https://maps.disasters.nasa.gov/arcgis/apps/sites/#/home/pages/floods)
NASA's fleet of Earth observing satellites can provide a wealth of information during and after flooding occurs.

Near Real-Time Global Flood Mapping
(https://floodmap.modaps.eosdis.nasa.gov/)
NASA's Near Real-time Global Flood Mapping provides routine global mapping of likely flood water using available satellite data resources. (Note: In general, the DFO website may have more accurate products as experts have been involved in building the flood extent maps using available data and are thus able to edit out errors. The NASA website will have more timely products, as they are generated and posted automatically within several hours of satellite overpass, but they have not been manually examined or edited for errors.)

Flood Maps from NOAA Operational Weather Satellites
(https://www.ssec.wisc.edu/flood-map-demo/)
NOAA provides experimental flood products based on satellite imagery that show flood areal extent and that can be used for situational awareness.

USGS Flood Information
(https://www.usgs.gov/mission-areas/water-resources/science/usgs-flood-information?qt-science_center_objects=0#qt-science_center_objects)
This webpage includes links to the collection of USGS flood data, including products to help Federal, State, and local agencies, decision makers, and the public before, during, and after a flood.

Hazard Data Distribution System (HDDSExplorer)
The HDDSExplorer is an event-based interface that provides a single point-of-entry for access to remotely sensed imagery and other geospatial datasets as they become available during a response, including data from public domain sources.

USGS Flood Inundation Mapper (FIM)
(https://fim.wim.usgs.gov/fim/)
The FIM Mapper allows users to explore the full set of inundation maps that shows where flooding would occur given a selected stream condition.

High-Water Mark + Mapping

Post-Event Depth Grids
FEMA generates post-event depth grids based on measured/observed data; damage assessments are made from depth grids, both of which are validated with satellite imagery.

Americas Strategic Analysis & Crisis Support
NGA collects LIDAR over major urban areas in the U.S. and generates unclassified products to provide information to FEMA within 24-48 hours for flood studies.

Post-Event Evaluations
NIST is in the process of developing post-disaster survey techniques that will allow for more representative data collection in which state of the art engineering and social science survey techniques are employed that will generate data and subsequently findings that can be combined to develop more robust and generalizable models upon which to base future algorithm development. (Note: The project leads for the Hurricane Matthew post-event evaluation noted difficulties in finding a reliable flood inundation map for the depth and extent of the flooding to drive sampling strategies for social indicators and noted a high uncertainty in parcel level flood inundation.)

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COMING SOON

Machine Learning/Artificial Intelligence and Flood Inundation Science and Technology Integration
NGA, in collaboration with the National Center for Supercomputing Applications (NCSA), UGSS, NASA, NOAA, and the University of Alabama, is beginning to integrate machine learning and artificial intelligence to produce automated imagery analysis workflows to produce refined flood inundation extent and depth mapping capabilities.

HISTORICAL FLOOD DOCUMENTATION

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