METEOROLOGICAL/HYDROLOGICAL FLOOD STANDARDS

MHF-1 Flood Event Data Sources

A. The modeling of floods in Florida shall involve meteorological, hydrological, and other relevant data sources.

B. The model shall incorporate relevant data sources in order to account for meteorological and hydrological events and circumstances occurring either inside or outside of Florida that result in or contribute to flooding in Florida.

C. Flood model calibration and validation shall be scientifically justified based upon historical data consistent with peer reviewed or publically developed data sources.

D. Calibration and validation shall encompass relevant flood event data sources required to model flood, which shall include, but not be limited to, coastal and inland flooding, as well as any partitions or subsets.

E. Any trends, weighting, or partitioning shall be justified and consistent with currently accepted scientific literature and statistical techniques.

Purpose: This standard requires that the flood model include coastal and inland flooding as a minimum. Coastal flooding includes storm surge, and inland flooding includes riverine, lacustrine, and surface water flooding.

This standard requires that utilized data sources associated with each type of flooding be documented, and the stochastic flood event data sources be scientifically defensible. If other flood sub-perils are included, they are to be identified.

Relevant Forms:
GF-2A, Meteorological/Hydrological Flood Standards Meteorologist Expert Certification
GF-2B, Meteorological/Hydrological Flood Standards Hydrologist Expert Certification
MHF-2, Coastal Flood Characteristics by Return Periods
MHF-3, Inland Flood Characteristics by Return Periods
AF-2, Flood Event Data Sources Statewide Losses
SF-1, Probability and Frequency of Florida Flood Events per Year
SF-5, Average Annual Zero Deductible Statewide Flood Loss Costs – Historical versus Modeled

Disclosures

1. Identify relevant data sources, their release dates, and the time periods used to develop and incorporate flood frequencies for coastal and inland flooding into the flood model.

2. Where the flood model incorporates modification, partitioning, or adjustment of the historical data leading to differences between modeled climatology and historical data, justify each modification and describe how it is incorporated.

3. State whether the model includes flooding other than coastal and inland flooding. State whether the other flooding types are independent of the minimum required sub-perils of coastal and inland flooding.

4. Provide a completed Form MHF-2 (Coastal Flood Characteristics by Return Periods) for coastal flooding, which includes data for flood extent and depth corresponding to 10, 25, 50, 100, 250, 500, and 1,000 year return periods. Provide a link to the location of the form [insert hyperlink here].

5. Provide a completed Form MHF-3 (Inland Flood Characteristics by Return Periods) for inland flooding which includes data for flood extent and depth corresponding to 10, 25, 50, 100, 250, 500, and 1,000 year return periods. Provide a link to the location of the form [insert hyperlink here].

Audit

1. The modeling organization's data sources will be reviewed.

2. Justification for any modification, partitioning, or adjustment to historical data and the impact on flood model parameters and characteristics will be reviewed.

3. Modeled frequencies will be compared with the observed spatial distribution of flood frequencies across Florida using methods documented in currently accepted scientific literature. The goodness-of-fit of modeled to historical statewide and regional coastal and inland flooding flood frequencies as provided in Form MHF-2 (Coastal Flood Characteristics by Return Periods) and Form MHF-3 (Inland Flood Characteristics by Return Periods) will be reviewed.

4. Form MHF-2 (Coastal Flood Characteristics by Return Periods) and Form MHF-3 (Inland Flood Characteristics by Return Periods) will be reviewed for consistency with Form SF-1 (Probability and Frequency of Florida Flood Events per Year).

5. Historical data used as the basis for the model's flood extent and depth will be reviewed. The appropriateness of the model's stochastic flood extent and depth with reference to the historical flood databases will be reviewed.

MHF-2 Flood Parameters (Inputs)

A. The flood model shall be developed with consideration given to flood parameters that are scientifically appropriate for modeling coastal and inland flooding. The modeling organization shall justify the use of all flood parameters based on information currently available in scientific literature.

B. Any differences in the treatment of flood parameters between historical and stochastic events shall be justified.

C. The land use and land cover (LULC) database shall be consistent with the National Land Cover Database (NLCD) 2011 or later. Use of alternate datasets shall be allowable if justified.

D. The grid cell size used in the model shall be scientifically justified.

Purpose: This standard requires that the modeling organization use only scientifically sound information for determining coastal and inland flooding parameters. Flood parameters are inputs to the flood model and are needed by the model to define or determine the nature, severity, and physical characteristics associated with coastal and inland flooding.

This standard requires that the flood model be implemented consistently with contemporary soil categories and LULC distributions.

This standard requires that any differences in the treatment of flood parameters between historical and stochastic floods be justified.

Relevant Forms: GF-2A, Meteorological/Hydrological Flood Standards Meteorologist Expert Certification
GF-2B, Meteorological/Hydrological Flood Standards Hydrologist Expert Certification
SF-3, Distributions of Stochastic Flood Parameters (Coastal and Inland)

Disclosures

1. For coastal and inland flood model components, identify and justify the various flood parameters used in model.

2. For coastal and inland flood model components, describe the dependencies among model parameters and specify any assumed mathematical dependencies among these parameters.

3. For coastal and inland flood model components, describe the dependencies which exist among and between each of the model components.

4. Identify whether flood parameters are modeled as random variables, functions, or fixed values for the stochastic flood event generation. Provide rationale for the choice of parameter representations.

5. Describe how any flood parameters are treated differently in the historical and stochastic flood event sets (e.g., varying versus fixed).

6. For coastal flood analyses, describe how the coastline is segmented (or partitioned) in determining the parameters for flood frequency used in the flood model.

7. For inland flood analyses associated with riverine and lacustrine flooding, describe how the rivers, lakes, and associated floodplains are segmented (or partitioned) in determining the parameters for flood frequency used in the flood model.

8. For inland flood analyses associated with surface water flooding, describe how the affected area is segmented (or partitioned) in determining the parameters for flood frequency used in the flood model.

9. Describe how any flood parameters change or evolve during an individual flood life cycle (e.g., the functional representation of Manning's roughness of trees varying with flood depth).

10. Describe any assumptions or calculations used in the model relating to antecedent conditions (e.g., groundwater levels, lake levels, river discharges, tides, waves, etc.).

11. For coastal modeling, describe any assumptions or calculations for wave radiation stresses and their impact on storm surge stillwater elevations.

12. Describe any assumptions or calculations used in the model relating to future conditions (e.g., sea level rise, changes in precipitation patterns, changes in storm frequency or severity).

13. Provide the source, resolution, and accuracy of the topography and bathymetry throughout the flood model domain. Provide the grid cell size(s) used in the model.

14. Describe any assumptions or calculations used in the model relating to flood-induced erosion or topographic changes.

15. As applicable, describe the methods used to account for soil infiltration rates and saturation in the flood model. Provide citations to all data sources used to develop and support the soil infiltration rate or soil saturation methodology, including publicly developed or peer reviewed information.

16. Describe the methods used to account for land-use conditions and future changes in land-use, if any, in the flood model. Provide citations to all data sources used to develop and support the land-use evaluation methodology, including publicly developed or peer reviewed information.

17. Provide the collection and publication dates of the soil and LULC data used in the flood model, and justify the data's applicability and timeliness for Florida.

18. Describe the methodology used to convert LULC information into a spatial distribution of hydrological parameters, including roughness coefficients, throughout the model domain.

19. For each parameter used in the model, provide the horizontal and vertical projection and datum references, if applicable. If any horizontal or vertical datum conversions are required, provide conversion factors and describe the conversion methodology utilized.

Audit

1. All flood parameters used in the flood model will be reviewed.

2. Prepare graphical depictions of flood parameters as used in the flood model. Describe and justify:
    a. The data set basis for any fitted distributions, the methods used, and any smoothing techniques employed,
    b. The modeled dependencies among correlated parameters in the flood model and how they are represented,
    c. The dependencies between the coastal and inland flooding analyses.

3. Scientific literature cited in Standard GF-1 (Scope of the Computer Flood Model and Its Implementation) may be reviewed to determine applicability.

4. The initial conditions for each flood event and how the flood event is initialized in an individual event calculation will be reviewed.

5. Any modeling organization specific research performed to develop the soil infiltration rates or soil saturation used in the flood model will be reviewed. The databases used will be reviewed in the context of the cited scientific literature.

6. Any modeling organization specific methodology used to incorporate LULC information into the food model will be reviewed. The databases used will be reviewed in the context of the cited scientific literature.

MHF-3 Wind and Pressure Field Structures for Storm Surge

A. Modeling of wind and pressure fields shall be employed to drive storm surge models due to tropical cyclones. Modeling of wind and pressure fields shall be employed to drive storm surge models due to non-tropical cyclones, unless non-tropical storm surge is otherwise incorporated into the flood elevation results.

B. The wind and pressure fields shall be based on contemporary scientific literature or developed using scientifically defensible methods.

C. Wind and pressure fields that drive coastal flood models shall be modeled for a time period that extends from at least before the storm's passage over the continental shelf waters of Florida and neighboring states to at least the time the storm no longer affects coastal flooding in Florida.

D. The features of modeled wind and pressure fields shall be consistent with those of historical storms affecting Florida.

Purpose: Wind is the dominant feature of tropical cyclones that drive storm surge and storm surge is frequently the dominant component of the associated flooding. The representation of the windfield and related pressure field is, therefore, crucial to storm surge modeling. This standard requires that the wind and pressure fields used to drive storm surge as part of flood models are scientifically sound and have been evaluated using comparison to historical storms affecting Florida. Non-tropical cyclones need not be explicitly modeled with wind and pressure fields but are not exempt from consideration in the flood elevation results.

Relevant Forms: GF-2A, Meteorological/Hydrological Flood Standards Meteorologist Expert Certification
GF-2B, Meteorological/Hydrological Flood Standards Hydrologist Expert Certification
AF-2, Flood Event Data Sources Statewide Losses

Disclosures

1. Describe the modeling of the wind and pressure fields for tropical cyclones. State and justify the choice of the parametric forms and the parameter values.

2. Describe the modeling of the wind and pressure fields for non-tropical cyclones, if implemented.

3. Provide the historical data used to estimate parameters and to develop stochastic storm sets from reanalysis.

4. Provide a rotational (*y*-axis) versus radial (*x*-axis) plot of the average or default wind and pressure profiles.

5. Describe how the parametric windfields are translated to surface windfields (e.g., numerically via planetary boundary layer models or parametrically via empirical surface wind reduction factors and inflow angles). Discuss the associated uncertainties.

6. Describe how storm translation is accounted for when computing surface windfields.

7. State if and describe how high-frequency windspeeds typically reported by meteorological agencies (e.g., 1-minute average peak) are converted to the longer averages more appropriate for driving storm surge models (e.g., 10- to 30-minute average peak).

8. Describe the derivation of surface water wind stress from surface windspeed. If a sea-surface drag coefficient is employed, describe how it is related to the surface windspeed. Provide a comparison of the sea-surface drag coefficient to coefficients from the scientific literature.

Audit

1. All external data sources that affect the modeled wind and pressure fields associated with storm surge will be identified and their appropriateness reviewed.

2. Calibration and evaluation of wind and pressure fields will be reviewed. Provide accepted scientific comparisons of simulated wind and pressure fields to historical storms.

3. The sensitivity of flood extent and depth results to changes in the representation of wind and pressure fields will be reviewed.

4. The over-land evolution of simulated wind and pressure fields and what impact, if any, they have on flooding will be reviewed.

5. The treatment of uncertainty in the factor used to convert from a reference windfield to a geographic distribution of surface winds and the impact of the resulting winds upon the storm surge will be reviewed and compared with currently accepted scientific literature.

MHF-4 Flood Characteristics (Outputs)

A. Flood extent and depth generated by the flood model shall be consistent with observed historical floods affecting Florida.

B. Methods for deriving flood extent and depth shall be scientifically defensible.

C. Inland flooding and its interaction with storm surge shall be represented.

D. The model shall yield flood characteristics relevant to the calculation of flood damage.

Purpose: This standard requires that the modeling organization use scientifically sound information for determining inland and coastal flooding characteristics.

This standard requires that the resulting surface flood extent, depth, and other characteristics be representative of historical floods in Florida.

This standard requires that comparison of flood characteristics produced by the stochastic flood events and historical flood events be documented and variations justified.

Relevant Forms: GF-2A, Meteorological/Hydrological Flood Standards Meteorologist Expert Certification
GF-2B, Meteorological/Hydrological Flood Standards Hydrologist Expert Certification
MHF-1, Historical Event Flood Extent and Depth Validation Maps
AF-2, Flood Event Data Sources Statewide Losses

Disclosures

1. Provide comparisons of the modeled and historical flood extents and depths for the following events: Hurricane Andrew (1992), Hurricane Ivan (2004), Hurricane Jeanne (2004), Hurricane Wilma (2005), Tropical Storm Fay (2008), Unnamed storm on east central Florida (May 2009), Unnamed storm on Florida panhandle (July 2013), and one additional Florida storm of the modeling organization's choosing. If data are not available, the modeling organization may substitute a historical storm of their choosing.

2. Demonstrate that each model component (coastal and inland flooding) is sufficiently robust to incorporate important flood parameters, replicate historical flood characteristics, and accommodate the varied geographic, geologic, hydraulic, and LULC conditions in Florida. Provide justification for validation using any historical events not specified in Disclosure 1.

3. For each of the coastal storm events in Disclosure 1, provide a comparison of the modeled flood extents and water surface elevations with either the NOAA Maximum Envelope of Water (MEOW) or NOAA validation case studies using Sea, Lake, and Overland Surges from Hurricanes (SLOSH) data, if applicable. The modeling organization should use the most reasonable vintage of the Maximum of MEOW (MOM) data for this exercise.

4. Provide a map comparing simulated water elevations to observed water elevations for each validation storm in Disclosure 1.

5. For coastal flooding, describe how the model accounts for wave generation and decay, wave breaking, wave run-up, and other wave effects.

6. For inland and coastal modeling, describe how the model accounts for flow velocity and other relevant flood characteristics in the calculation of flood damage.

7. Identify all hydrological variables that affect the flood extent, depth, and other flood characteristics.

8. Describe the effect of any assumptions or calculations relating to antecedent conditions, as referenced in MHF-2, Disclosure 10, on the flood characteristics.

9. Describe and provide visual depictions of how the characteristics of each flood model component are utilized in or interface with the other components, if applicable.

10. Demonstrate the consistency of the modeled flood extent and depth with observed floods affecting Florida. Describe and justify the appropriateness of the databases used in the flood extent and depth validations.

11. Describe any variations in the treatment of the flood model flood extent and depth for stochastic versus historical floods and justify this variation.

12. Provide the level of resolution of the grid or areas modeled for the flood extent and depth and how the hydrological characteristics associated with the grid or areas are determined.

13. Provide a completed Form MHF-1, Historical Event Flood Extent and Depth Validation Maps. Explain any differences between modeled flood extent and depth and historical flood extent and depth. Provide a link to the location of the form [insert hyperlink here].

Audit

1. Any modeling organization specific research performed to develop the flood extent and depth functions used in the flood model will be reviewed along with the associated databases.

2. Any modeling organization specific research performed to derive the hydrological characteristics associated with the topography, soil type, and LULC distributions for the flood extent and depth will be reviewed.

3. The flood parameters used in calculating the flood loss costs for the historical flood events given in Disclosure 1 will be reviewed. Calculations based on flood model results for coastal and inland flooding, specification of flood parameters used in the model for all storm events, and the resulting temporal and spatial distributions of any flood characteristics contributing to flood damage will be reviewed. These will be reviewed with Form AF-2 (Flood Event Data Sources Statewide Losses). [consider deletion of this sentence if Form AF-2 is not going to specify a list]

4. If applicable, present time-based contour animations (capable of being paused) to demonstrate scientifically reasonable temporal evolution of flood characteristics. (Trade Secret item to be provided during the closed meeting portion of the Commission meeting to review the flood model for acceptability.)

5. Form MHF-1 (Historical Event Flood Extent and Depth Validation Maps) will be reviewed.

6. Calculation of relevant characteristics in the flood model for coastal and inland flooding will be reviewed. The methods by which each flood model component utilizes the characteristics of or interfaces with other model components, if applicable, will be reviewed.

7. The flood elevation frequency distributions associated with each segment for coastal and inland flooding will be reviewed.

8. The comparison of the calculated characteristics with historical flood events will be reviewed. The selected locations and corresponding storm events will be reviewed to verify sufficient representation of the varied geographic areas. If a single storm is used for both coastal and inland flooding validation, then its appropriateness will be reviewed.

9. The comparison of the flood extents and water surface elevations calculated in the model with the NOAA Maximum of MEOW (MOM) or NOAA validation studies using SLOSH data for each location will be reviewed, if applicable. The reasonableness of the MOM data vintage used will be reviewed.

MHF-5 Flood Probability Distributions

A. Flood probability distributions and the associated flood extent and depth shall be scientifically defensible and shall be consistent with flooding observed for Florida and neighboring states impacting Florida.

B. Flood probability distributions for storm surge affected areas shall include both tropical and non-tropical events.

C. Any additional probability distributions of flood parameters and modeled characteristics shall be consistent with historical floods for Florida resulting from coastal and inland flooding.

Purpose: This standard requires that the probability of occurrence of floods and associated flood extent and depth reasonably reflect the historical record with respect to geographical locations. This standard addresses consideration of flooding events in neighboring states (e.g., Georgia) which could impact Florida (e.g., Apalachicola River flooding from rainfall in the Chattahoochee River watershed in North Georgia).

This standard requires that the probability of occurrence of flood extent and depth be determined by combining storm surge from tropical and non-tropical events. Such combination can be through explicit modeling of both types of events, or by statistically combining non-tropical flood frequency information with explicitly modeled tropical event flood frequency.

This standard requires that the probability distributions of flood parameters not treated as constants and modeled characteristics be consistent with those documented in official meteorological and hydrological databases. Consistent means that spatial distributions of modeled flood probabilities accurately depict coastal and inland flooding in Florida.

Relevant Forms:
- GF-2A, Meteorological/Hydrological Flood Standards Meteorologist Expert Certification
- GF-2B, Meteorological/Hydrological Flood Standards Hydrologist Expert Certification
- MHF-2, Coastal Flood Characteristics by Return Periods
- MHF-3, Inland Flood Characteristics by Return Periods
- AF-2, Flood Event Data Sources Statewide Losses
- SF-1, Probability and Frequency of Florida Flood Events per Year
- SF-3, Distributions of Stochastic Flood Parameters (Coastal and Inland)

Disclosures

1. List assumptions used in creating the database(s) containing flood parameters and characteristics.

2. Describe how non-tropical and tropical event coastal storm surge flood probability distributions are combined. Provide one example demonstrating the process.

3. Provide the rationale for each of the probability distributions used for relevant flood parameters and characteristics.

Audit

1. Demonstrate that similar model flood parameters and characteristics are accounted for in the same manner across Florida and are appropriate for adjacent segments in Alabama and Georgia.

2. The method and supporting material for generating stochastic coastal and inland flood events will be reviewed.

3. The method and supporting material for determining flood extent and depth for coastal and inland flooding will be reviewed.

4. Any modeling organization specific research performed to develop the functions used for simulating flood model variables and to develop flood databases will be reviewed.

5. Form SF-3 (Distributions of Stochastic Flood Parameters – Coastal and Inland) will be reviewed for the probability distributions and data sources.

6. Comparisons of modeled flood probabilities and characteristics for coastal and inland flooding against the available historical record will be reviewed. Modeled probabilities from any subset, trend, or fitted function will be reviewed, compared, and justified against this historical record. In the case of partitioning, modeled probabilities from the partition and its complement will be reviewed and compared with the complete historical record.

MHF-6 Modeling of Regional/Local Flood Mitigation and Prevention Measures

A. The model's treatment of flood mitigation and prevention measures shall be consistent with historical records and with current state-of-the-science.

B. The modeling organization shall have a documented procedure for reviewing available flood mitigation and prevention data and shall update the flood model mitigation and prevention databases as necessary.

C. Any treatment of the potential failure of flood mitigation or prevention measures shall be based upon currently accepted scientific literature, empirical studies, or engineering analyses.

Purpose: This standard requires that regional/local flood mitigation and prevention measures are accounted for and updated as necessary. It also requires that any treatment of the potential failure of flood mitigation or prevention measures properly reflects the scientific and engineering basis.

Relevant Forms: GF-2A, Meteorological/Hydrological Flood Standards Meteorologist Expert Certification
GF-2B, Meteorological/Hydrological Flood Standards Hydrologist Expert Certification

Disclosures

1. List the flood mitigation and prevention measures incorporated in the flood model and the sources of all data employed.

2. Describe the methodology to account for flood mitigation and prevention measures in the flood model and indicate if these measures can be set (either to on or off) in the flood model.

3. Describe if flood mitigation and prevention measures which require human intervention or ongoing maintenance are incorporated into the flood model. Disclose the consideration given, if any, on the time required to construct, install or activate such measures, as compared with warning time that may be available before a flood event. Disclose the consideration given, if any, for the likelihood of construction/installation/ activation based on reports for past storm events.

4. Provide the probability distributions of flood extent, depth, and other characteristics showing the impact of flood mitigation and prevention measures versus no flood mitigation and prevention measures.

5. Describe how a determination is made to update any flood mitigation and prevention measure modeling databases or the time period planned for regular updating of databases.

6. Describe and justify the methodology used to account for the potential failure or alteration of flood mitigation and prevention measures in the flood model and if the level of failure can be adjusted in the flood model.

7. State whether the flood model incorporates intentional discharge of flood waters by governmental or other human actions for flood mitigation purposes. If so, describe how this is handled in the flood model.

Audit

1. Treatment of flood mitigation and prevention measures incorporated in the flood model will be reviewed.

2. The documented procedure addressing the updating of flood mitigation and prevention measures as necessary will be reviewed.

3. The methodology and justification used to account for the potential failure or alteration of flood mitigation and prevention measures in the flood model will be reviewed.

4. The probability distribution for flooding scenarios incorporating the failure of flood mitigation and prevention measures will be reviewed.

5. If the flood model incorporates discharge of flood waters by governmental or other human actions, the methodology used in the model will be reviewed.

MHF-7 Logical Relationships Among Flood Parameters and Characteristics

A. The water surface elevation shall increase with increasing terrain roughness, all other factors held constant.

B. The rate of water flow shall increase with increase in steepness in the topography, all other factors held constant.

C. The inland flood extent and depth associated with riverine and lacustrine flooding shall increase with increasing discharge, all other factors held constant.

D. The coincidence of storm surge and inland flooding shall increase the flood extent and depth, all other factors held constant.

E. Storm surge shall increase with greater over-water storm size, as measured by the area enclosed by windspeed or pressure contours, all other factors held constant.

F. Storm surge shall increase with shallower bathymetry, all other factors held constant.

G. Storm surge shall increase with increasing windspeeds, all other factors held constant.

H. If locally generated coastal waves are represented, the heights and periods shall increase with increasing windspeed, subject to depth, fetch and duration limits, all other factors held constant.

Purpose: This standard requires that the relationships among the parameters and characteristics of the flood model are logically consistent.

Relevant Forms: GF-2A, Meteorological/Hydrological Flood Standards Meteorologist Expert Certification
GF-2B, Meteorological/Hydrological Flood Standards Hydrologist Expert Certification

Disclosures

1. Provide a sample graph of water surface elevation and discharge versus time associated with inland flooding for each region in Florida: Panhandle, Gulf Coast, North Florida, Central Florida, and South Florida. Discuss how the flood characteristics exhibit logical relationships.

2. Provide sample plots and tabulations of storm surge elevations and associated wave conditions at open coast and bay/estuarine locations around the Florida coastline. The number of examples shall be sufficient to demonstrate logical relationships with geographic, oceanographic, hydraulic, and meteorological conditions.

3. Describe sensitivity analyses performed in response to this standard.

Audit

1. The flood model's ability to produce logical relationships will be reviewed.

2. The modeling organization's sensitivity analyses will be reviewed.

Form MHF-1: Historical Event Flood Extent and Depth Validation Maps

A. Provide color coded contour maps with appropriate base map data illustrating modeled flood extents and peak stillwater elevations for the following historical Florida flood events:

Hurricane Andrew (1992)
Hurricane Ivan (2004)
Hurricane Jeanne (2004)
Hurricane Wilma (2005)
Tropical Storm Fay (2008)
Unnamed Storm East Central Florida (May 2009)
Unnamed Storm Florida Panhandle (July 2013)
Storm chosen by modeling organization

If data are not available, the modeling organization may substitute a historical storm of their choosing.

B. Provide corresponding color coded contour maps with modeled flood depths for each of the historical events, contoured at no more than one foot intervals.

Elevation datum shall be North American Vertical Datum 1988 (NAVD88).

Plot the locations and values associated with validation points (maximum flood elevations or depths from observations such as gage data, water marks, etc.) on each contour map for the historical events.

Provide the resolution of the model depth grid used on each contour map.

Demonstrate the consistency of the modeled flood extent and depth with observed flood extent and depth for each historical event.

C. Explain any differences between the modeled flood extent and depth and the historical floods observations. Include an explanation if the differences are impacted by flood mitigation and prevention measures.

Open Issues:

Return Period years
What data will be used to prepare Forms MHF-2 and MHF-3?
Select 5 specific locations as a possibility
Revisit Forms MHF-2 and MHF-3 after discussions on the Vulnerability Flood Standards

Form MHF-2: Coastal Flood Characteristics by Return Periods

For areas subject only to coastal flooding,

A. If erosion is incorporated in the flood model, provide erosion depth grids (original grade elevation minus eroded grade elevation) corresponding to modeled 10, 25, 50, 100, 250, 500, and 1,000 year return periods.

B. Provide stillwater flood extent and depth grids corresponding to modeled 10, 25, 50, 100, 250, 500, and 1,000 year return period flood events. If the flood model incorporates erosion, include erosion effects in the flood depth grids.

C. Provide flood extent and depth grids, including overland waves and wave run-up as appropriate, corresponding to modeled 10, 25, 50, 100, 250, 500, and 1,000 year return period flood events. If the flood model incorporates erosion, include erosion effects in the flood depth grids.

D. Provide wave height grids corresponding to modeled 10, 25, 50, 100, 250, 500, and 1,000 year return period flood events.

E. If flow velocity is considered in the vulnerability functions, provide flow velocity grids corresponding to modeled 10, 25, 50, 100, 250, 500, and 1,000 year return period flood events.

F. Provide graphs and underlying data in Excel format depicting flood elevation probability distributions (include wave effects, if present) for selected locations.

G. Provide color coded maps depicting grids at selected locations. Increasing flood depths, flood velocities, and erosion shall be indicated by greater color intensity.

H. Plot the areas where the erosion depth, flood depth, or flood velocity grids are affected by flood protection system failure.

I. Provide this form in Excel format. The file name shall include the abbreviated name of the modeling organization, the standards year, and the form name. Form MHF-2 (Coastal Flood Characteristics by Return Periods) shall also be included in a submission appendix.

Form MHF-3: Inland Flood Characteristics by Return Periods

For areas subject only to inland flooding,

A. If erosion is incorporated in the flood model, provide erosion depth grids (original grade elevation minus eroded grade elevation) corresponding to modeled 10, 25, 50, 100, 250, 500, and 1,000 year return period flood events.

B. Provide stillwater flood extent and depth grids corresponding to modeled 10, 25, 50, 100, 250, 500, and 1,000 year return period flood events. If the flood model incorporates erosion, include erosion effects in the flood depth grids.

C. If flow velocity is considered in the vulnerability functions, provide flow velocity grids corresponding to modeled 10, 25, 50, 100, 250, 500, and 1,000 year return period flood events.

D. For selected locations and flood events, compare the flood model elevation probability distributions with historical floods as available data allow.

E. Provide graphs and underlying data in Excel format depicting stillwater flood elevation probability distributions for selected locations.

F. Provide color coded maps depicting grids at selected locations. Increasing flood depths, flood velocities, and erosion depths shall be indicated by greater color intensity.

G. Plot the areas where the erosion depth, flood depth, or flood velocity grids are affected by flood mitigation and prevention measures or other flood protection system failure.

For areas subject to both inland and coastal flooding,

H. Provide separate flood depth and flood velocity and erosion grids with combined coastal and inland stillwater flooding, including erosion effects if the flood model incorporates erosion.

I. Provide this form in Excel format. The file name shall include the abbreviated name of the modeling organization, the standards year, and the form name. Form MHF-3 (Inland Flood Return Periods) shall also be included in a submission appendix.