Edits to the Meteorological Hydrological Flood Standards

Flood Standards Development Committee Meeting

December 16, 2014

MHF-1, Flood Event Data Sources

Standard

AIR: **Technical/Editorial**

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

C. Annual frequencies used in both flood model calibration and flood model validation shall be ~~based upon~~consistent with peer reviewed data sources, publically developed data sources, or both types representing an unadjusted long-term record.

D. Calibration and validation shall encompass ~~all~~ relevant flood event data sources required to model flood, which shall include, but not be limited to, coastal flooding associated with storm surge, ~~flood plain~~fluvial flooding, and ~~non-flood~~pluvial plain flooding, as well as any partitions or subsets.

Purpose

AIR: **Editorial**

~~The Flood Event Data Sources cover the period [add dates]. The primary use of the Flood Event Data Sources is to both calibrate and validate modeled versus historical flood events impacting Florida. Failure to update modeled flood statistics based on changes in the Flood Event Data Sources through their latest publication dates will not be acceptable.~~

Disclosures

AIR: **Editorial**

1. Identify ~~the Flood Event Data Sources~~relevant data sources, the release dates, and the time periods used to develop and implement flood frequencies for coastal flooding associated with storm surge, flood plain flooding, and non-flood plain flooding into the flood model.

2. If the modeling organization has made any modifications to ~~the Flood Event Data Sources~~original data sources related to flood frequencies and characteristics for any aspect of coastal flooding associated with storm surge, flood plain flooding, and non-flood plain flooding, provide justification for each such modification.

4. Where the flood model incorporates short-term or long-term modification of the historical data leading to differences between modeled climatology and that in the ~~Flood Event Data~~

~~Sources~~original data, describe how this is incorporated.

Technical

5. Provide a completed Form MHF-1, Annual Flood Occurrence Rates for storm surge, fluvial flooding, and pluvial flooding by ~~County~~ region or for specified locations, which includes data for various probabilities of exceedances ~~the most recent~~ (corresponding to 5, 25, 50, and 100 year return periods). Provide a link to the location of the form [insert hyperlink here].

Audit

AIR: **Editorial**

1. The modeling organization's ~~Flood Event Data Sources~~data sources will be reviewed.

{Move Audit items 5 & 6 to MHF-3 Audit 6 & 7}

~~5. Comparisons of modeled flood probabilities and characteristics for coastal flooding associated with storm surge, flood plain flooding, and non-flood plain 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.~~

~~6. Comparisons of coastal flood extremes will be reviewed and compared with the historically determined Maximum Envelope of Winds (MEOW) database at a county level or finer.~~

{Moved from MHF-2 Disclosure 11}

5. ~~For coastal flooding associated with storm surge, d~~Describe the historical data used as the basis for the model's flood profile. Discuss the appropriateness of the model stochastic flood profiles with reference to the historical ~~coastal~~ flood databases ~~associated with storm surge~~.

{Moved from MHF-2 Disclosure 12}

6. If the historical flood data are partitioned or modified, describe how the various flood parameters and characteristics are affected.

MHF-2, Flood Parameters and Characteristics

Standard

AIR: **Technical**

B. ~~If any of the following flood parameters or characteristics are not incorporated with the type of flood being modeled, justification shall be provided:~~
   ~~1. Tidal levels,~~
   ~~2. Windfields producing storm surge (e.g., spatial and time variant distributions of wind and pressure, minimum central pressure, spatial extent of storm related winds, landfall frequency, tracks, and conversion factors),~~
   ~~3. Forward speed of tropical systems or tropical disturbances contributing to flood,~~
   ~~4. Bathymetry,~~
   ~~5. Coastal geography,~~
   ~~6. Exposure location,~~
   ~~7. Wave field properties (e.g., height, periodicity, speed, and force),~~
   ~~8. Land contours, topography, vegetation, and other natural barriers,~~
   ~~9. Commercial and consumer usages of water,~~
   ~~10. Soil type and soil saturation in the flood profile area,~~
   ~~11. Unusual and rapid accumulation or runoff of surface waters from any source,~~
   ~~12. Historical rainfall amounts and duration,~~
   ~~13. Surface water evaporation,~~
   ~~14. Flow and shape of rivers, creeks, and streams,~~
   ~~15. Duration of flood waters in an area and the time it takes for flood waters to recede,~~
   ~~16. Catchments including lakes, ponds, streams, creeks, and man-made drainage areas,~~
   ~~17. Flood control or mitigation including levees, dams, drainage ponds, diversion canals, river defenses, coastal defenses, self-closing flood barriers, and other man-made and natural measures deemed relevant by the modeling organization,~~
   ~~18. The interaction of coastal flooding associated with storm surge, flood plain flooding, and non-flood plain flooding which exacerbates water flow retrograding,~~
   ~~19. Non-flood plain characteristics associated with urban development and infrastructure, residential and rural development, and~~
   ~~20. Other hydrological factors dealing with the speed, forces, energy, weight, hydraulic roughness, and direction and movement of water or debris.~~

   Parameters used to model flooding associated with storm surge, fluvial flooding, and pluvial flooding shall be scientifically defensible.

C. Flood ~~models shall consider water height and the duration of the flood event (time needed for flood waters to recede) and water flows including wave action, rate of water flow along banks and structures, and the weight, pressure, the energy generated by moving water and its volume, and impacts of debris transported by the flow~~characteristics produced by the model will be scientifically defensible.

RMS: **Technical**

~~C. Flood models shall consider water height and the duration of the flood event (time needed for flood waters to recede) and water flows including wave action, rate of water flow along banks and structures, and the weight, pressure, the energy generated by moving water and its volume, and impacts of debris transported by the flow.~~

Jack Nicholson: **Technical**

C. Flood ~~models shall consider water height and the duration of the flood event (time needed for flood waters to recede) and water flows including wave action, rate of water flow along banks and structures, and the weight, pressure, the energy generated by moving water and its volume, and impacts of debris transported by the flow~~characteristics produced by the model shall be scientifically defensible.

Purpose:

AIR: **Editorial**

This standard requires that the modeling organization use only scientifically sound information for determining coastal flooding associated with storm surge, flood plain flooding and non-flood plain flooding parameters and characteristics. The stochastic flood event data sources shall ~~include only floods that have realistic flood characteristics~~be scientifically defensible. Any differences in the treatment of flood parameters between historical and stochastic floods shall be justified.

Flood characteristics are outputs of the flood model. ~~Examples~~ An example of a flood characteristics ~~are~~ is a modeled flood profile ~~(depth, expanse, speed and force associated with movement, and its duration) associated with flood plain flooding and non-flood plain flooding at various locations, and~~ of coastal flooding associated with storm surge ~~including weight and energy of the flood event at coast locations~~.

Characteristics associated with flood parameters ~~static water volume and dynamic flows of waters resulting from flooding~~ shall be scientifically determined and recognized in the flood model.

Disclosures:

AIR: **Technical**

~~2. Identify and justify the various flood parameters or characteristics listed in this standard which have not been used in each of the flood model components: coastal flooding associated with storm surge, flood plain flooding, and non-flood plain flooding.~~

Editorial

{Move Disclosures 8, 9 & 10 to Audit 6, 7 & 8}

~~8. For coastal flooding associated with storm surge, describe how the flood height and the force of the water, including the action of waves are calculated in the flood model.~~

~~9. For flood plain flooding, describe how the flood height and the force of the water are calculated in the flood model.~~

~~10. For non-flood plain flooding, describe how the flood height and the force of the water are calculated in the flood model.~~

{Moved Disclosures 11 & 12 to MHF-1 Audit 6 & 7}

~~11. For coastal flooding associated with storm surge, describe the historical data used as the basis for the model's flood profile. Discuss the appropriateness of the model stochastic flood profiles with reference to the historical coastal flood database associated with storm surge.~~

~~12. If the historical flood data are partitioned or modified, describe how the various flood parameters and characteristics are affected.~~

{Move the frequency distribution portion of Disclosures 13, 14 & 15 to Audit 9, 10, & 11}

~~13.~~7. For coastal flooding associated with storm surge, describe how the coastline is segmented (or partitioned) in determining the parameters for coastal flood frequency used in the flood model. ~~Provide the frequency distribution of the flood profile associated with each segment.~~

~~14.~~8. For flood plain flooding, describe how the flood plain is segmented (or partitioned) in determining the parameters for flood frequency used in the flood model. ~~Provide the frequency distribution of the flood profile associated with each segment.~~

~~15.~~9. For non-flood plain flooding, describe how the non-flood plain area is segmented (or partitioned) in determining the parameters for flood frequency used in the flood model. ~~Provide the frequency distribution of the flood profile associated with each segment.~~

Technical

~~17~~11. Describe ~~the~~ any assumptions ~~used and the~~or calculations used in the model ~~which account for evaporation, absorption, the amount of saturation, and the amount of commercial and consumer use of water~~ relating to antecedent conditions in the flood profile area.

Editorial

{Move Disclosures 19, 20 & 21 to Audit 12, 13 & 14}

~~19. Describe how storm surge is initialized in an individual storm surge calculation. In particular, describe how storm surge development is related to the storm track out to sea.~~

~~20. Provide a comparison of the storm surge calculated in the model with historical storm surge for five locations, each location from a different coastal county.~~

~~21. Provide a comparison of the storm surge calculated in the model worst case for the same five locations and compare with the NOAA *Maximum of MEOW* for each location.~~

{Moved from MHF-5 Disclosures 4 & 5}

13. As applicable, ~~D~~describe the method or methods used to account for soil infiltration rates in the flood model. Provide citations to published papers, if any, used to develop and support the soil infiltration rate methodology.

14. As applicable, ~~D~~describe the method or methods used to account for soil saturation in the flood model. Provide citations to published papers, if any, used to develop and support the soil saturation methodology.

Audit

AIR: **Editorial/Technical**

{Moved from Disclosures 8, 9 & 10}

6. For coastal flooding associated with storm surge, describe how the ~~flood height and the force of the water, including the action of waves~~relevant intensity parameters are calculated in the flood model.

7. For ~~flood plain~~fluvial flooding, describe how the ~~flood height and the force of the water~~relevant intensity parameters are calculated in the flood model.

8. For ~~non-flood plain~~pluvial flooding, describe how the ~~flood height and the force of the water~~relevant intensity parameters are calculated in the flood model.

Editorial

{Moved frequency distribution portion from Disclosures 13, 14 & 15}

9. For coastal flooding associated with storm surge, provide the frequency distribution of the flood profile associated with each coastal segment.

10. For fluvial flooding, provide the frequency distribution of the flood profile associated with each flood plain segment.

11. For pluvial flooding, provide the frequency distribution of the flood profile associated with each non-flood plain segment.

Editorial/Technical

{Moved from Disclosures 19, 20 & 21}

12. Describe how ~~storm surge~~the flood event is initialized in an individual ~~storm surge~~event calculation. ~~In particular, describe how storm surge development is related to the storm track out to sea.~~

13. Provide a comparison of the ~~storm surge~~flood footprint calculated in the model with historical ~~storm surge~~flood events for five locations, each location from a different ~~coastal~~ county.

14. Provide a comparison of the ~~storm surge~~water depth calculated in the model worst case for the same five locations and compare with the NOAA *Maximum of MEOW* for each location. The modeler should use the most reasonable vintage of the *MEOW* data for this exercise.

Editorial

{Moved from MHF-5 Audit 2 & 3}

15. Provide any modeling organization specific research performed to develop the soil infiltration rates used in the flood model. Identify the databases used. This material will be reviewed in the context of the cited scientific literature.

16. Provide any modeling organization specific research performed to develop soil saturation in the flood model. Identify the databases used. This material will be reviewed in the context of the cited scientific literature.

MHF-3, Flood Probabilities

Standard

AIR: **Technical**

B. Modeled flood frequency distributions shall ~~reflect the Flood Event Data Sources used for a specific set of return periods (and corresponding probabilities)~~be scientifically defensible and shall be consistent with flooding observed for Florida over the time frames relevant to each data source and shall be consistent with those observed for each coastal and inland segment (or partition) of Florida and in which the flood event could occur in other parts of the United States where flooding damage impacts Florida.

C. Flood models shall use ~~wave energy, storm surge height, flood penetration, and the duration and other~~pertinent characteristics of standing water prior to receding to assess severity of damage for coastal flooding associated with wind related flood events.

Jack Nicholson: **Technical**

C. Flood models shall use ~~wave energy, storm surge height, flood penetration, and the duration and other~~the force of water and other pertinent characteristics of standing water prior to receding to assess severity of damage for coastal flooding associated with wind related flood events.

Disclosures

AIR: **Technical**

2. Provide a brief rationale for the probability distributions used for ~~all~~ relevant flood parameters and characteristics.

Audit

AIR: **Technical**

2. Describe and support the method of generating stochastic storm surge, fluvial, and pluvial flood events.

Editorial

{Moved from MHF-1 Audit items 5 & 6}

6. Comparisons of modeled flood probabilities and characteristics for coastal flooding associated with storm surge, flood plain flooding, and non-flood plain 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.

7. Comparisons of coastal flood extremes will be reviewed and compared with the historically-determined Maximum Envelope of ~~Winds~~ Water (MEOW) database at a county level or finer.

MHF-4, Flood Profile Structure

Standard

AIR: **Technical**

MHF-4 Flood ~~Profile~~ Footprint Structure

A. Flood profiles generated by the flood model shall be consistent with observed historical floods affecting Florida ~~adjusted for flood mitigation and prevention measures~~.

D. The flood model shall account for ~~rising waters and the~~relevant forces ~~associated with water flow and weight~~that interact with structures.

E. ~~The flood model shall account for the duration of flood waters and the time for flood waters to recede.~~Methods for depicting all modeled flood parameters and characteristics shall be based on information documented in currently accepted scientific literature.

Jack Nicholson: **Technical**

D. The flood model shall account for rising waters and ~~the~~other relevant forces ~~associated with water flow and weight~~that interact with structures.

E. ~~The flood model shall account for the duration of flood waters and the time for flood waters to recede.~~Methods for depicting all modeled flood parameters and characteristics associated with the flood footprint structure shall be based on information documented in currently accepted scientific literature.

Disclosures

AIR: **Technical**

1. Provide visual descriptions (~~total of eleven~~sufficient to illustrate various regions in Florida) illustrating the flood profile ~~of~~for coastal and inland flooding.~~:~~
   ~~a. A coastal flooding area associated with storm surge for Florida's Panhandle, East Coast, Gulf Coast, South Florida, and Monroe County including the Keys,~~
   ~~b. A flood plain area for the regions of North Florida, Central Florida, and South Florida, and~~
   ~~c. A non-flood plain area for the regions of North Florida, Central Florida, and South Florida.~~

   ~~The visual description should illustrate each area subject to flooding prior to the flooding and various stages of flooding from initiation to maximum flooding to the flood waters receding indicating the time intervals and key statistics during the flooding process. Such statistics should include the area of flooding, volume of water, depth of water, and speed and forces of the water flow.~~

Jack Nicholson: **Technical**

1. Provide visual descriptions (~~total of eleven~~sufficient to illustrate various regions in Florida) illustrating the flood ~~profile of:~~ footprint for coastal, fluvial, and pluvial flooding.

~~a. A coastal flooding area associated with storm surge for Florida's Panhandle, East Coast, Gulf Coast, South Florida, and Monroe County including the Keys,~~
~~b. A flood plain area for the regions of North Florida, Central Florida, and South Florida, and~~
~~c. A non-flood plain area for the regions of North Florida, Central Florida, and South Florida.~~

~~The visual description should illustrate each area subject to flooding prior to the flooding and various stages of flooding from initiation to maximum flooding to the flood waters receding indicating the time intervals and key statistics during the flooding process. Such statistics should include the area of flooding, volume of water, depth of water, and speed and forces of the water flow.~~

AIR: **Technical**

2. For coastal flooding associated with storm surge, describe how the ~~wave action and their forces are calculated and used in the flood~~ model accounts for relevant forces that interact with structures.

Audit

AIR: **Technical**

4. If applicable, ~~P~~provide the collection and publication dates of the land use and land cover data and soil type data used in the flood model and justify their timeliness for Florida.

MHF-5, Modeling of Natural and Man-Made Flood Mitigation and Prevention Measures

Standard

AIR: **Technical**

MHF-5 Modeling of ~~Natural and Man-Made~~ Flood Mitigation and Prevention Measures and their Failures

A. The ~~flood~~ model's treatment of flood mitigation and prevention measures shall ~~account for levees, dams, drainage ponds, diversion canals, river defenses, coastal defenses, self-closing flood barriers, and other man-made and natural mitigation/prevention measures~~be consistent with historical records and with current state-of-the-science.

~~B. The flood model shall account for the soil infiltration rates associated with various soil types and conditions and shall be based on information documented in currently accepted scientific literature.~~

~~C. The flood model shall account for the varying nature of soil saturation including water table levels in the modeled flood zone and shall be based on information documented in currently accepted scientific literature.~~

~~D.~~B. The modeling organization shall have a documented procedure for ~~addressing the periodic review of current~~reviewing available flood mitigation and prevention ~~measures~~ data sets and shall update the flood model mitigation and prevention databases as necessary ~~in their appropriate databases used in the flood model~~.

{Moved from MHF-6}

~~E.~~C. ~~The flood model shall appropriately model~~Any treatment of the potential failure of ~~natural and man-made flood~~ mitigation or prevention measures ~~and~~ shall be based upon currently accepted scientific literature, empirical studies, or engineering analyses.

Purpose

AIR: **Technical**

This standard ensures that flood mitigation and prevention measures are accounted for and updated on a periodic basis. It also ensures that any treatment of the potential failure of natural and man-made flood mitigation or prevention measures shall properly reflect the scientific and engineering basis.

Disclosures

AIR: **Technical**

1. If applicable, ~~D~~describe the methodology ~~used~~ to account for ~~natural and man-made~~ flood mitigation and prevention measures in the flood model and indicate if these measures can be set (either to on and off) in the flood model.

2. List ~~all~~ the ~~natural and man-made~~ flood mitigation and prevention measures used in the flood model and the sources of all data employed.

3. If applicable, ~~I~~illustrate the flood profile distributions showing the impact of flood mitigation and prevention measures versus no flood mitigation and prevention measures.

AIR: **Editorial**

{Moved Disclosures 4 & 5 to MHF-2 Disclosures 13 & 14}

~~4. Describe the method or methods used to account for soil infiltration rates in the flood model. Provide citations to published papers, if any, used to develop and support the soil infiltration rate methodology.~~

~~5. Describe the method or methods used to account for soil saturation in the flood model. Provide citations to published papers, if any, used to develop and support the soil saturation methodology.~~

AIR: **Technical**

~~6~~4. ~~Describe the process for conducting the periodic review of natural and man-made flood mitigation and prevention measures.~~ 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.

{Moved from MHF-6 Disclosures 1, 2, 3 & 4}

~~1.~~5. If applicable, ~~D~~describe and justify the methodology used to account for the potential failure or alteration of ~~natural and man-made~~ flood mitigation and prevention measures in the flood model and if the level of failure can be adjusted in the flood model.

~~2.~~6. If applicable, ~~P~~provide the probability distribution for flooding scenarios incorporating the failure of flood mitigation and prevention measures.

~~3.~~7. State whether the flood model incorporates natural discharge of flood waters or 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.

~~4.~~8. If applicable, ~~D~~describe the flood loss distributions assuming no failure of ~~natural and man-made~~ flood mitigation and prevention measures compared to the flood loss distribution accounting for failure.

Audit

AIR: **Technical**

1. ~~Natural and man-made~~Treatment of flood mitigation and prevention measures incorporated in the flood model will be reviewed.

AIR: **Editorial**

{Moved Audit items 2 & 3 to MHF-2 Audit items 15 & 16}

~~2. Provide any modeling organization specific research performed to develop the soil infiltration rates used in the flood model. Identify the databases used. This material will be reviewed in the context of the cited scientific literature.~~

~~3. Provide any modeling organization specific research performed to develop soil saturation in the flood model. Identify the databases used. This material will be reviewed in the context of the cited scientific literature.~~

AIR: **Technical**

4. The documented procedure addressing the periodic ~~review and~~ updating of current flood mitigation and prevention measures will be reviewed.

{Moved from MHF-6 Audit items 1, 2, 3 & 4}

~~1.~~ 5. As applicable, ~~T~~the methodology and justification used to account for the potential failure or alteration of ~~natural and man-made~~ flood mitigation and prevention measures in the flood model will be reviewed.

~~2.~~ 6. As applicable, ~~T~~the probability distribution for flooding scenarios incorporating the failure of flood mitigation and prevention measures will be reviewed.

~~3.~~ 7. If the flood model incorporates discharge of flood waters by governmental or other human actions, the methodology used in the model will be reviewed.

~~4.~~ 8. As applicable, ~~T~~the flood loss distributions assuming no failure of ~~natural and man-made~~ flood mitigation and prevention measures compared to the flood loss distribution accounting for failure will be reviewed.

MHF-6, Modeling for the Failure of Flood Mitigation or Prevention Measures

Standard

AIR: **Technical/Editorial**

{Moved MHF-6 to MHF-5.C}

~~The flood model shall appropriately model the potential failure of natural and man-made flood mitigation or prevention measures and shall be based upon currently accepted scientific literature, empirical studies, or engineering analyses.~~

Purpose

AIR: **Technical/Editorial**

~~The flood model should appropriately adjust the probability distribution of flooding if flood mitigation or prevention measures fail or are intentionally altered. Failure of mitigation and prevention measures shall be modeled and probabilities accounted for by modeling such scenarios.~~

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

Disclosures

AIR: **Technical/Editorial**

{Moved Disclosures 1, 2, 3 & 4 to MHF-5 Disclosures 5, 6, 7 & 8}

~~1. Describe and justify the methodology used to account for the potential failure or alteration of natural and man-made flood mitigation and prevention measures in the flood model and if the level of failure can be adjusted in the flood model.~~

~~2. Provide the probability distribution for flooding scenarios incorporating the failure of flood mitigation and prevention measures.~~

~~3. State whether the flood model incorporates natural discharge of flood waters or 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.~~

~~4. Describe the flood loss distributions assuming no failure of natural and man-made flood mitigation and prevention measures compared to the flood loss distribution accounting for failure.~~

Audit

AIR: **Technical/Editorial**

{Moved Audit items 1, 2, 3 & 4 to MHF-5 Audit items 5, 6, 7 & 8}

~~1. The methodology and justification used to account for the potential failure or alteration of natural and man-made flood mitigation and prevention measures in the flood model will be reviewed.~~

~~2. The probability distribution for flooding scenarios incorporating the failure of flood mitigation and prevention measures will be reviewed.~~

~~3. If the flood model incorporates discharge of flood waters by governmental or other human actions, the methodology used in the model will be reviewed.~~

~~4. The flood loss distributions assuming no failure of natural and man-made flood mitigation and prevention measures compared to the flood loss distribution accounting for failure will be reviewed.~~

MHF-7, Logical Relationships of Flood Characteristics

Standard

AIR: **Technical**

A. The larger the area of the over water windfield, the greater the coastal flood profile area all other factors held constant.

B. The ~~rate of~~ water ~~flow~~ level shall ~~decrease~~ increase with increasing surface roughness, all other factors held constant.

~~C. The rate of water infiltration shall decrease with increasing surface roughness, all other factors held constant.~~

~~D. Increases in the rate of water absorption shall reduce the flood profile area, all other factors held constant.~~

~~E.~~C. The coastal flooding associated with storm surge shall increase with a shallow and gently sloping shoreline, all other factors held constant.

~~F. Increases in the soil saturation level shall increase the flood profile area, all other factors held constant.~~

~~G.~~D. The interaction of coastal flooding associated with storm surge and inland flooding shall increase the flood profile area, all other factors held constant.

~~H. Aboveground water flows associated and combined with underground water flows in an area shall increase the flood profile area, all other factors held constant.~~

~~I.~~E. The rate of water flow shall increase with increase in steepness in~~the steeper~~ the topography and ~~greater the~~ increase in surface slope, all other factors held constant.

F. The height of storm surge shall increase with increasing windspeeds, all other factors held constant.

~~J.~~G. The fluvial flood footprint shall increase with increasing discharge in the river.

Editorial – Reorder

A. The ~~rate of~~ water ~~flow~~ level shall ~~decrease~~ increase with increasing surface roughness, all other factors held constant.

B. The interaction of coastal flooding associated with storm surge and inland flooding shall increase the flood profile area, all other factors held constant.

C. The rate of water flow shall increase with increase in steepness in~~the steeper~~ the topography and ~~greater the~~ increase in surface slope, all other factors held constant.

D. The larger the area of the over water windfield, the greater the coastal flood profile area all other factors held constant.

E. The coastal flooding associated with storm surge shall increase with a shallow and gently sloping shoreline, all other factors held constant.

F. The height of storm surge shall increase with increasing windspeeds, all other factors held constant.

G. The fluvial flood footprint shall increase with increasing discharge in the river.

Form MHF-1: Annual Flood Occurrence Rates by County

AIR: **Technical**

A. Provide annual ~~historical and modeled~~ flood occurrence rates for storm surge, fluvial, and pluvial flooding by region or for specified locations, which includes data for various probabilities of exceedance ~~the most current~~ (corresponding to 5, 25, 50, and 100 year~~s~~ return periods) ~~of data for each County in the entire state of Florida~~. Annual flood occurrence rates shall be rounded to four decimal places.

C. Provide vertical bar graphs depicting distributions of flood frequencies ~~by Florida County~~.

D. Provide a color coded map ~~by County~~ with a legend displaying the flood frequency ranges. Increasing flood frequency shall correspond to greater color intensity.

EQECAT: **Technical**

A. Provide annual historical ~~and modeled~~ flood occurrence rates for the most current 5, 25, 50, and 100 years of data and modeled flood occurrence rates for each County in the entire state of Florida. Annual flood occurrence rates shall be rounded to four decimal places.

Form MHF-2: Maps of Flood Profiles by Return Period

AIR: **Technical**

A. Identify six recent historical Florida floods ~~with return periods of 10, 25, 50, 75, 100, 250, 500, and greater than 500 years for each of the following:~~ that illustrate coastal flooding associated with storm surge, ~~flood plain~~fluvial flooding, and ~~non-flood plain~~pluvial flooding (two events for each type).

B. Provide ~~color contour maps~~exhibits for the selected historical flood events illustrating modeled return periods for different river or coastal segments. ~~associated with each 10, 25, 50, 75, 100, 250, 500, and greater than 500 year return periods for:~~

~~1. Coastal flooding associated with storm surge,~~

~~2. Flood plain flooding, and~~

~~3. Non-flood plain flooding.~~

Plot the locations and numerical measures of the maximum flood level relative to the local datum for ~~by the level of~~ storm surge, ~~for coastal areas or the level above river flood stage for~~ flood plain, ~~areas~~ or ~~the level above the sea level elevation for~~ non-flood plain areas on each contour map for the six historical events.

C. Demonstrate the consistency of the spatial distribution of model-generated flood profiles with observed flood profiles for~~For coastal flooding associated with~~ storm surge, fluvial, and pluvial floods affecting Florida. ~~provide static color maps of the maximum area flood profiles that match the above five locations of the historical 10, 25, 50, 75, 100, 250, 500, and greater than 500 year return periods. Plot the locations and numerical measures of the maximum flood level by the level of storm surge on each contour map.~~ Contour colors will be the same as those used for the maps provided in response to B~~.1~~ above.

~~D. For flood plain flooding, provide static color maps of the maximum area flood profiles that match the above five locations of the historical 10, 25, 50, 75, 100, 250, 500, and greater than 500 year return periods. Plot the locations and numerical measures of the maximum flood level by the level above river flood stage on each contour map. Contour colors will be the same as those used for the maps provided in response to B.2 above.~~

~~E. For non-flood plain flooding, provide static color maps of the maximum area flood profiles that match the above five locations of historical 10, 25, 50, 75, 100, 250, 500, and greater than 500 year return periods. Plot the locations and numerical measures of the maximum flood level by the level above the sea level elevation on each contour map. Contour colors will be the same as those used for the maps provided in response to B.3 above.~~

F. Explain any differences between the modeled flood profiles and the historical flood profiles identified in item A. above. Include an explanation if the differences are impacted by flood mitigation and prevention measures.