Mission Modeling Overview

US Army Corps of Engineers®

Questions, comments, and suggestions related to this overview are encouraged. For more information, please contact the U.S. Army Corps of Engineers, Office of Homeland Security, Civil Emergency Management, 441 G Street NW, Washington, DC 20314-1000.

Edward J. Hecker
Chief, Office of Homeland Security
U.S. Army Corps of Engineers

OV-01-2007-007

June 2007

Mission Modeling Overview

Introduction

Through the use of geospatial tools, the USACE provides estimates of possible debris volumes, needs for water and ice commodities, number of people and households likely within hurricane force winds, and possible temporary roofing and temporary housing needs beginning approximately three days prior to a forecasted hurricane landfall. Model estimates are developed and posted on ENGLink (internal and public) and distributed via email. Timing of the release of model results is dependent on the National Hurricane Center (NHC) forecast times, the speed of a storm and estimated time of landfall. The models are applicable for the US East Coast and Gulf Coast.

The mission models are run for Category 1 hurricanes or greater. The first model runs are made approximately three days before landfall, however the last model runs may be days after landfall and may be a reduced suite of model runs and model outputs.

About three days before landfall, possible landfall locations impacting major population centers and/or critical areas in the zone of potential landfall will be modeled. These model results provide managers and responders with a first look at the potential severity of a storm of interest. Similar information will be developed about two days before landfall. These models are intended to set the "scale and scope" of the storm event, but are still general in nature due to the uncertainties possible for any storm at this stage.

Models for debris, ice and water commodities, temporary roofing and temporary housing are created on or before 1200 Coordinated Universal Time (UTC) and 2000 UTC starting about one day before landfall for only the most probable (NHC) landfall scenario. These models will continue to be run as storms continue toward landfall, at intervals that vary due to storm speeds. The additional models will be run as appropriate to provide guidance of possible storm effects as the direction and/or intensity of a storm changes. With each storm event, information on the number of persons and the number of households that may be within the envelope of hurricane force winds will also be provided. Post-landfall models will be created as soon after landfall as information is available. The final ENGLink posting of models will be within one day after landfall with a target time of 1200 UTC. All model results are presented as values for counties (or parishes in Louisiana) for ease of visualization and for responders use in working with local governments. These models are currently run in ESRI ArcView 3.x and are being re-written to operate in ESRI ArcGIS 9.x.

Model Input Databases

Each of the mission models rely on a series of census tract level pre-built databases that include data regarding population, households, vegetation and commercial density. These databases are maintained with the most current information available. Census tracts chosen as counties were considered too "coarse" of a unit for estimating the storm effects. Census tracts are much smaller, typically an area that includes 4,000 to 10,000 persons. Census blocks were examined as an alternative and even smaller set of input polygons, but testing determined that the additional detail available did not create any improvement in model results and a significant time penalty was obvious due to increased computations required.

Data regarding population and households are based on Census 2000 values and have been updated to 2006 estimates. The recent updates were based on the US Census Bureau county-level estimates of population and households as of June 1, 2005, and the changes from June 1, 2000

were applied uniformly to all tracts in each county. Data regarding population and households following areas significantly affected by hurricanes in 2005 have been modified based on best available information as of June 1, 2006.

Vegetation data have been updated as of June 1, 2006 to account for normal changes that occur in vegetation patterns due to land use changes and past storm effects. A major new addition to the vegetation includes a modifier to address counties that have significant roadway mileage with a low population density. A sliding scale was developed so that heavily vegetated counties with many miles of roads and low population are better represented in debris modeling.

The commercial density database is influenced by population and households data, the consideration is in part that more people require or demand more services and associated facilities. This database is used in the modeling effort to account for debris that is likely to be generated from non-residential sources.

Additional databases that are used in the event modeling process include critical facilities such as hospitals, police stations, fire stations, schools, potable water treatment plants and wastewater treatment plants. No attempt is made to estimate damage to any of these facilities individually or collectively, rather it is a means to highlight the number of each type of critical infrastructure that might be at risk.

Storm Specific Databases

For each storm and each model run, a unique dataset is developed to characterize the possible spatial distribution of winds from sub-hurricane force winds (generally greater than 60 miles per hour, but less than 74 miles per hour – referred to here as Category 0) to the highest hurricane force winds expected. One polygon is created to spatially include areas expected to receive sub-hurricane force winds and a single polygon is also created to spatially include Category One winds. Category Two and higher winds can be subdivided into multiple polygons to better capture the differences in damage that can be expected within a wind "category". As these polygons are created, the associated database is populated with a numeric factor that is used in the calculation of expected debris. These wind polygons may be used in the calculation of commodity needs in the absence of data regarding expected or known power outages.

Similarly, for each storm and each model run, a unique dataset is developed to characterize the possible spatial distribution of storm related rainfall. This information is used in the assessment of possible debris and attempts to capture the role precipitation plays in influencing the amount of vegetative debris that may result (saturated soils aiding in whole trees falling as compared to limbs falling) and also in the assessment of household and commercial debris.

For each storm and each model run, a unique dataset can be added describing power outages for estimation of ice and water commodity needs. This dataset substitutes for the generally less specific wind polygons. Outage data can be either estimated pre-event conditions or actual outages reported following landfall. Outage percentages can be assigned as needed by specific polygons based on census tracts, zip codes, political subdivisions or utility unique service areas.

Mission Modeling Overview

For each storm and each model run, a unique dataset can be added describing storm surge which is used primarily in the estimation of debris volumes. Numeric factors are added to the various estimated surge depths for estimation of debris. If the storm surge module is included, the debris value reported is the sum of wind generated debris and storm surge generated debris.

USACE model outputs can be viewed at www.englink.usace.army.mil for this storm season. Terry.S.Siemsem@lrl02.usace.army.mil is the point of contact for the models.