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 National Ocean Service

Subject: Implementation of New Extratropical Surge and Tide Operational Forecast System (ESTOFS) for Micronesia: Effective February 13, 2018

Effective February 13 2018, beginning at 1200 Coordinated Universal Time (UTC), the Extratropical Surge and Tide Operational Forecast System for the Oceania sub-region of Micronesia (ESTOFS Micronesia) will be implemented on NOAA's Weather Climate Operational Supercomputing System (WCOS) operated by the National Centers for Environmental Prediction (NCEP) Central Operations (NCO). The ESTOFS Micronesia model output provides coverage of the Western Tropical Pacific, including the Federated States of Micronesia, Palau, Marianas Islands, Marshall Islands, and Wake Island. The system will provide users with nowcasts (analyses of near present conditions) and forecast guidance of water level conditions. The forecast outputs will extend out to 180 hours and will include water levels caused by the combined effects of storm surge and tides, by astronomical tides alone, and by sub-tidal water levels (isolated storm surge).

The hydrodynamic model employed by ESTOFS is the Advanced Circulation Model (ADCIRC) finite element model. ADCIRC was developed to perform high-resolution simulations of time-dependent, free surface circulation and transport problems in two and three dimensions. ESTOFS uses the Two-Dimensional Depth Integrated (2DDI) version of ADCIRC, which computes the water surface elevation and barotropic depth-averaged currents. ADCIRC uses the finite element method in space, taking advantage of highly flexible, irregularly spaced grids.

The unstructured grid used by ESTOFS Micronesia consists of 234,333 nodes and 462,967 triangular elements. Nearshore coastal resolution is about 200m, and overland resolution extends to the 10m topographic height. The open-ocean boundary surrounds the entire domain, where harmonic tidal constituents from the global tidal model TPXO 7.2 are used to specify tidal water surface fluctuations, while tidal potential forcing is applied within the interior of the domain. The performance of this grid for astronomical tides was verified using tidal elevation data from observation stations located throughout the domain.

ESTOFS is designed to provide water surface elevations caused by storm surge and astronomical tide to the NCEP WAVEWATCH III (WW3) wave model for coupling wave and water level predictions. ESTOFS setup is designed to mimic the WW3 model. It uses the same Global Forecast System (GFS) atmospheric forcing (ESTOFS applies 10m wind speeds and sea level pressure from the GFS Semi-Lagrangian T1534). It also has the same forecast cycle (four times per day concurrent with GFS), length (6-hour nowcast followed by a 180-hour forecast), and both will run concurrently.

ESTOFS output files are provided in two formats, structured gridded binary version two (GRIB2) files for the North Pacific (10.0 km resolution) and Guam (2.5 km resolution) grids, and unstructured NetCDF files on the native ESTOFS finite element grid. NetCDF output is also provided at station locations and warning points located near major populated islands.

Operational forecast guidance from ESTOFS Micronesia will be available in the netCDF and GRIB2 files described below via NCEP Web Services:

<http://www.ftp.ncep.noaa.gov/data/nccf/com/estofs/prod>
<http://nomads.ncep.noaa.gov/pub/data/nccf/com/estofs/prod>
<ftp://ftp.ncep.noaa.gov/pub/data/nccf/com/estofs/prod>

Where the directory is estofs_mic.YYYYMMDD (YYYYMMDD is year, month and day)

GRIB2 files are created for each hourly prediction during a forecast cycle, consisting of records of combined water level (surge with tide), harmonic tidal prediction (astronomical tides), and sub-tidal water levels (the isolated surge).

estofs.mic.tCCz.AAAA.ffff.grib2 Where FFF is forecast hour (000-180)
estofs.mic.tCCz.AAAA.htp.grib2
estofs.mic.tCCz.AAAA.swl.grib2
estofs.mic.tCCz.AAAA.cwl.grib2
Where CC is the cycle (00, 06, 12, 18), AAAA is area (guam, northpacific).

NetCDF files contain an entire nowcast/forecast cycle and consist of the hourly combined water level over the native ESTOFS grid, or six-minute water level records at station locations and warning points.

estofs.mic.tCCz.fields.cwl.nc
estofs.mic.tCCz.points.cwl.nc
estofs.mic.tCCz.points.htp.nc

ESTOFS provides Standard Hydrometeorological Exchange Format (SHEF) E format output at station locations. SHEF files contain 30-minute combined water level (surges with tides), harmonic tidal prediction (astronomical tides), and sub-tidal water levels (the isolated surges).

estofs.mic.tCCz.points.cwl.shef
estofs.mic.tCCz.points.htp.shef
estofs.mic.tCCz.points.swl.shef

Advanced Weather Interactive Processing System (AWIPS) Product Additions:

World Meteorological Organization (WMO) Headers are as follows:

- SHEF Harmonic Tidal Prediction: SXUS01 KWBM TIBEM
- SHEF Combined Water Level: SXUS02 KWBM TIBEM
- SHEF Sub-tidal Water Levels: SXUS03 KWBM TIBEM

Users will also be able access maps of the ESTOFS Micronesia guidance from the NOAA nowCOAST map service:

<http://nowcoast.noaa.gov>

(Where "guidance_model_coastalocean_estofs_time" is the selectable target) using two different protocols:

ArcGIS Representational State Transfer (REST) Map Service
OGC Web Map Service (WMS)

In addition, users will also be able to view the guidance via the nowCOAST map viewer.

A consistent parallel feed of data is available on the NCEP HTTP site at the following URL:

<http://para.nomads.ncep.noaa.gov/pub/data/nccf/com/estofs/para/>

Any questions, comments, or requests regarding this implementation should be directed to the contacts below. We will review any feedback and decide whether to proceed.

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National Service Change Notices are online at:

<https://www.weather.gov/notification/archive>

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