NOAA's Global Extratropical Surge and Tide Operational Forecast System (Global ESTOFS)

Supporting Coastal Resilience and Navigation Services

NOAA/National Ocean Service (NOS) Storm Surge Modeling Team Greg Seroka, Yuji Funakoshi, Michael Lalime, Panagiotis Velissariou, Soroosh Mani, Zachary Burnett, Georgios Britzolakis, William Pringle, Saeed Moghimi, Edward Myers





The Joint IHO-Singapore Innovation and Technology Laboratory Launch and Webinar Series on Integrated Marine Geospatial Information Management 26 – 29 OCTOBER 2021

It takes a village to raise a child...

Academic partners (>20 PIs, Scientists, Postdocs and PhD students)

- University of Notre Dame
- University of North Carolina at Chapel Hill
- Virginia Institute of Marine Science
- Argonne National Laboratory
- National Center for Atmospheric Research
- Texas Advanced Computing Center
- Columbia River Inter-Tribal Fish Commission
- Louisiana State University
- Sandia National Laboratories
- University of Massachusetts Dartmouth
- Cooperative Institute for Great Lake Research
- Oregon State University

International partners

- Helmholtz-Zentrum Hereon, Germany
- Laboratório Nacional de Engenharia Civil, Portugal
- European Commission Joint Research Centre, Belgium
- International Hydrographic Organization
- United Nations

NOAA and agency partners

- National Ocean Service
 - The U.S. Integrated Ocean Observing System
 - o Center for Operational Oceanographic Products and Services
 - National Geodetic Survey
- National Weather Service
 - o Office of Science and Technology Integration
 - Environment Modeling Center
 - o Office of Water Prediction
- Oceanic and Atmospheric Research
 - o Great Lakes Environmental Research Laboratory
- U.S. Geological Survey
- U.S. Environmental Protection Agency

Industrial and cooperative partners

- UCAR
- Spatial Front Inc
- Axiom

NOS Storm Surge Modeling Team - Products and Services

Operational

 Global Extratropical Surge and Tide Operational Forecast System (ESTOFS-Global)

Pre-operational (R2O)

 Inland-Coastal Flooding Guidance System (ESTOFS-3D)

Research and development (R&D)

- COASTAL Act: Name Storm Event Model (NSEM)
- Hurricane Storm Surge On-Demand (HSOFS)
- Enhancing Northern Pacific Ocean Modeling
- On-demand unstructured mesh generation



Pre-operational once-day STOFS-3D (SCHISM based) Hurricane Ida (Aug 2021)

NOA

IENT OF

NOAA's Global ESTOFS: Storm Surge and Tides

Overview:

- ESTOFS is a global ocean model used to predict storm **surge** and **tides**, called "storm tide".
- It is the world's highest resolution operational global surge model.
- ESTOFS outputs are an important source of information for coastal resilience (e.g. storm surge) and navigation safety (e.g. tides).



Diagrams showing components of storm tide: tides (top) and storm surge (bottom)

Global ESTOFS Description



NOAF

End users of Global ESTOFS

• Storm surge forecasters, e.g.

- NOAA Weather Forecast Offices (WFOs) to generate flood forecasts during winter storms
- NOAA Ocean Prediction Center (OPC) for operational extratropical coastal storm surge forecasts



• Mariners, e.g.







How to access Global ESTOFS results



nowcoast.noaa.gov

Screenshot of Global ESTOFS storm surge forecast guidance for Pacific region displaying nowCOAST's map viewer



NWS NOMADS: https://nomads.ncep.noaa.gov/

How to access Global ESTOFS results





aws

Registry of Open Data on AWS

NOAA Global Extratropical Surge and Tide Operational Forecast System (Global ESTOFS)

stal disaster response environmental global meteorological oceans sustainability water weather

Description

NDAX Global Extratopical Surge and Tide Operational Process System (Global ESTOFS) provides users with novascial chanjase of near present conditions) and forecast guidance of water level conditions for the entire globa. Global ESTOFS has been developed to surve the marken enarylation, wather forecasting, and disater mitigation user communities. Global ESTOFS was developed in a collaborative effort between the NDAA/National Coares Brovice (NDS)/OHC or Coars Survey, the NDAA/National Wather Service (NWS)/National Centers for Environmental Prediction (NECP) central Operations (NCO), the University of Notrh Canolina, and The Water Institute of the Guit. The model generates forecasts out to 180 hours four times enday forecast output includes water levels caused by the combined effects of storm surge and tides, by astronomical tides alone, and by sub-tidal water levels flobaled toffs musice.

The hydrodynamic model employed by Global ESTOFS is the ADvanced CIRCulation (ADCIGC) finite element model. The model is forced by GS winds, mean sale level pressure, and sale isc. The unstructured grid used by Global ESTOFS consists of 8.05,4309 nodes and 15.478,900 triangular elements. Costal resolution is up to 80 m for Hawaii and the U.S. West Coast; up to 90-720 m for the Pacific Islands including Gaum, American Samo, Marianas, Wake Island, Marshall Islands, and Palua; and up to 120 m for the U.S. East Coast; up to 90-720 m for the VacIfic Islands including stends overland to approximately of melvation ASI for the U.S. East Coast and up to 20 m elevation ASI. For the Pacific Islands, Global ESTOFS a) reduces bias and errors due to the removal of the open coarse hourdnism that were included in previous ESTOFS regional domains (ESTOFS-Atlantic, -Pacific, -Micronesia); b) includes internal de-induced displantion in the deep oncear; lo includes asic effect on wind drag, and d) incorporates a bias correction using 2-day average water level observations from Co-OPS tide stations that are interpreted spatially across the Global ESTOFS meth.

Resources on AWS

Description NOAA Global ESTOFS Water Level Forecast Guidance

Resource type S3 Bucket

Amazon Resource Name (ARN) arn:aus:s3:::noaa-gestofs-pds

AWS Region us-east-1

AWS CLI Access (No AWS account required) aws s3 ls s3://noaa-gestofs-pds/ --no-sign-request

Explore Browse Bucket

Description

NOAA Global ESTOFS Water Level Forecast Guidance New Dataset Notification

Resource type SNS Topic

Amazon Resource Name (ARN) arn:aws:sns:us-east-1:123901341784:NewGESTOFSObject

AWS Region

us-east-1

registry.opendata.aws/noaa-gestofs

Screenshot of Global ESTOFS output on Amazon cloud (AWS) via NOAA Big Data

https://cera.coastalrisk.live/

(Username: nos.surge@noaa.gov Password: nos.surge) Screenshots of Global ESTOFS storm surge forecast guidance (zoomable)

Hurricane Ida (August 2021)







CERA: Hurricane Ida (2021)

Storm surge (disaster mitigation use)

Map data ©2021 Imagery ©2021 TerraMetrics Terms of Use Report a map error





https://cera.coastalrisk.live/

(User: nos.surge@noaa.gov Password: nos.surge)

Screenshot of Global ESTOFS storm surge forecast guidance (zoomable)

CERA: Tides near Singapore

Tides (marine navigation use)





https://cera.coastalrisk.live/

(User: nos.surge@noaa.gov Password: nos.surge)

Screenshot of Global ESTOFS storm surge forecast guidance (zoomable)



Thank you!

Global ESTOFS contacts

Michael.Lalime@noaa.gov Gregory.Seroka@noaa.gov

Saeed.Moghimi@noaa.gov