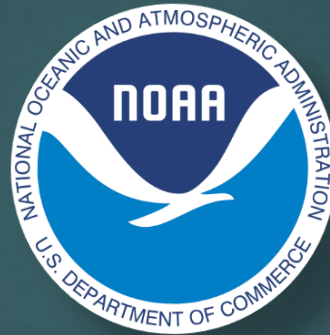


U.S. National Ocean Service S-111 HDF5 Encoding Update

NOAA/NOS/OCS/CSDL



IHO TWCWG4, 08-11 April 2019

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NOS/OCS/Coast Survey Development Lab (CSDL)

S111 Operational Project

Objective

- Establish S-111 operational encoding program and experimental dissemination service for S-111 HDF5 – Type2 Files for testing by Commercial partners

Overview

- The program is written in Python 3.6 using a variety of open source libraries (h5py, netCDF4, shapely, gdal, scipy, numpy), running in real-time on an NOS/Office of Coast Survey (OCS) Linux Server
- Current Data Source : NOAA/NOS Operational Forecast Systems (OFS)
NOAA/NOS Operational Forecast Systems(OFS), consisting of an automated integration of near-real-time data from observing systems and 4-D hydrodynamic modelling systems, provides near nowcasts and short-term oceanographic forecast guidance for a distinct coastal or lake region throughout the U.S.
- Current Dissemination Site: NOS/Office of Coast Survey FTP
FTP: ftp://ocsftp.ncd.noaa.gov/OFS_Data

US S-111 Encoding Dissemination Update

Currently producing experimental S-111 Edition 1.0.0 & S-100 Edition 4.0.0 compliant S-111 HDF5 Type 2 files for:

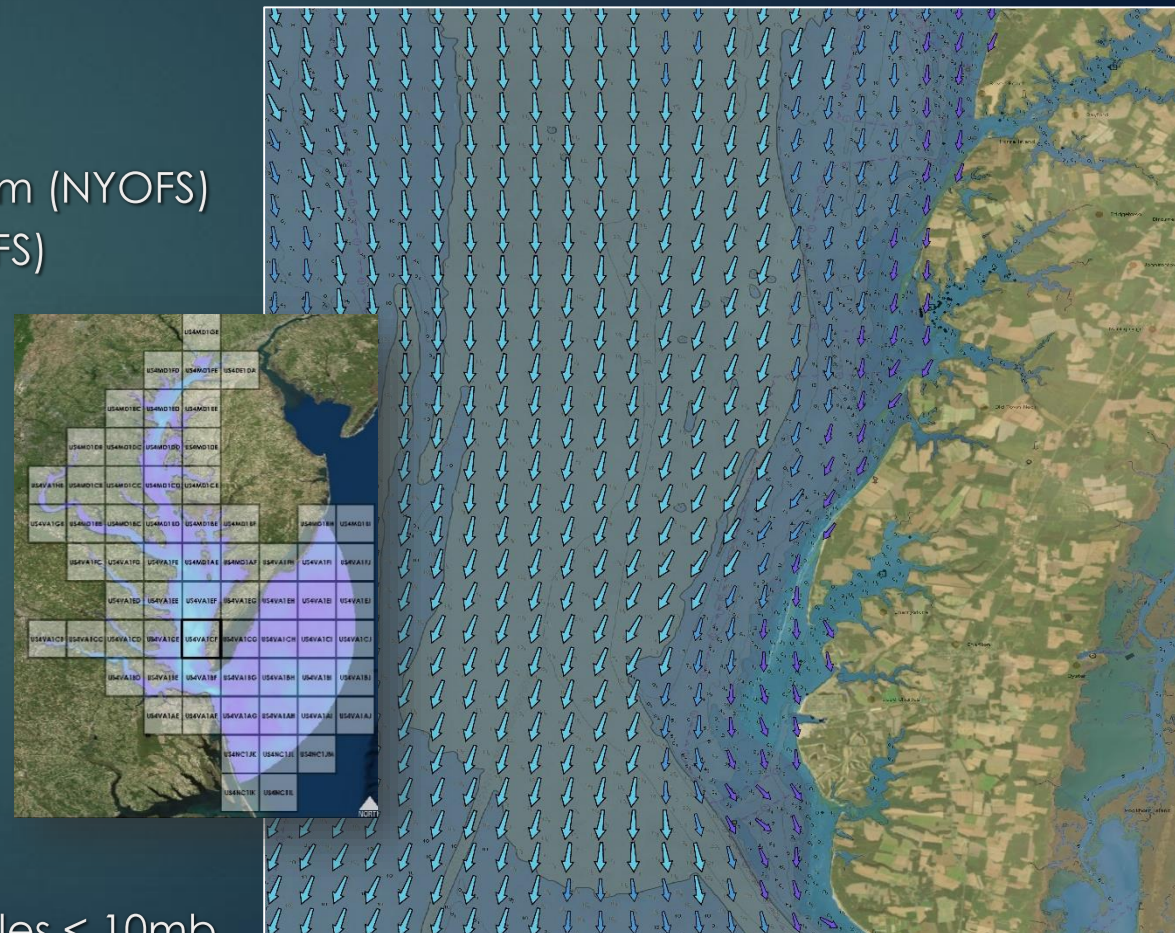
- Chesapeake Bay Ocean Forecast System (CBOFS)
- Delaware Bay Ocean Forecast System (DBOFS)
- Port of New York & New Jersey Ocean Forecast System (NYOFS)
- NCEP Global Real-Time Ocean Forecast System (RTOFS)

S-111 File	Horizontal Resolution	Current Depth	Maximum Forecast Time
CBOFS	500 m	4.5 m	48 hr
DBOFS	500 m	4.5 m	48 hr
NYOFS	500 m	4.5 m	54 hr
RTOFS	8.5 km	4.5 m	72 hr

Splitting output into multiple S-111 files to match NOS

Reschemed ENC digital chart cells and produce S-111 files < 10mb

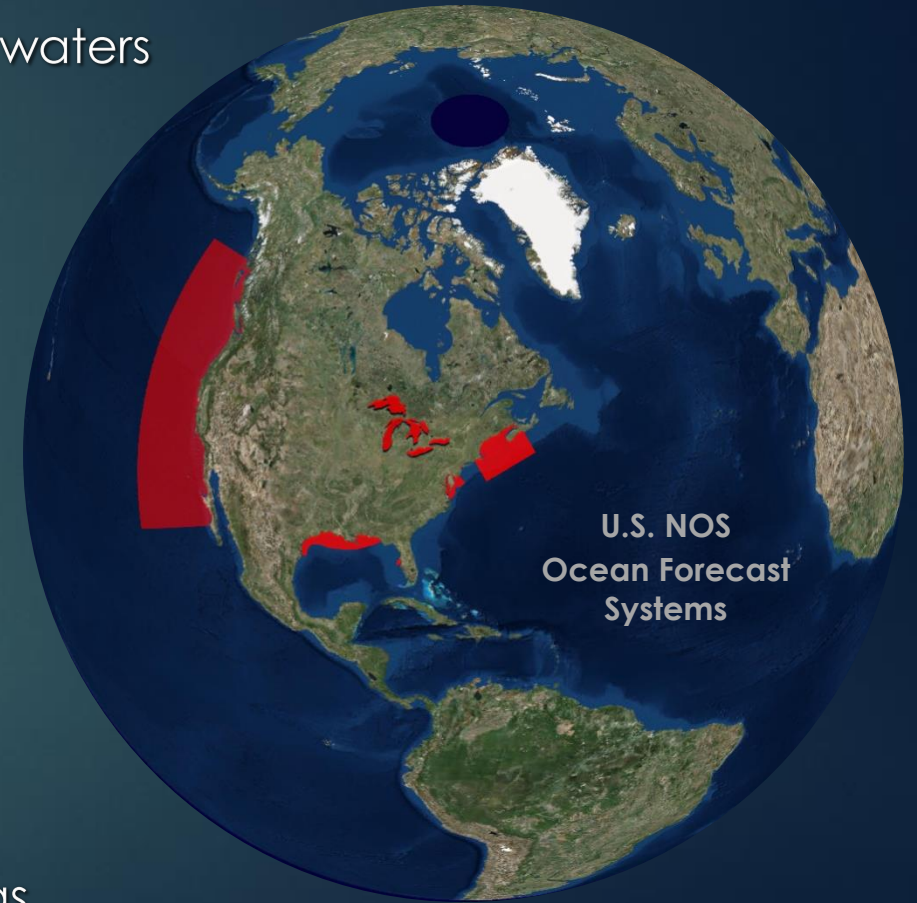
S111US_CBOFS_20181203T00Z_TYP2_US4VA1CF.h5



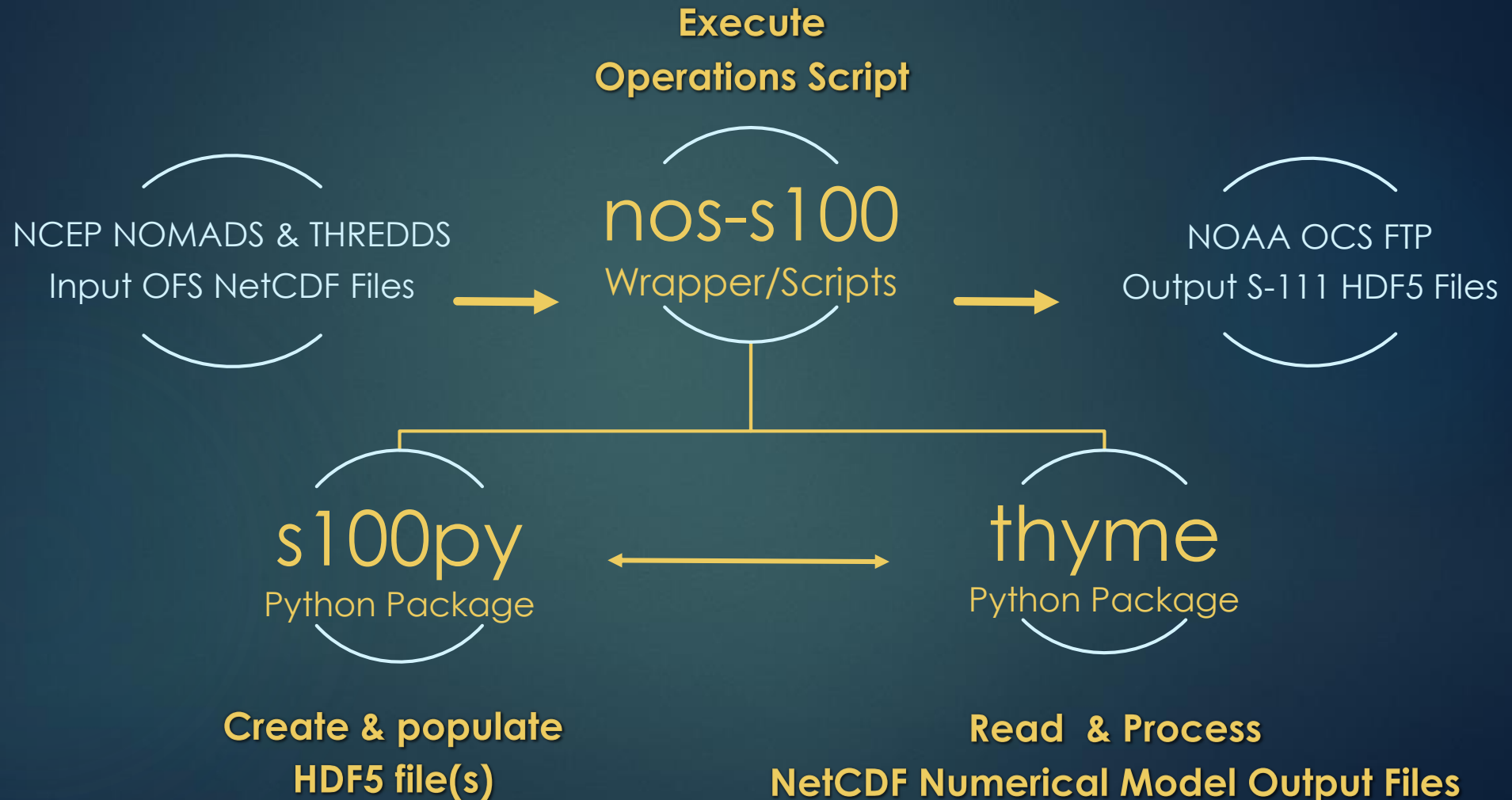
Disseminating 63 CBOFS S-111 Files 4x/Day

S-111 Encoding Python Program Update

- Supports NOS ROMS, FVCOM, POM, HYCOM-based models
- Supports 16 NOS Operational Forecast Systems for U.S. coastal waters
- Supports S-111 Type 1, 2, 3, 4 production
- Supports horizontal output at any resolution, automatically generates a regular grid definition corresponding with model extent
- Vertical interpolation to any depth within water column
- Supports chopping output into multiple sub-grid extents, i.e. S-111 tiles
- Given a shoreline shapefile, output grid will mask out land areas
- Improved Interpolation processing times reducing overall run time



NOS/CSDL S111 Encoding Operations

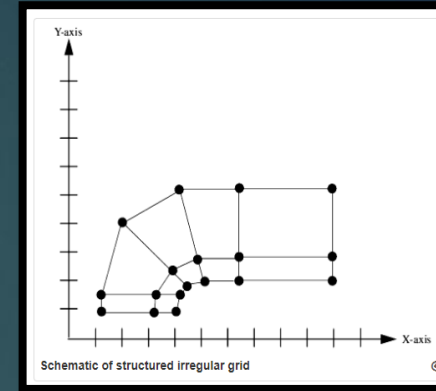


Processing Numerical Ocean Models

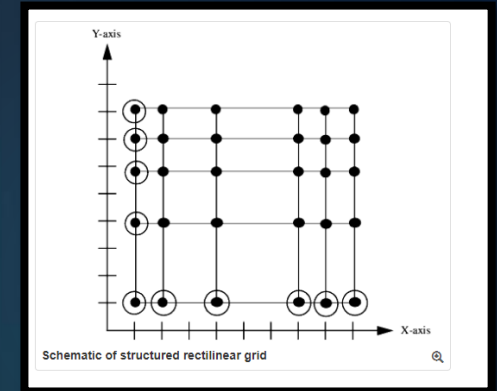
Python modules are developed specifically for each numerical ocean modeling framework and customized to support nuances specific to U.S. NOS numerical operational forecast systems

Things to consider:

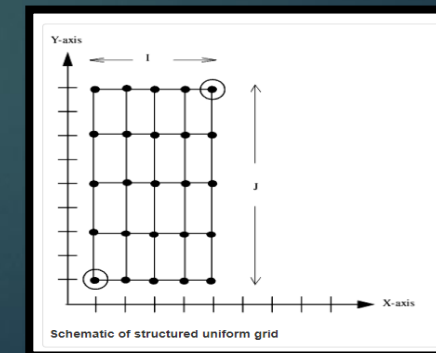
- Horizontal and vertical coordinate grid type
- Staggered u/v coordinates may require averaging to common coordinates and/or rotation to true North/East
- Variables may not have masks, mask may vary horizontally/vertically
- Depth values positive up or down
- How time variables are stored, calendar, time zone, forecasts per file



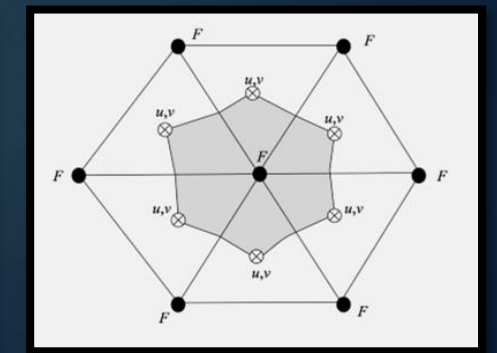
Curvilinear
(Irregular)



Rectilinear Grid (Irregular)
Axes are orthogonal, but the spacing around the elements are not equal



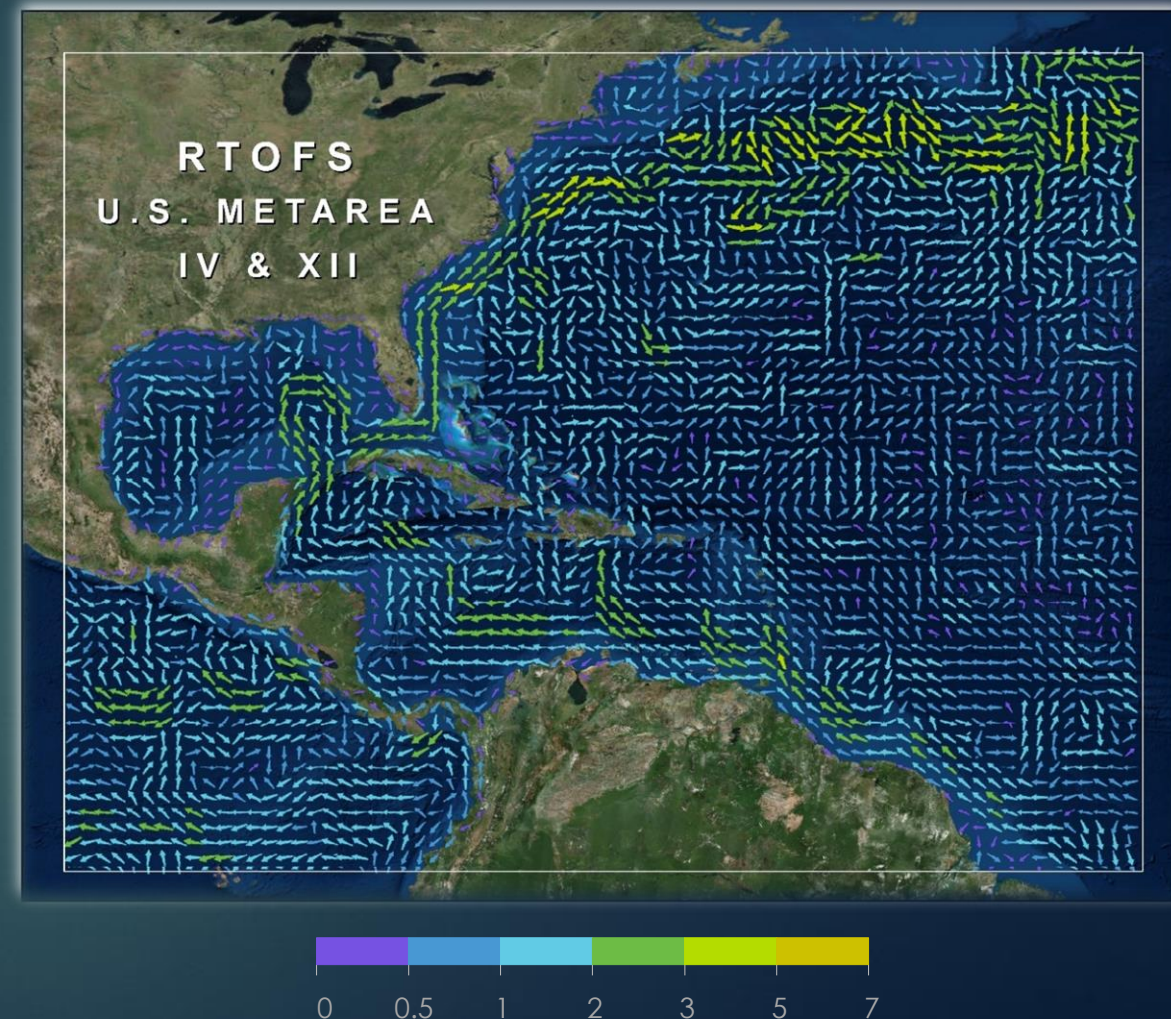
Uniform Grid
(Regular)



Unstructured Grid (Irregular)
An unstructured triangle is comprised of three nodes, a centroid, and three sides

Next Steps

- Distribute python packages on GitHub
- Add support for OFS models with wet/drying masks
- Add support for SELFIE- and ERDC-based models
- Add support for S100/S111 Exchange Package
- Dockerize python framework for easier deployment
- Migrate production of S-111 files for all 16 NOS OFS to commercial cloud infrastructure (e.g. AWS)



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- CSDL Team

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- NOAA/NOS nowCOAST Project – <https://nowcoast.noaa.gov>

