Sea Level Scenario Sketch Planning Tool
SLR Calculator Version 1.5.2 Exercise:
Creating GIS Layers of SLR Inundation

Software Requirements

ESRI ArcGIS Desktop 10.1 or 10.2.2, with Spatial Analyst

Step 1: Download and Install the Calculator

A. Download the Calculator

For this exercise, download calculator and test data from GeoPlan's FTP site:
ftp://ftp.sls.geoplan.ufl.edu/pub/sls/demo/calc_v152_demo.zip

B. Install the Calculator

Navigate to the location of the downloaded file. Then choose one of the install methods below. Note: If you have installed a previous version of the calculator, use Method 2 (Manual Installation). Once you open the Add-In Manager, delete the old SLR calculator add-in before installing the new one.

Method 1: Automatic Installation (using ArcGIS Add-In Installation Utility)

1. Unzip calc_v152_demo.zip
2. Double-click the SLR Calculator .esriaddin File
3. Start ArcMap
4. Add "SLR Toolbar" (Customize --> Toolbars --> Check "SLR ToolBar")
5. Click SLR Calculator button on toolbar to open application window

Method 2: Manual Installation Method

1. Unzip calc_v152_demo.zip
2. Open ArcMap
3. Click "Customize" on menu bar
4. Click "Add-In Manager"
5. Select Options Tab
6. Click Add Folder "Add Folder" and browse to folder location of unzipped .esriaddin
7. Select Add-Ins Tab Choose SLR Surface Calculator and Click Customize
8. Check "SLR Toolbar" and Close
9. Click SLR Calculator button on toolbar to open application window

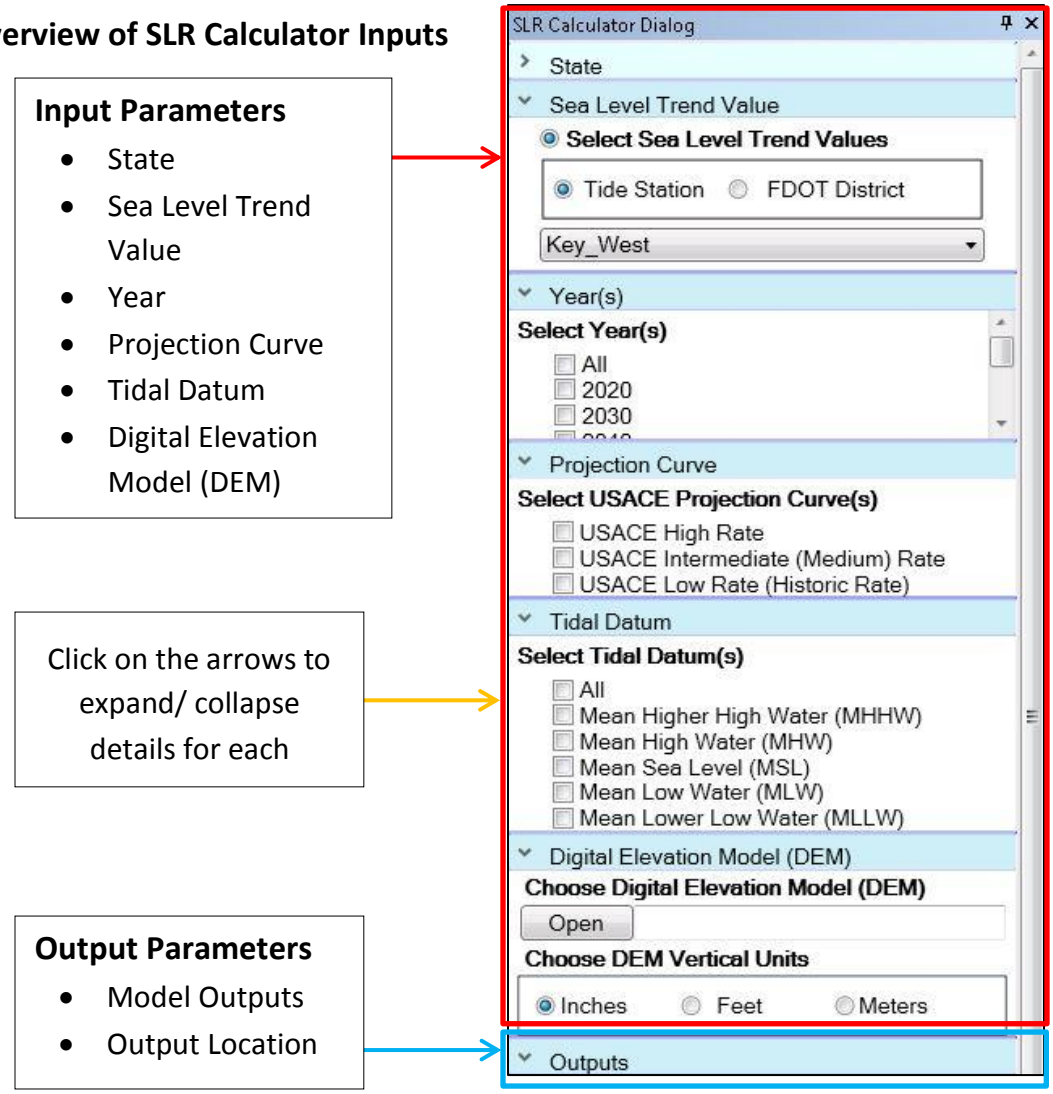
C. DEM Test Data

A File geodatabase (FGDB) with a DEM of Key West was included in the download. If the FGDB is not in a desired location, then copy it now. You will use the Key West DEM in this exercise.

Step 2: Choosing Input Parameters

Six input parameters and two output parameters are required to run the calculator. The input parameters define the Sea Level Scenario(s) for which you are creating inundation layers.

Overview of SLR Calculator Inputs



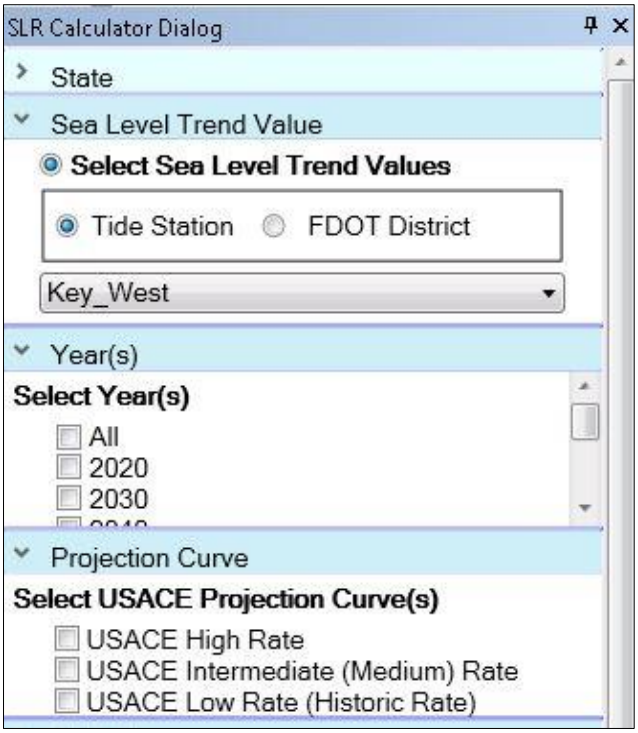
A. Choose Input: State

Select the State in which you want to create inundation surfaces. This version of the calculator only includes data for Florida and the default is Florida, so you can skip this input.

B. Choose Input: Sea Level Trend (SLT) Value

User can choose one of the following for SLT values: Tide Station or FDOT District.

For this exercise, choose Tide Station and then Key_West from the dropdown menu.



Tide Station: Choose a NOAA tide station to use the sea level trends and water levels associated with that tide station. Only one tide station can be chosen at a time. There are 14 stations available to choose; each has a long-term data records for calculation of SLT.

FDOT District: User can choose a SLT trend value for each FL Dept of Transportation District. These values were calculated using an average weighted mean method to average data from multiple tide stations closest to each District. For technical methods, see the Phase 1 Final report on project website: sls.geoplan.ufl.ed

C. Choose Input: Year

Select one of more decades for which inundation surfaces will be created. Decades 2020 – 2100 are available. Checking "All" will select all decades. For each decade selected, one layer will be created.

For this exercise, choose Year 2050.

D. Choose Input: Projection Curve

Select USACE Projection Curve to use for inundation calculation. One or multiple curves can be selected. For each curve selected, one layer will be created.

1. ***USACE High Rate:*** Computed from the modified NRC Curve III considering the IPCC AR4 projections and modified NRC projections with the local rate of vertical land movement added. This rate exceeds the upper bounds of IPCC estimates from both 2001 and 2007 to accommodate the potential rapid loss of ice from Antarctica and Greenland, but it is within the range of values published in peer-reviewed articles since that time.
2. ***USACE Intermediate (Medium) Rate:*** Computed from the modified NRC Curve I considering the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4) projections and modified NRC projections with the local rate of vertical land movement added.

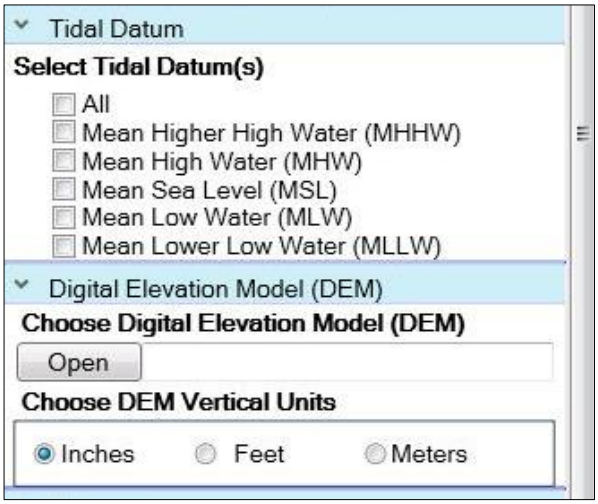
3. ***USACE Low Rate (Historic Rate):*** Represents a linear extrapolation of the historic rate of SLR based on observed sea level measurements.

For this exercise, choose USACE High Rate.

E. Choose Input: Tidal Datum

Select the tidal datum(s) which to add the projected sea level change. The tidal datum values are utilized as constant offsets to the sea level change projections calculated for each rate and time period. For each datum selected, one layer will be created.

- ***Mean Higher High Water (MHHW):*** The average of the higher high water height of each tidal day observed over the NTDE.
- ***Mean High Water (MHW):*** The average of all the high water heights observed over the NTDE.
- ***Mean Sea Level (MSL):*** The arithmetic mean of hourly heights observed over the NTDE.
- ***Mean Low Water (MLW):*** The average of all the low water heights observed over the NTDE.
- ***Mean Lower Low Water (MLLW):*** The average of the lower low water height of each tidal day observed over the NTDE.



For this exercise, choose Mean Higher High Water (MHHW).

F. Choose Input: Digital Elevation Model (DEM)

Select a Digital Elevation Model from which to create the inundation surfaces. This exercise came with a DEM of Key West.

For this exercise, click the "Open" button and navigate to the location where you saved the DEM. Open the FGDB named "DEM_keywest" and select the DEM raster inside the FGDB. Choose "Inches" as the DEM Vertical Units.

The SLR calculator accepts DEM vertical units in inches, feet, or meters. In the calculator dialog, users must indicate the vertical units of the input DEM. If feet or meters are selected, the SLR calculator will convert from feet or meters to inches to correspond with the USACE sea level rise projections, which are stored in inches for the SLR calculator. If the input DEM is inches, then no conversion will take place.

Important Note**:** The spatial extent of the DEM determines the spatial extent of the output inundation layers.

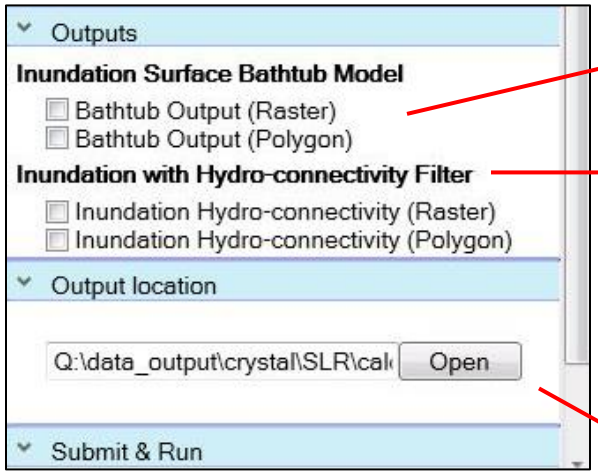
Step 2: Choosing Output Parameters

The output parameters define the inundation models to be created, file format (raster or vector), and location of the output layers. The inundation models include (1) a bathtub model of inundation and (2) an enhanced bathtub model with a hydro-connectivity filter applied. The bathtub method identifies all areas with an elevation below that of the SLR projection value as potentially inundated. The hydro-connectivity filter attempts to remove isolated areas not as likely to be directly inundated due to their isolation from the ocean or gulf.

Important Note: Output data layers can currently only be saved to a File Geodatabase (FGDB).

A. Choose Output Models & Output Location

The outputs parameters define the output models to be created and the location where to save the inundation layers. All layers are saved as feature classes in a File Geodatabase. One or multiple output types can be selected.



Check for creation of bathtub inundation surface model in raster or vector (polygon) format. Both outputs can be chosen.

Check for creation of inundation model with hydro-connectivity filter in raster or vector (polygon) format. Both outputs can be chosen.

Navigate to the File Geodatabase in which to save the output inundation layers or use the dialog to create an output File Geodatabase.

For this exercise, choose one Bathtub Output (Polygon) and Inundation Hydro-connectivity (Polygon).

For the Output location, click "Open" to browse, and then create a new FGDB named "outputs". Choose this new FGDB to save the outputs.

Step 3: Running the Calculator

A. Run the Calculator

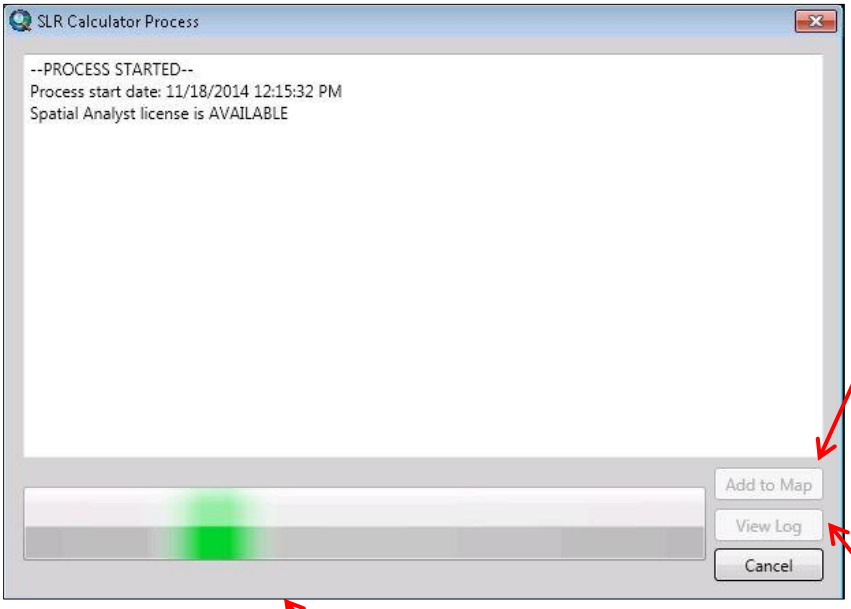
If you do not see the "Run" button at the very bottom of the SLR Calculator dialog, then expand the Submit & Run section by clicking on the arrow to the left of "Submit".

Next, hit the "Run" button at the very bottom under the Submit section.

About the Progress Dialog Window & Logging

Shortly after the calculator is submitted, a progress dialog window will open to show the progress. Please be patient, the process will take some time to complete, depending on the parameters chosen, the geographic extent of the input DEM, and the specifications of your computer (RAM, CPU, etc). If you want to cancel the process, simply hit the "Cancel" button.

Both the progress dialog window and the log file will display the process start time, the process end time, and the elapsed running time. Taking note of these times and the parameters chosen can help you plan for future iterations of the calculator.



Add to Map: This button is greyed out (disabled) while processed are running. Once processes are complete, the button will enable and allow the user to add the calculator output layers to the current map session.

View Log: A log file is created the first time the calculator is run. The log is appended for subsequent runs. If the log is opened before the process is complete, it will need to be reloaded to see the complete details of the log.

Progress Dialog: The green arrow at the bottom will display as long as processes are running. The process is complete when the green arrow stops AND the dialog says: --PROCESS COMPLETE--

Step 4: Explore Results in ArcMap

A. Add results to map

Once you see "PROCESS COMPLETE" in the dialog box, click the "Add to Map" button.

You should have two output layers:

Filename/ Output	Input Parameters Chosen
KeyWest_2050_H_MHHW_HC_Polygon	• Key West tide gauge/ sea level trend • Projection year – 2050 • USACE High Rate • Mean Higher High Water (MHHW) tidal datum • HC = Hydro-connectivity model • Polygon (vector) layer
KeyWest_2050_H_MHHW_Bathtub_Polygon	• Key West tide gauge/ sea level trend • Projection year – 2050 • USACE High Rate • Mean Higher High Water (MHHW) tidal datum • Bathtub model • Polygon (vector) layer

B. Explore layers in ArcMap

Add a basemap from ArcGIS Online:

If you need a basemap for viewing your results, connect to ArcGIS Online:

ArcCatalog window → GIS Servers → Add ArcGIS Server

URL: http://services.arcgisonline.com/arcgis/services

Change Symbology

To better view the output layers, you may want to change the symbology, and remove the polygon outline color.

Examining Model Outputs

Put the HC (hydro-connectivity) model output on top, and the Bathtub model output on bottom for viewing. If the bathtub model is on top, then all the areas in the HC model will be covered up.

Understanding the Attribute Table

Open the attribute table. The "grid_code" field will indicate the level of inundation after calculating the datum conversions. This level is not the amount of sea level rise, but rather the elevation at which land will be affected under this scenario of SLR.