

C-RISe: altimetry sea-level validation software overview

Francisco Calafat, NOC
17 May 2018

Introduction

This note outlines the software used for the C-RISe sea-level validation training.

All code is written in python and requires the following python packages:

- os
- numpy
- netCDF4
- matplotlib
- basemap
- scipy

These packages mostly come with Anaconda (or miniconda) python, with the netCDF4, scipy and basemap packages needing separate installation (using “conda install netcdf4”, “conda install scipy”, “conda install -c conda-forge basemap”). A special command is needed to get the latest development version of basemap.

See the document “Python on Windows” for instructions and guidance on installing python on to a Windows environment. Note that the code requires a Windows 10 environment to operate.

Data sources

Data	Description
Along-track altimetry sea level ~/Data/C-RISe/altimetryByPass/	Along-track collocated coastal altimetry data. Data are provided as one file per pass and cover the period from 2002 to 2016 Filename example: j1j2_stats_ales_p0005.nc is data for pass 5. Source is Jason-1 and Jason-2 satellite altimeter data reprocessed by NOC. These data are available via ftp from SatOC
High-frequency tide-gauge data ~/Data/TideGauge/C-RISe_TG_validation/	High-frequency sea-level observations from tide gauges. One file per tide-gauge station in the t2k format covering different periods depending on the station Filename example: HA_100_000001_054284_GS_01_TS_Pemba.t2k is data for

	<p>the Pemba tide gauge</p> <p>The primary source for these data is the Permanent Service for Mean Sea Level (www.psmsl.org)</p>
<p>Monthly tide-gauge data ~/Data/ TideGauge/C-RISe_Seasonal_Variability/</p>	<p>Monthly sea-level observations from tide gauges.</p> <p>One file per tide-gauge station covering different periods depending on the station. Data are provided in two different formats depending on the source (PSMSL or IOC)</p> <p>Filename example: 1673.rlrdata is data for the tide gauge with PSMSL ID 1673.</p> <p>The primary source for these data is the Permanent Service for Mean Sea Level (www.psmsl.org)</p>

Table of software, inputs and outputs

Program name	Description
genStats.py	Produces figures for a selected tide gauge showing the correlation and root mean square difference as a function of distance from the coast for the closest altimetry passes. It will also produce a figure comparing the sea level time series from altimetry and the tide gauge for the “distance from coast” providing the maximum correlation. Finally, it will also generate a map showing the location of the tide gauge and the selected altimetry passes. All figures will be saved to folder ~/Software/SeaLevel/SeaLevelValidation/figures/.
genStats_allTg.py	Same as ‘genStats.py’ but will generate figures for all the tide gauges for which high-frequency data are available.
plotStatsMap.py	Plots maps of a preselected domain showing the amplitude and phase of the sea-level annual and semi-annual cycles, the spatial distribution of sea-level trends, and the standard deviation of detrended and deseasoned sea-level anomalies.
plotSeriesSelect.py	Plots the sea-level anomalies at a selected point along a satellite track.
genStatsTracks.py	Generates statistics required by the function “plotStatsMap.py” and save the results to the file ~/Software/SeaLevel/SeaLevelValidation/data/statsAltiTracks. It takes a long time to run and hence it should be run only if that file is missing or new altimetry data are available and you want to update the statistics based on the new data.
genReportFun.py	Generates a validation report for a selected tide-gauge station and save it to ~/Software/SeaLevel/SeaLevelValidation/reports/. This functions requires the ‘appy pod’ Python library.

Program name	Inputs	Outputs
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<p>genStats.py</p>	<p>Function input arguments: 1. Name of the tide gauge. For example: Granger_Bay</p> <p>Data required: Along-track altimetry sea level ~/Data/C-RISe/altimetryByPass/ High-frequency tide-gauge data ~/Data/TideGauge/C-RISe_TG_validation/ Monthly tide-gauge data ~/Data/ TideGauge/C-RISe_Seasonal_Variability/</p>	<p>Figures showing the correlation and root mean square difference as a function of distance from the coast for the closest altimetry passes.</p> <p>Figure comparing the sea level time series from altimetry and the tide gauge for the “distance from coast” providing the maximum correlation.</p> <p>Map showing the location of the tide gauge and the selected altimetry passes.</p>
<p>genStats_allTg.py</p>	<p>Function input arguments: None.</p> <p>Data required: Along-track altimetry sea level ~/Data/C-RISe/altimetryByPass/ High-frequency tide-gauge data ~/Data/TideGauge/C-RISe_TG_validation/ Monthly tide-gauge data ~/Data/ TideGauge/C-RISe_Seasonal_Variability/</p>	<p>Same as “genStats.py” but for all tide gauges.</p>
<p>plotStatsMap.py</p>	<p>Function input arguments: 1. lon_min 2. lon_max 3. lat_min 4. lat_max 5. stats lon_min, lon_max, lat_min, lat_max denote the four vertices of a rectangle encompassing the domain</p>	<p>Map of a preselected domain showing the selected statistic along all satellite tracks in the domain.</p>

	<p>you are interested in. They represent coordinates and have units of degree.</p> <p>The last input “stat” denotes the statistic you want to plot and can take the following values:</p> <p>amp_an : amplitude of the annual cycle</p> <p>phase_an : phase of the annual cycle</p> <p>amp_semian : amplitude of the semi-annual cycle</p> <p>phase_semian : phase of the semi-annual cycle</p> <p>trend : trend</p> <p>sdev : standard deviation of detrended and deseasoned sea-level anomalies</p> <p>Data required:</p> <p>File file “statsAltiTracks” generated by function “genStatsTracks.py”</p>	
plotSeriesSelect.py	<p>Function input arguments:</p> <p>None. Running the function will open a map showing all the altimetry tracks. Select a point on the tracks using the mouse.</p> <p>Data required:</p> <p>Along-track altimetry sea level</p> <p>~/Data/C-RISe/altimetryByPass/</p>	Plot of the timeseries of sea-level anomalies at a selected point along a satellite track.
genStatsTracks.py	<p>Function input arguments:</p> <p>None.</p> <p>Data required:</p> <p>Along-track altimetry sea level</p>	statistics required by the function “plotStatsMap.py” and save the results to the file “statsAltiTracks”

	~/Data/C-RISe/altimetryByPass/	
genReportFun.py	<p>Function input arguments:</p> <ol style="list-style-type: none"> 1. Name of the tide gauge. For example: Granger_Bay <p>Data required:</p> <p>Requires statistics generated by either "genStats.py" or "genStats_allTg.py".</p>	Report summarizing the validation of altimetry sea level for the selected tide gauge.