IPCC AR6 sea-level change projection files

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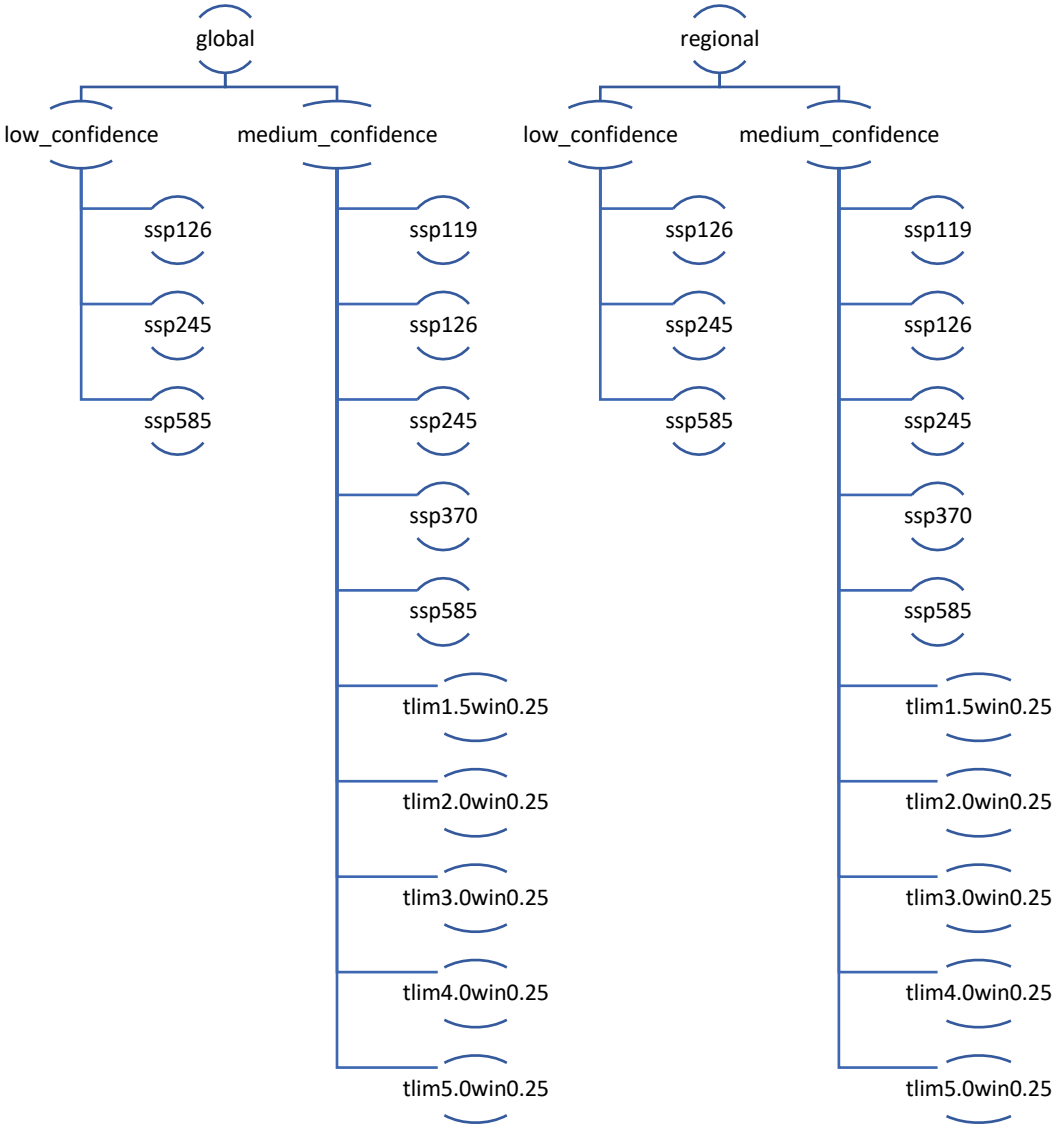
Overview:
The IPCC AR6 sea-level change projection files are provided in a simplified format but represent a more complicated workflow involving combinations of multiple lines of evidence for the various individual contributors to sea-level change. We highly recommend using the data as provided in these confidence-level output files to remain consistent with the assessment in IPCC AR6 Chapter 9.

Directory Structure:



File Description:

%COMPONENT%_%SCENARIO%_%CONFIDENCE%_%TYPE%.nc

These files contain the time-series probability boxes of the sea-level change levels and rates. The probability boxes are derived from multiple workflows (see IPCC WG1 Chapter 9 for description of workflows). Values or rates at quantiles below 0.5 represent the minimum value or rate across all workflows for that particular quantile. Values or rates at quantiles above 0.5 represent the maximum value or rate across all workflows for that particular quantile. The value or rate at the 0.5 quantile represents the mean of the medians across all workflows. Below are how to construct these file names.

%COMPONENT%	Component represented in file
AIS	Antarctic Ice Sheet
GIS	Greenland Ice Sheet
glaciers	Glaciers
landwaterstorage	Land Water Storage
oceandynamics	Ocean Dynamics (includes Thermal Expansion)
verticallandmotion	Vertical Land Motion (non-climatic processes)
total	Total integrated over all components

%SCENARIO%	Scenario represented in file
ssp119	Shared Socio-economic Pathway 1-1.9
ssp126	Shared Socio-economic Pathway 1-2.6
ssp245	Shared Socio-economic Pathway 2-4.5
ssp370	Shared Socio-economic Pathway 3-7.0
ssp585	Shared Socio-economic Pathway 5-8.5
tlim1.5win0.25	1.5 degC in year 2100 Temperature Target (0.25 degC window)
tlim2.0win0.25	2.0 degC in year 2100 Temperature Target (0.25 degC window)
tlim3.0win0.25	3.0 degC in year 2100 Temperature Target (0.25 degC window)
tlim4.0win0.25	4.0 degC in year 2100 Temperature Target (0.25 degC window)
tlim5.0win0.25	5.0 degC in year 2100 Temperature Target (0.25 degC window)

%CONFIDENCE%	Confidence level represented in file
medium_confidence	Projections using only processes with assessed medium confidence
low_confidence	Projections using both assessed medium-confidence and low-confidence processes

%TYPE%	Type of values represented in file
values	Value or level of sea-level change (units = mm)
rates	Rate of sea-level change (units = mm per year)

Example – “oceandynamics_ssp370_low_confidence_values.nc” contains contribution of thermal expansion and ocean dynamics to the overall sea-level change for the SSP3-7.0 emissions scenario using both the assessed medium-confidence and low-confidence processes.

These are NetCDF version 4 files. All files are formatted the same with the only exception being that the “values” files contain the variable “sea_level_change” and the “rates” files contain the variable “sea_level_change_rate”. Below is the meta data for a regional “values” projection file.

```
dimensions:
   locations = 66190 ;
   quantiles = 107 ;
   years = 14 ;
variables:
   float lat(locations) ;
        lat:_FillValue = NaNf ;
        lat:units = "Degrees North" ;
   float lon(locations) ;
        lon:_FillValue = NaNf ;
        lon:units = "Degrees East" ;
   short sea_level_change(quantiles, years, locations) ;
        sea_level_change:_FillValue = -32768s ;
        sea_level_change:units = "mm" ;
        sea_level_change:scale_factor = 1. ;
   int years(years) ;
   int locations(locations) ;
   float quantiles(quantiles) ;
        quantiles:_FillValue = NaNf ;
```

As noted before, the “rates” files will be formatted the same way, only instead of “sea_level_change”, the variable name will be “sea_level_change_rate”. Below is a brief description of each of these variables.

locations	Each projection is associated with a specific location. This dimension variable holds all the location IDs. For a global projection file, there is only one location with the ID of -1. The regional files contain tide gauge projections and a 1x1 degree global grid. Tide gauge location IDs are consistent with their PSMSL IDs while the global grid location IDs are formatted “10MMM0NNN0” where MMM and NNN are the whole degrees latitude and longitude respectively. A simple filter would be IDs greater than 10^9 are

	global grid locations. IDs less than 10^9 are tide gauges.
quantiles	Quantiles of the probability box of the sea-level change variable. 107 quantiles are available, including 0.0 to 1.0 in 0.01 increments and a few key quantile values (i.e. 0.995, 0.999, etc.). Multiply the quantiles by 100 to get the equivalent percentile values.
years	Years at which projection data are available. The medium-confidence projections are available from 2020-2150 in 10-year increments while the low-confidence projections are available from 2020-2300 in 10-year increments.
lat	Latitude of the locations. For global projections, this value is Infinity.
lon	Longitude of the locations. For global projections, this value is Infinity.
sea_level_change	The level of sea-level change since the AR6 reference period. Values have units of millimeters. Values of -32768 should be considered missing data. Note: The Python netCDF4 package will read in this data with the dimension order [quantiles, years, locations] but MatLab and R will use the reverse order of [locations, years, quantiles].
sea_level_change_rate	The rate of sea-level change. Rates are 10-year average rates with units of millimeters per year. These are stored in the netCDF file as tenths of a millimeter per year with a scale_factor of 0.1 which is generally automatically applied when reading in the data. Rates of -3276.8 should be considered missing data. Note: The Python netCDF4 package will read in this data with the dimension order [quantiles, years, locations] but MatLab and R will use the reverse order of [locations, years, quantiles].

%PBOX%_%SCENARIO%_milestone_figuredata.nc

These files contain the “milestone” data that’s depicted in IPCC AR6 Chapter 9 Fig 9.29. Below is how to construct the filename.

%PBOX%	Confidence level represented in file
pb_1f	Probability box 1f which includes only medium-confidence processes for calculating milestones.
pb_2f	Probability box 2f which includes both low- and medium-confidence processes for calculating milestones.

The %SCENARIO% portion of the file name is consistent with the %SCENARIO% table above for the projection files.

Example – “pb_2f_tlim2.0win0.25_milestone_figuredata.nc” is a low-confidence milestone data file for the 2.0 degC temperature target scenario.

Below are the meta-data for this type of file.

```
dimensions:
   heights = 99 ;
   quantiles = 5 ;
   sites = 66190 ;
variables:
   short heights(heights) ;
        heights:units = "mm" ;
   float quantiles(quantiles) ;
   int sites(sites) ;
   short exceedance_years(sites, quantiles, heights) ;
        exceedance_years:units = "-" ;
```

heights	The milestone heights at which the year of exceedance is calculated. Height levels are provided from 100 through 5000 mm in 100 mm increments.
quantiles	Quantiles of the probability box of the year at which a particular height is exceeded. Only the 0.05, 0.17, 0.5, 0.83, and 0.95 quantiles are provided, which are the most commonly used quantiles throughout the report and figures. Multiply the quantiles by 100 to get the equivalent percentiles.
sites	See the “locations” dimension description in the projection file table above.

exceedance_years	The years at which a particular level (see heights above) of sea-level change is exceeded.

location_list.lst

This is the location list file used to produce the projections. It can be used to cross-reference location IDs with names of the locations.

Column 1 – Location name (string with spaces having been replaced with underscores)
Column 2 – Location ID (integer value)
Column 3 – Latitude (-90 to 90 degrees)
Column 4 – Longitude (-180 to 180 degrees)