

## **Proposed approach for making MACA downscaling output available for a delta approach**

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Feedback from our first conference call indicated that CHAMP group members would like to conduct initial climate impact studies using an approach in which a historical simulation is modified by applying changes to the mean annual cycle of meteorological inputs. This so-called delta approach is the simplest way to assess the impact of changing mean conditions.

There are choices to make regarding the applied deltas. Though the deltas vary over the annual cycle, should they vary spatially? Should the deltas vary from year to year to capture, for example, a warming trend during the simulation period? Should the deltas be applied as absolute or fractional changes?

Our proposal is to provide the mean annual cycle at monthly and  $\frac{1}{4}$  degree resolution of most of the MACA variables and all climate models (as well as the multi-model ensemble mean or median) for 10-year increments over the time domain under consideration: 1981-2050 (i.e., 1981-1990, 1991-2000, ... 2041-2050). The RCP8.5 greenhouse gas emissions scenario from MACAv2-METDATA product will be chosen. We choose 10 years as the interval because it should be long enough to remove interannual variability and short enough to capture long-term trends due to changes in greenhouse gas concentrations. The spatial domain will be a rectangle that fully covers the Chesapeake Bay and its watershed. Hydrological and estuarine modelers can use the mean annual cycles in any way that they please. For example, they may wish to retain the full spatial resolution or compute an area average before applying the deltas. If the runs proposed are long (say, 30 years), then modelers may wish to have the deltas vary gradually from year to year. To do so, we suggest that annual values be computed from the 10-year averages via interpolation or curve fitting.

Variables we will provide are: daily maximum air temperature, daily minimum air temperature, precipitation, specific humidity, downwelling shortwave radiation, wind speed, zonal wind velocity, and meridional wind velocity. Some modelers may need downwelling longwave radiation. There are algorithms for computing downwelling longwave radiation from downwelling solar radiation, air temperature, and humidity, and these will be looked into if modelers feel this is needed. We suggest that the deltas be applied in fractional changes for all variables except temperature, which should be applied as absolute changes.

We will conduct some preliminary analysis of the decadal average MACA results. We will compute and plot vs. time the spatial average of the following for all of the models, the multi-model average or median, and some metric of model spread (e.g., interquartile range):

- annual average of daily mean temperature
- winter-spring precipitation
- summer-fall precipitation
- summer zonal wind velocity

Suggestions for other parameters are welcome.