**Information about Level 1 – Basic ENSO diagnostics**

At this level, POD calculates simple seasonal averages, composites, regression and correlations.

Based on a reference ENSO index (e.g., area-averaged SST anomalies over Nino3.4 region), seasonal composites of variables relevant to MSE budget are constructed for the entire 2-year life-cycle of ENSO. Here, Y (0) refers to the developing, and Y (1) the decaying phase of ENSO.

To perform composites set ENSO\_COMPOSITE = 1 in the ~/diagnostics/ENSO\_MSE/settings.jsonc.

The code files related to this Level 1 are stored in the ~/diagnostics/ENSO\_MSE/COMPOSITE directory. All input data should be under ~/diagnostics/inputdata/model/$model/mon, (e.g. $model = CESM1), the intermediate output data are in: ~/diagnostics/wkdir/MDTF\_$model\_$first\_year\_$last\_year/ENSO\_MSE/

COMPOSITE/model/netCDF, (e.g. $model = CESM1, $first\_year = 1950, $last\_year = 2005),

while graphics is under ~/diagnostics/wkdir/MDTF\_$model\_$first\_year\_$last\_year/ENSO\_MSE/model

The required input variables are:

*Z(x,y,z,t)* geopotential height,

*U(x,y,z,t), V(x,y,z,t)* u and v wind components

*T(x,y,z,t)*  temperature

*Q(x,y,z,t)* specific humidity

*OMG(x,y,z,t)* vertical velocity

*PR(x,y,t)*  precipitation

*SST(x,y,t)*  surface temperature

S*HF(x,y,t)*  sensible heat flux

*LHF(x,y,t)*  latent heat flux

*RSDT(x,y,t)* top of the atmosphere shortwave down

*RSUT(x,y,t)* top of the atmosphere shortwave up

*RLUT(x,y,t)* top of the atmosphere longwave up

*RSDS (x,y,t)* surface shortwave down

*RSUS(x,y,t)* surface shortwave up

*RLUS(x,y,t)* surface longwave up

*RLDS(x,y,t)* surface longwave down

All input file should be in netCDF format following CF convention, one variable per file, with monthly output frequency, $model.$variable.mon.nc. For instance, CESM2 temperature data will be in CESM2.ta.mon.nc file. *CF convention refers to standard CMIP-era model outputs.*

Final output directories:

The output files are under ~/diagnostics/wkdir/MDTF\_$model\_$first\_year\_$last\_year/ENSO\_MSE/$diag\_name/model/netCDF (e.g. $model = CESM1, $fist\_year= 1950, $last\_year = 2005, $diag\_name = COMPOSITE )

The composites for El Niño/La Nina are under

~/diagnostics/wkdir/MDTF\_$model\_$first\_year\_$last\_year/ENSO\_MSE/$diag\_name/model/netCDF/ELNINO (or LANINA)

Similarly 2-year life cycle ENSO composite results are under:

~/diagnostics/wkdir/MDTF\_$model\_$first\_year\_$last\_year/ENSO\_MSE/$diag\_name/model/netCDF/24MONTH\_ELNINO (or 24MONTH\_LANINA)

Graphical output is now set to be all global and for all surface variables. The actual files are in ~/diagnostics/wkdir/MDTF\_$model\_$first\_year\_$last\_year/ENSO\_MSE/model.