Information about Level 3 – MSE variance diagnostics

At this level the code calculates terms of MSE variance/covariance diagnostics.

To select this level set the parameter MSE_VAR = 1 in ~/mdtf.py python file.

The necessary input data are already estimated in **Level 2** and **Level 1.**

Level 3 diagnostics are estimated as:

$$s_x = \frac{\left\| x \cdot \langle h \rangle \right\|}{\left\| \langle h \rangle^2 \right\|}$$

Where *x* can be any one of the following MSE budget term:

moist advection: $x = -\langle V \cdot \nabla q \rangle$

MSE vertical advection: $x = -\left\langle \omega \frac{\partial h}{\partial p} \right\rangle$

net shortwave flux: $x = \langle SW \rangle$

net longwave flux: $x = \langle LW \rangle$

sensible heat flux: $x = \langle SHF \rangle$

latent heat flux: $x = \langle LHF \rangle$

The column MSE is, $h = C_P T + gz + Lq$ where C_p is specific heat at constant pressure, *T* is temperature, *g* is the gravitational acceleration, *z* is geopotential height, *L* is latent heat of vaporization, and *q* is specific humidity. $\|\|\|\|$ represents area averages.

There are two default and one custom selected areas for averaging the MSE variances:

a) Equatorial Central Pacific 180°–200°E 10°S – 5°N
b) Equatorial Eastern Pacific 220°–280°E 5°S – 5°N
c) user prescribed area defined by environmental variables **slon1, slon2 , slat1** and **slat2** (longitudes, latitudes) in ~/mdtf.py file in the MSE_VAR section.

Final output directories:

The output data are saved in ~/wkdir/MDTF_{case_name}/MSE_VAR/model/netCDF.
Graphical output is in ~/wkdir/MDTF_{case_name}/{MSE_VAR}/model
(e.g. case_name = CCSM4).

The calculated co-variances are scaled by MSE variance and plotted as a bar chart.