**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:

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

moist advection:

MSE vertical advection:

net shortwave flux:

net longwave flux:

sensible heat flux:

latent heat flux:

The column MSE is,  where *Cp* 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 180o–200oE 10oS – 5oN

b) Equatorial Eastern Pacific 220o–280oE 5oS – 5oN

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.