

## Information about Level 2 – Ambient flow diagnostics

At this level, the code estimates basic state or climatological flow properties that determine generation and propagation of stationary Rossby waves. Specifically, restoring effect for Rossby waves ( $\beta_*$ ) that is dependent on meridional gradient in absolute vorticity ( $\beta$ ) and meridional curvature of the climatological zonal flow or gradients in relative vorticity  $\partial^2 \bar{U} / \partial y^2$ , and resultant stationary wave number ( $K_s$ ) are diagnosed.

Required input data are calculated in **Level 1**.

Users need to complete **Level 1** diagnostics first before running **Level 2**.

The following terms are calculated at an appropriate upper tropospheric level:

$$\beta_* = \beta - \partial^2 \bar{U} / \partial y^2 \quad (1)$$

$$K_s = (\beta_* / \bar{U})^{1/2} \quad (2)$$

where  $\beta$  is  $\partial f / \partial y$  latitudinal variations in planetary vorticity ( $f$ ),  $\bar{U}$  is the basic-state zonal wind velocity, and  $\partial^2 \bar{U} / \partial y^2$  is the curvature of the ambient zonal flow. Stationary Rossby waves are possible if the flow is westerly ( $\bar{U}$  positive) and  $\beta_*$  is positive.

### **Final output directories:**

The seasonal climatologies are under directories:

~/wkdir/MDTF\_\$model\_\$first\_year\_\$last\_year/ENSO\_RWS/model/netCDF/

Graphical output files reside in: ~/wkdir/MDTF\_\$model\_\$first\_year\_\$last\_year/ENSO\_RWS/model

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