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Estimation of the vertical velocities associated with large scale dynamics

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Apart from some exceptions (e.g. certain convection movements, small scale turbulence, or surface gravity wave), vertical velocities in the ocean are generally too weak to be measured. In particular, that is the case of the vertical movements associated to the large scale (basin wide) dynamics. This prevents any accurate assessment of the thermohaline circulation return flow and the thermocline vertical ventilation (mass, heat, oxygen and carbon fluxes).

A 24 year averaged global run is used to assess the domain of validity of the linear vorticity balance (LVB). In this data set vertical velocities are mainly controlled by the large scale LVB dynamics at subtropical and tropical latitudes. Therefore it should be possible to reconstruct the vertical velocity field by integrating vertically the LVB with an appropriate boundary condition. Various conditions have been tested and it turns out that the condition of no vertical motion at 1000 m is the most promising for applying the same methodology to climatological observations ...