

SIO 217B Atmospheric and Climate Sciences II

Exercise #19

1. Download the files containing zonal and meridional components of surface wind stress for 1993 March 14 00Z. Plot wind stress vectors in the domain 20-50°N, 270-310°E.
2.
 - a) Write equations for U_e and V_e , the zonal and meridional components of oceanic Ekman transport, in terms of surface wind stress components and any other necessary parameters.
 - b) Calculate U_e and V_e assuming that seawater density is 1025 kg m^{-3} . Note that you will need to multiply wind stress values by 10^{-3} to convert them to units of N m^{-2} . Add Ekman transport vectors to the plot of wind stress vectors. For convenience, we will consider the entire domain to be ocean.
 - c) What is the spatial relationship between wind stress vectors and Ekman transport vectors?
3.
 - a) Derive an equation in spherical coordinates for w_e , the vertical velocity at the bottom of the oceanic Ekman layer. Put it in terms of the zonal and meridional components of wind stress and any other necessary parameters.
 - b) Calculate w_e assuming that seawater density is 1025 kg m^{-3} . Add contours of w_e to the wind stress vectors and Ekman transport vectors using an interval of 2 m day^{-1} .
 - c) Is the atmospheric surface low center associated with upward or downward oceanic Ekman pumping?