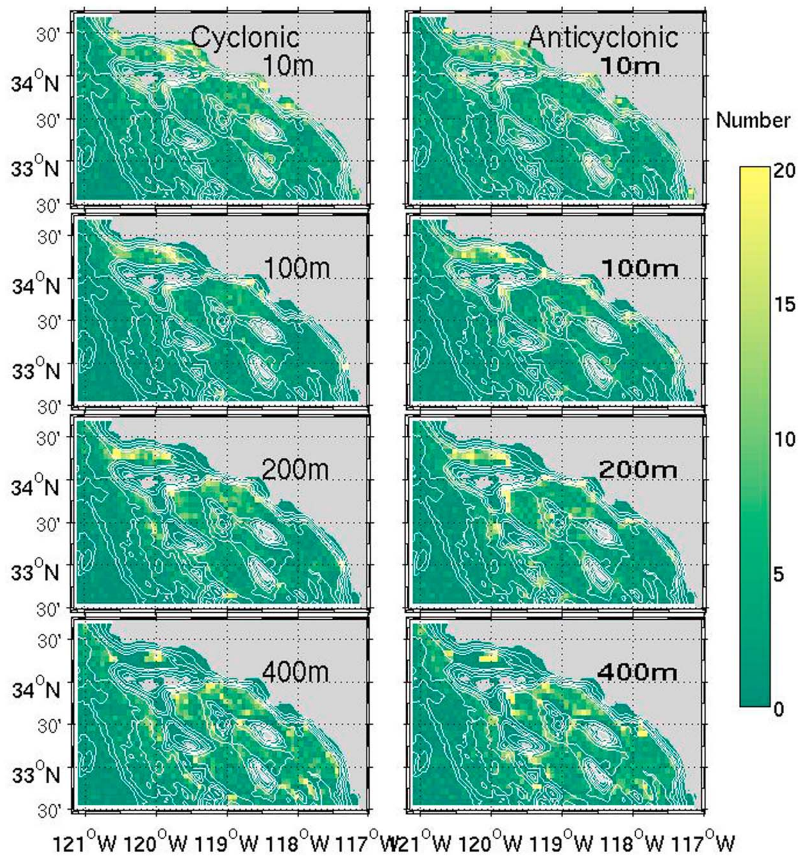

Figure 20. Same as Figure 18 but for eddy termination number inside the domain.

radial and tangential velocities respectively, and the first term is the pressure gradient, the second term is Coriolis acceleration and terms in parentheses denote the nonlinear effect. For an eddy in which the first two terms are dominant, the eddy is in geostrophic balance; if the terms in the parentheses cannot be neglected, the eddy is in ageostrophic balance when the local Rossby number is a finite value. To exclude the effect of the surface wind stress curl, two eddies at 50 m are plotted in Figure 21 as examples: the one with a mesoscale size is in geostrophic balance and another with submesoscale size is in ageostrophic balance.

[41] The twelve-year numerical product shows that most of eddies are in geostrophic balance, but some submesoscale eddies are ageostrophic balance because local Rossby numbers are in finite values. Figure 22 shows a scattering figure that characterize the relationship between eddy size and relative vorticity normalized by the planet vorticity, i.e., Rossby number. Actually, when the tangential velocity of an eddy is in a scale of 0.2 m/s, and its size is 10 km, its local Rossby number (normalized relative vorticity, see Figures 10 and 11) at 34°N is about 0.5. When an eddy size is less than 10 km (the first baroclinic deformation radius in the SCB is about 20–30 km [*Dong and McWilliams*, 2007]), the eddy can considered as a submesoscale eddy. Most of eddies with their sizes larger than 10 km have Rossby numbers smaller than 0.5 and they are in a good geostrophic balance. With their sizes smaller than 10 km, some of them have finite Rossby numbers around one unit but some of them still hold good geostrophic relationship with Rossby number smaller than 0.5.

6.3. Summary

[42] Oceanic circulation in the SCB is characterized by multiple-scale variations due to the complexity in the bottom topography, coastline and wind stress curls as well [*Dong et al.*, 2009a]. Using twelve years (1996–2007) high-resolution (1 km) numerical products of an oceanic circulation model in the SCB, which has been verified by previous studies, we investigate eddy variations in the SCB. First of all, an eddy data set on nine vertical levels is developed using a velocity geometry-based automated eddy detection scheme. Statistical analysis applied to the eddy data set reveals statistical characteristics of three-dimensional eddies in the SCB, including vertical and horizontal distribution of eddy parameters, such as, sizes, relative vorticity and lifetime. These eddy generation data have indicated that the dominant eddy generation mechanism in the SCB is likely caused by the presence of islands and headlands: horizontal shearing of oceanic flow-passing islands and headlands, wind stress curls due to islands, fronts and unevenly distributed bottom stresses and bottom fronts due to shelf slopes around islands. The seasonal and interannual eddy variations show that anticyclonic eddies have the largest numbers during the season of fall. The sandwiched vertical structure shows that the stratification present a barrier for