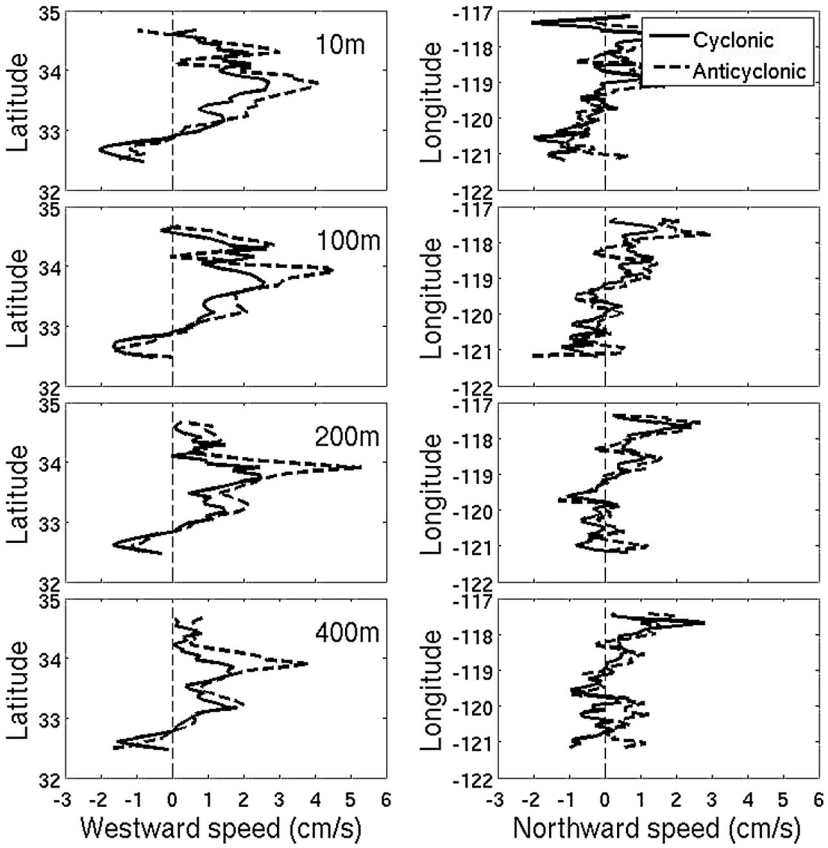

Figure 15. Eddy (left) westward and (right) northward moving speeds vary with latitude (averaged every 0.25 degree in latitude band) at four levels: 10 m, 100 m, 200 m, and 400 m.

evolutions of these parameters during the lifetime of each eddy well present how an eddy evolves. Following a method proposed by Liu et al. (submitted manuscript, 2011), we consider eddies with long lifetimes equal to or longer than 20 days. With this definition, the total numbers of such eddies are: 436 cyclonic eddies and 256 anticyclonic eddies at the surface. An eddy age is normalized by its lifespan and parameters are normalized by the corresponding maximum in the lifespan of each eddy and by taking average over all eddies with life spans longer than 20 days. Normalized temporal evolutions for these four parameters are thus obtained and plotted in Figure 13. Eddy size and kinetic energy increase during the first 1/5 of an eddy's life cycle (youth) and then it remains stay stable for next 3/5 of its life cycle (adult). In the last 1/5 of the mean life cycle (aged), these parameters decrease sharply. The deformation rate shows the opposite trend, in its first 1/6 of life cycle (youth), the rate decreases and then stays roughly constant for the next 2/3 of the life cycle and finally it increases sharply before the eddy eventually dies. The lifetime eddy evolution for lower levels is similar to that at the surface (not shown).

4.5. Eddy Movement

[30] Shown in Figure 14 are plots of trajectories of cyclonic and anticyclonic eddies which live longer than 50 days at four levels (10 m, 100 m, 200 m and 400 m). Generally, these eddies move westward in the northern part of the SCB and return eastward in the southern part via an offshore path turning southward. When averaged over zonal bands of 1/4 degree in width, shown in Figure 15 (left), the westward velocity of eddies varies with the latitude: north of about 33°N, eddies move westward and the peak of the speed is reached at 34°N; south of 33°N, eddies move eastward. The zonal movement is due to the combination of β effect and self-advection [*McWilliams and Flierl*, 1979]. Shown in Figure 15 (right), the mean meridional velocity of eddies at all levels averaged over meridional bands of 1/4 degree in width is northward east of 119°W and southward west of 119°. As discussed in section 1, the mean circulation in the SCB is a cyclonic gyre, which contributes to the pattern of eddy movement.

4.6. Eddy Vertical Structure

[31] In sections 4.1–4.5, it is clearly shown that eddies vary with depth in terms of eddy parameters. In this section, we apply the approach introduced in section 3.2 to examine three-dimensional structures of eddies. Starting from the sea surface by looking downward, we try to determine how deep each eddy can penetrate, i.e., the depth of the eddy bottom. The histogram of eddy depth (limited to 400 m) is plotted in Figure 16. The number at each level in Figure 16 is the number of eddies only found at one level and levels shallower (deeper) by looking upwards (downward). Most eddies can reach less than 50 m. The number of eddies