ceding the February 1986 storm, compressing the magnetosphere. L^* calculations show marked deviations from a dipolar field even at 5 R_E. CCE was in the magnetosheath several times during this period, and *Dst* was consistently positive. If the positive *Dst* is due to magnetospheric compression, then the ring current will be compressed and adiabatically energized as well. The energy density from L^*=3–5 during the period of positive *Dst* in January 1986 was higher than on the rest of the quiet days. Therefore we require that |*Dst*| be less than 11 nT as the first quiet time limit.

The uneven global coverage of *Kp* is a well-known problem [*Rostoker*, 1972], and therefore *Kp* may be low even when substorm activity is occurring. So we use the *Kp* index as an independent indicator of magnetospheric activity, but as a less stringent criterion than *Dst*. We also checked the data for some agreement with the Earth based indices. Low *Dst* correlated with low ring current energy density except in January, 1986, as discussed above. Therefore we added the fifth criterion: the maximum (proton) energy density averaged between L=3–5 must be less than 60 keVcm^{-3}. We base this on the average energy density, where we have chosen the energy range and radial range to encompass the peak of the quiet time ring current.

As a final check on these quiet time criteria, we plotted the H^+ flux at constant energy and L shell versus time (Figure 2). After the great February 1986 storm (minimum *Dst*=-312 nT) the energetic (300>E>190 keV) H^+ flux in the middle magnetosphere (L>3) was depressed, while the inner magnetosphere fluxes were elevated. These fluxes slowly approached their prestorm equilibrium values, but at relaxation times that depended on energy and radial distance. For the ions at L>4, normal short-term fluctuations are much greater than the long-term effects of the storm, while at L<3, the flux has smaller fluctuations with more of a long-term, large storm contribution. These inner magnetosphere fluxes do not contribute greatly to the ring current energy density except during great storms, but they are far from quasi-equilibrium for a long period after the storm. We therefore eliminated several days in March and April of 1986 that had satisfied the other criteria, both because of their proximity to the great storm and the persistence of storm effects.

Data Overview

By definition, "ring current" refers to those particles making a significant contribution to the energy density and therefore to the *Dst* index. In Figure 3 we plot the 1–300 keV/e energy density

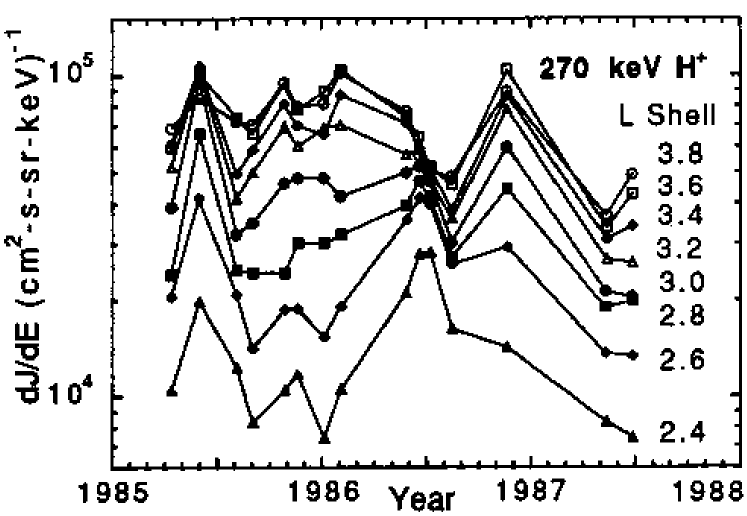

Fig. 2. Average H^+ fluxes (300> E >190 keV) as a function of time and L shell spanning all three years. Note the effect of the storm in early 1986.

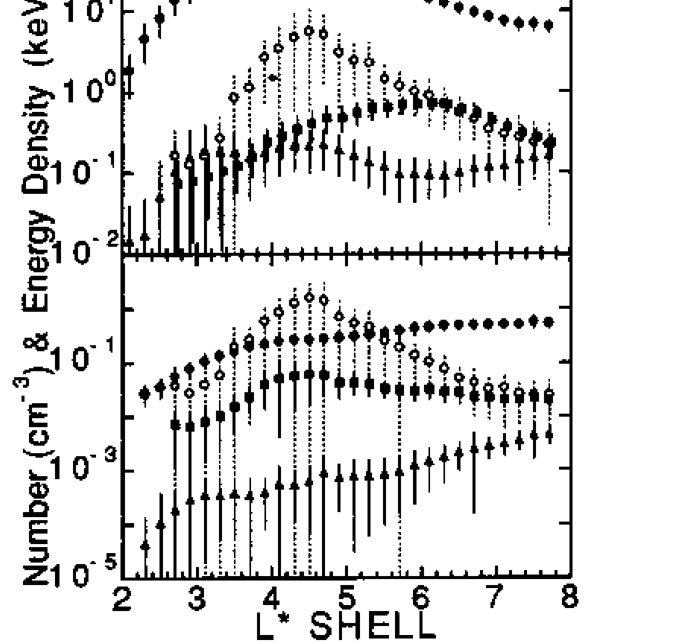

Fig. 3. Energy and number density profile of the quiet ring current (1–3 keV/e) as measured by the CHEM instrument for the four most populous i species. Error bars indicate the variance between orbital passes. H^+ (sol circle), O^+ (open circle), He^+ (solid square), and He^{++} (solid triangle).

and number density of the four most populous ring current speci versus L shell. If we use the 1/e points of the proton energ density curve, we see that the ring current region encompass ~3<L<6. Protons dominate the quiet time ring current energ density primarily because they are also the most numerous, althou see the discussion of O^+ below. The peak of the H^+ distributio moves from 100 keV at L=6, to 250 keV at L=4, to E>300 ke and above the CHEM energy range at L=3 (Figure 4). This is als true to a lesser extent for He^+ and He^{++}, so that the measure energy density values are lower limits only at L<4. Thus the rin current as defined by the energy density 1/e point may extend to low as L=2.5.

We show the O^+ with some reservation both because of its gre temporal variability and because of the high background in th region that required a substantial correction. O^+ often had numb densities exceeding protons between L=4–5 during 1985–1986, b had much lower densities, nearly identical to He^+, during 1987. W attribute the O^+ peak at L=4–5 to a soft spectrum that extends belo the CHEM energy threshold (~1 keV) at L=7.5 [*Lennartsson a Sharp*, 1982], which becomes adiabatically energized from L=7. 4.5, and thus measurable with this instrument. Then the appearan of a density peak is related to the low energy spectrum at L=7. which in turn is apparently quite time variable. Since this paper concerned with characterizing the steady state species, and becau O^+ never dominates the quiet time energy density, we will exclu further treatment of O^+.

By plotting the energy density versus energy at constant L she Figure 4, we can see that the CHEM instrument just manages to g the peak of the distribution over the entire L>3 radial range. T peak of the H^+ distribution increases in energy with decreasing both because of adiabatic energization and because of increasi charge exchange losses around 60 keV with decreasing altitud This compromises the averaging done in Figure 3, since we lo some of the high energy particles from the energy density averag but it does not compromise the binning or the later modeling of t phase space density.