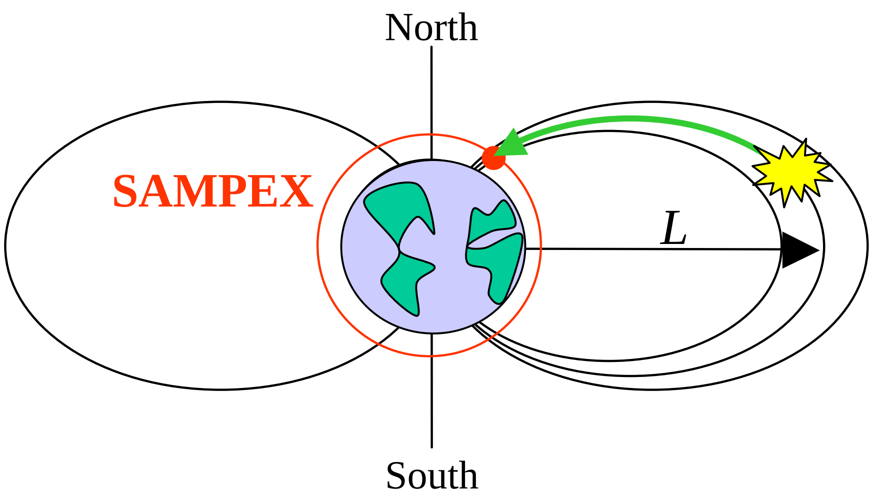
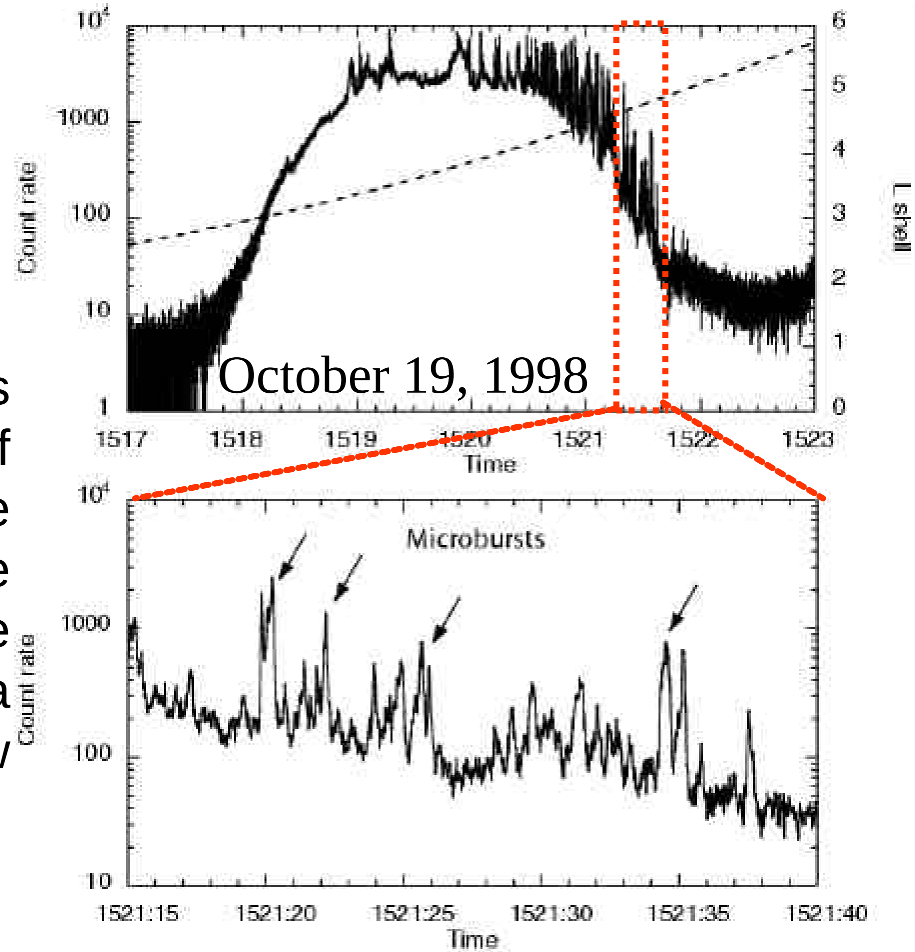
Microbursts

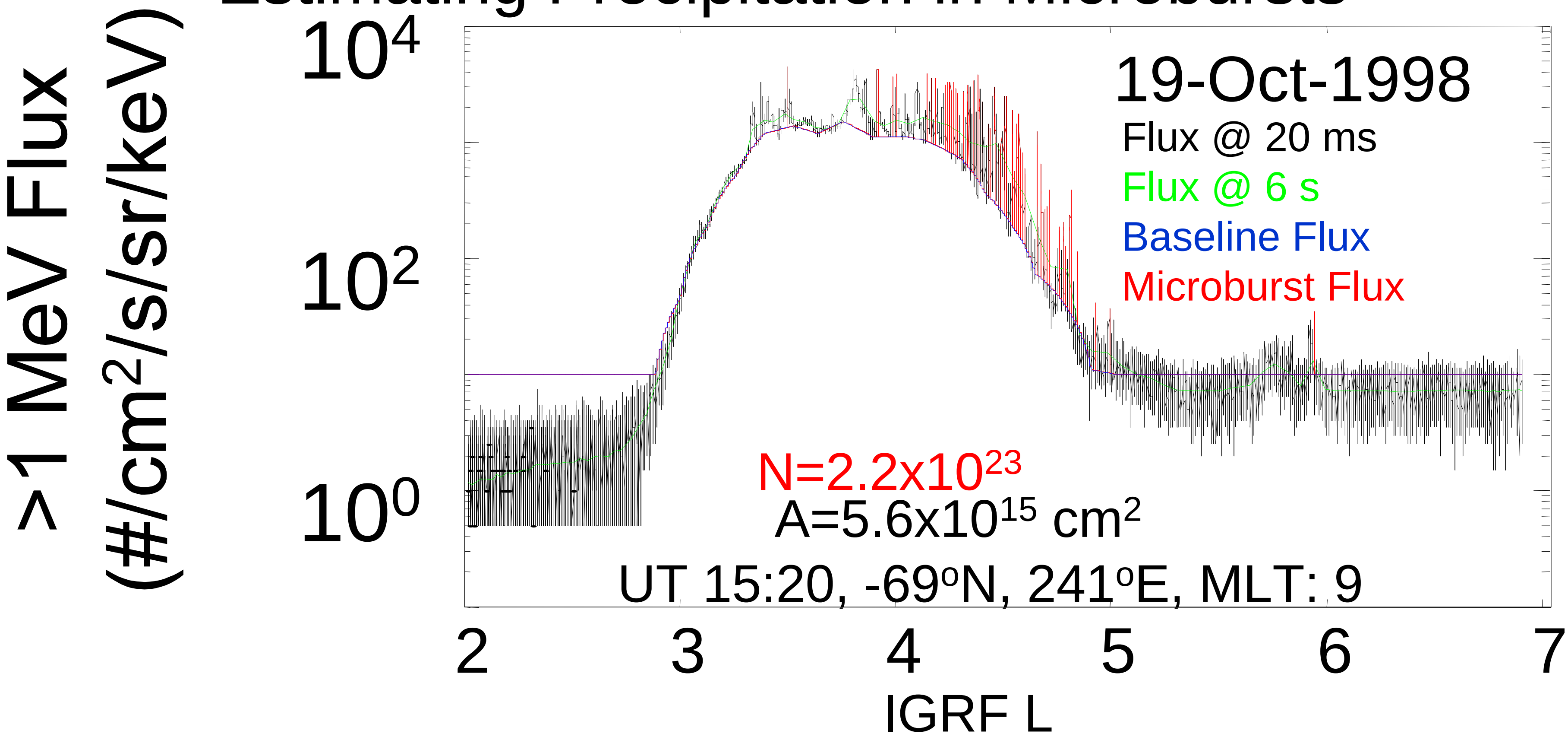


A VLF Wave-Particle Interaction scatters electrons into the atmosphere, producing a microburst at SAMPEX



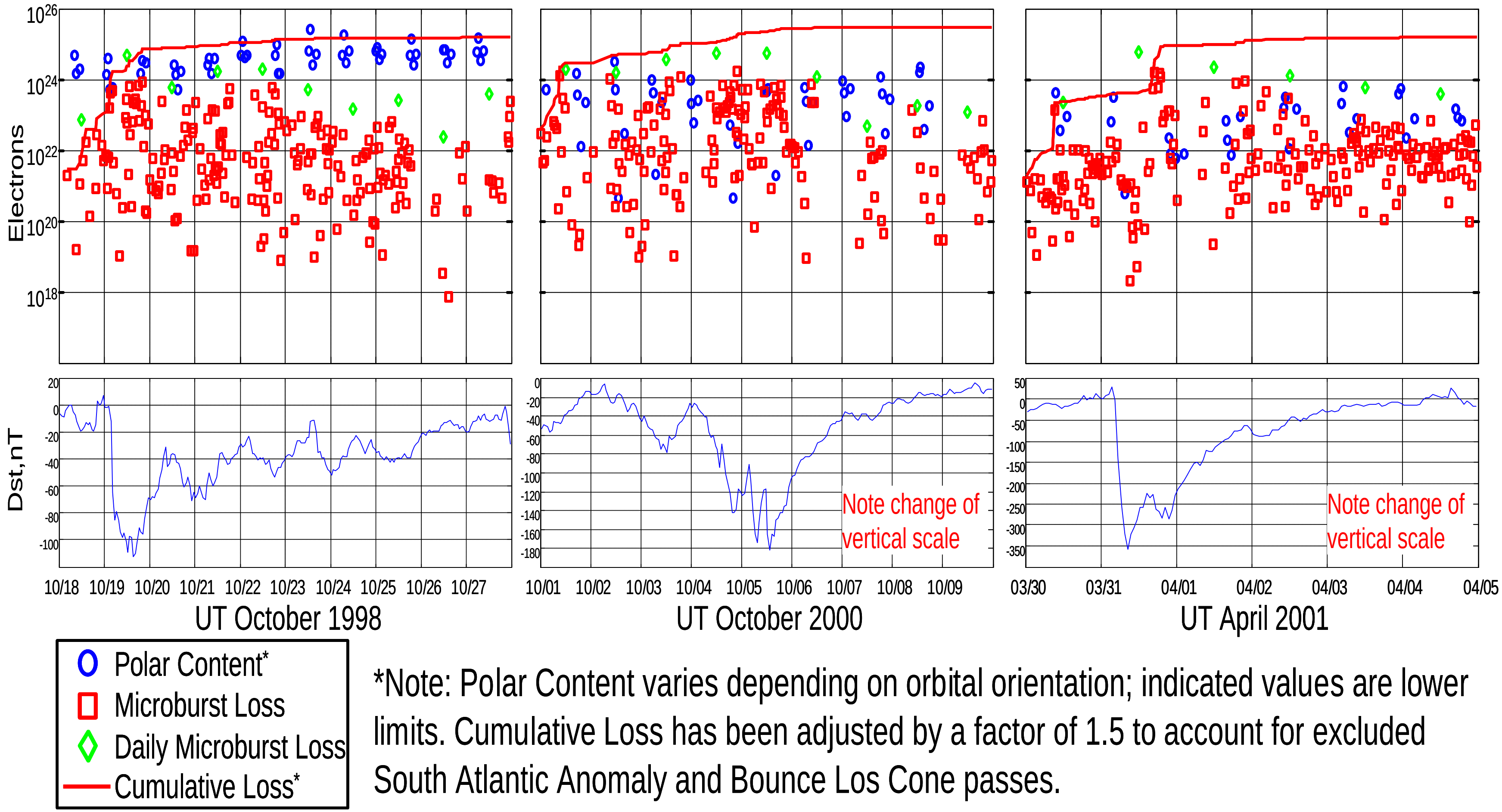
SAMPEX >1 MeV electron microbursts appear as brief, large enhancements of the precipitating electron flux (note the logarithmic scale). The dashed line shows the spacecraft position in L. The lower panel shows 25 seconds of data from the upper panel, in order to show the temporal structure more clearly.

Estimating Precipitation in Microbursts



First, we fit a spline to the running 10th percentile of the 20 ms flux. The baseline is restricted to be at least 10 counts/cm^2/s/sr/keV. Then, we count as microbursts any flux excursions above √10 times the baseline. The difference between the microburst flux and the baseline is considered to be the flux of precipitating particles. We multiply this by 6 hours of local time and by 1.5 hours of real time times the latitude extent to obtain an estimate for the total electrons lost in this microburst.

>1 MeV Electron Content vs Loss

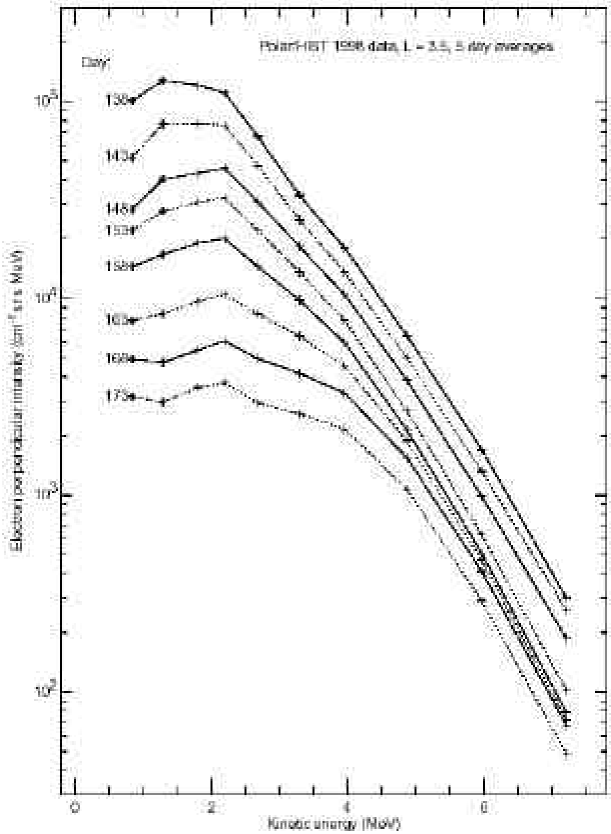


*Note: Polar Content varies depending on orbital orientation; indicated values are lower limits. Cumulative Loss has been adjusted by a factor of 1.5 to account for excluded South Atlantic Anomaly and Bounce Los Cone passes.

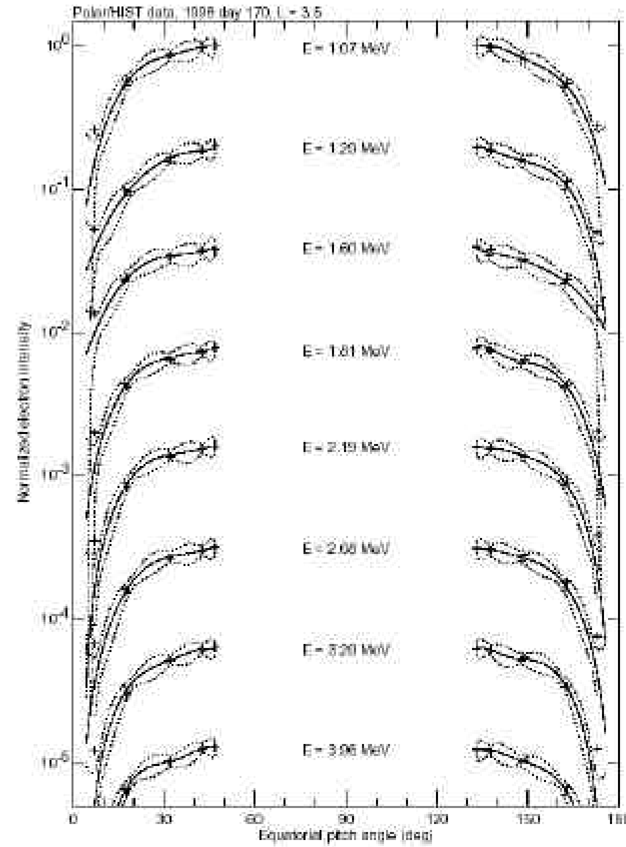
Electron losses to microbursts estimated from SAMPEX are on the same order of magnitude as the total radiation belt content estimated from Polar. Loss due to microbursts drops by an order of magnitude after minimum Dst. Therefore, much of the main-phase “Dst effect” may be due to actual loss.

CEPPAD/HIST observations of decaying quiet time electrons at L=3.5

Spectra from 1998 days 135 to 175:



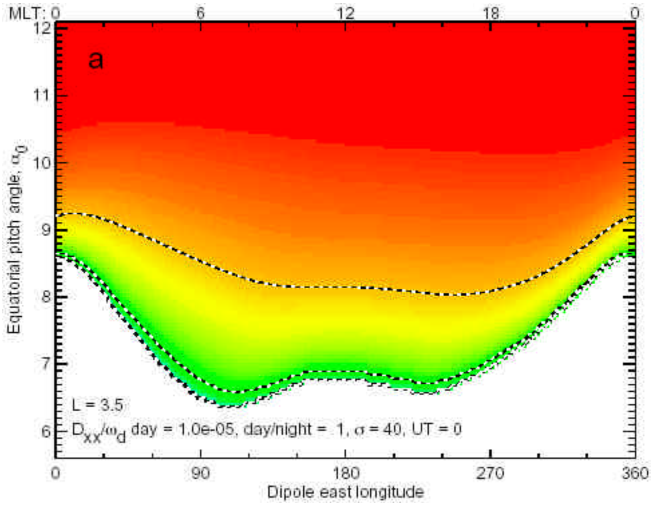
Pitch angle distributions from day 170:



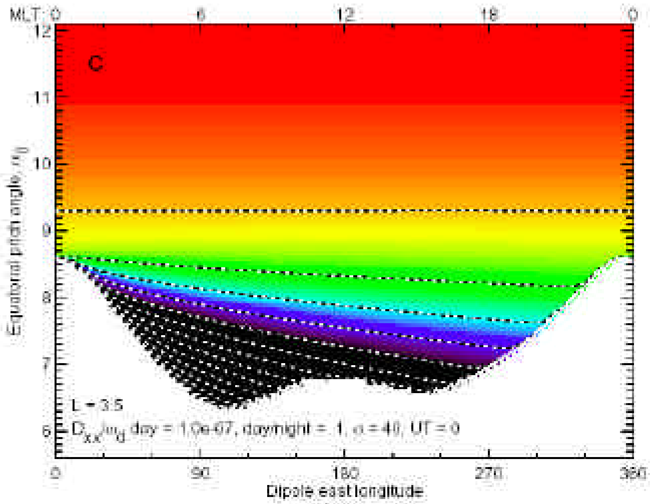
Use these data as upper boundary conditions for a model of electron loss into the atmosphere by pitch angle diffusion.

Model balances longitudinal drift and pitch angle diffusion into the atmosphere

Solution with high diffusion relative to drifts:

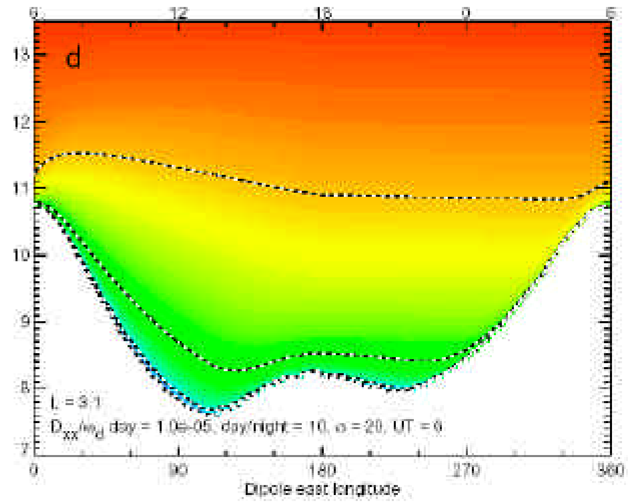


Solution with low diffusion relative to drifts:

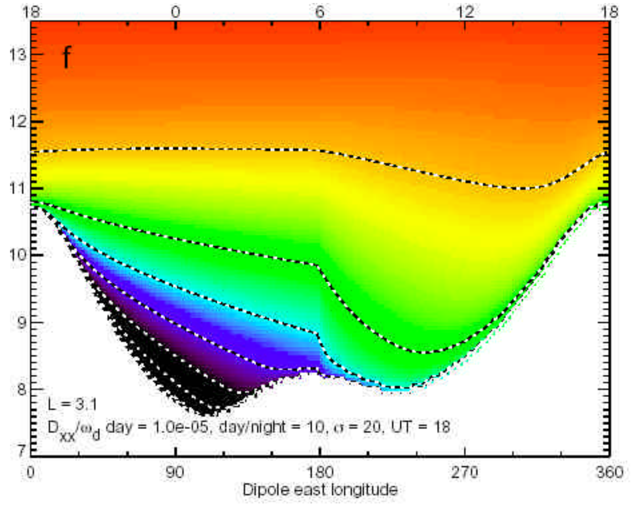


Solutions with high diffusion on day side and low diffusion on night side

UT = 0600:

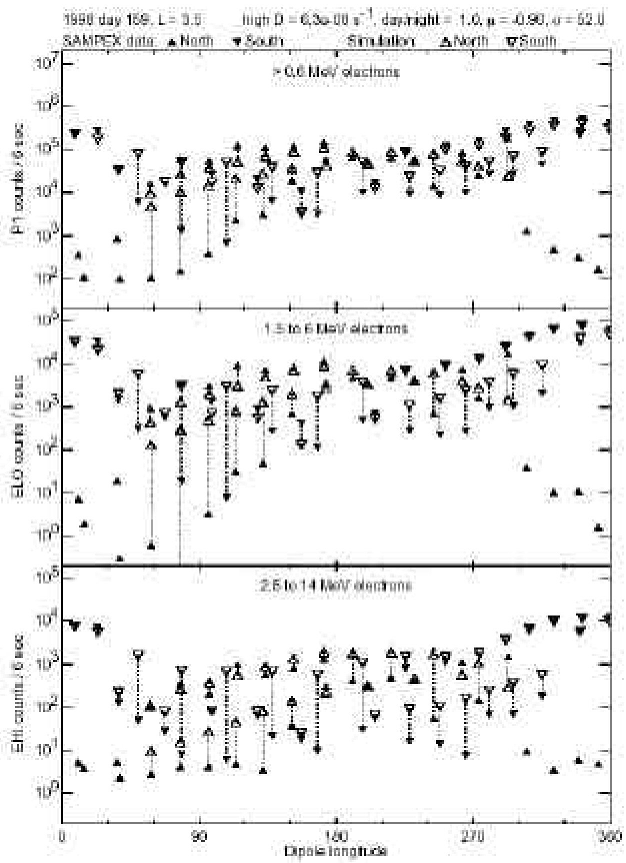


UT = 1800:

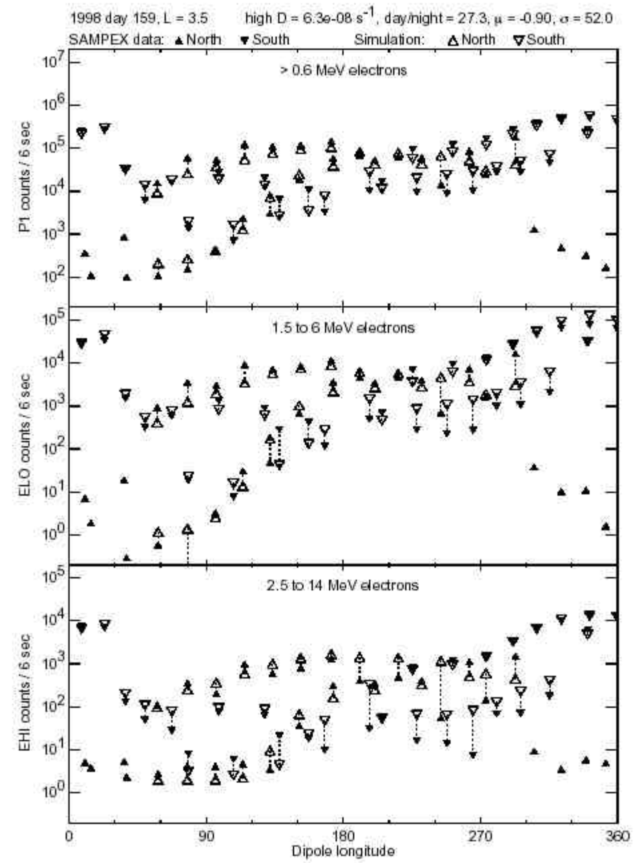


Sample 1-day fits of model to SAMPEX electron data (1998 day 159)

Equal day/night diffusion (BAD FIT):



Day/night diffusion ratio = 30 (GOOD FIT):



Conclusions:

1. Can determine diffusion loss rate into atmosphere from fits to SAMPEX and Polar data
2. Loss rates are generally higher on the day side