UT/LONGITUDINAL VARIATIONS OF COMPOSITION IN DE DATA

A. E. Hedin
Code 614
NASA/Goddard Spaceflight Center
Greenbelt, MD 20771

Composition data obtained by the quadrupole mass spectrometer (NACS) carried aboard the DE-B satellite have been examined for variations in the polar regions during magnetically quiet conditions. The corresponding predictions of the MSIS-83 model are often used for comparison. The MSIS-83 model is used to emphasize the variations of interest by suppressing all other variations. A persistent enhancement of N_2 density and a depletion of He density are present in the vicinity of the magnetic poles with maximum density response in the morning hours (magnetic) on average. A universal time (UT) variation in average density levels is evident near both the geographic and magnetic poles. There are systematic morphology changes with UT and between summer and winter which are qualitatively consistent with the simple concept that thermospheric heating effects are shifted or spread in the downwind direction of the global circulation systems driven by EUV and magnetospheric sources. The magnitude of the UT variations is larger in the southern hemisphere and is larger in local winter than summer.

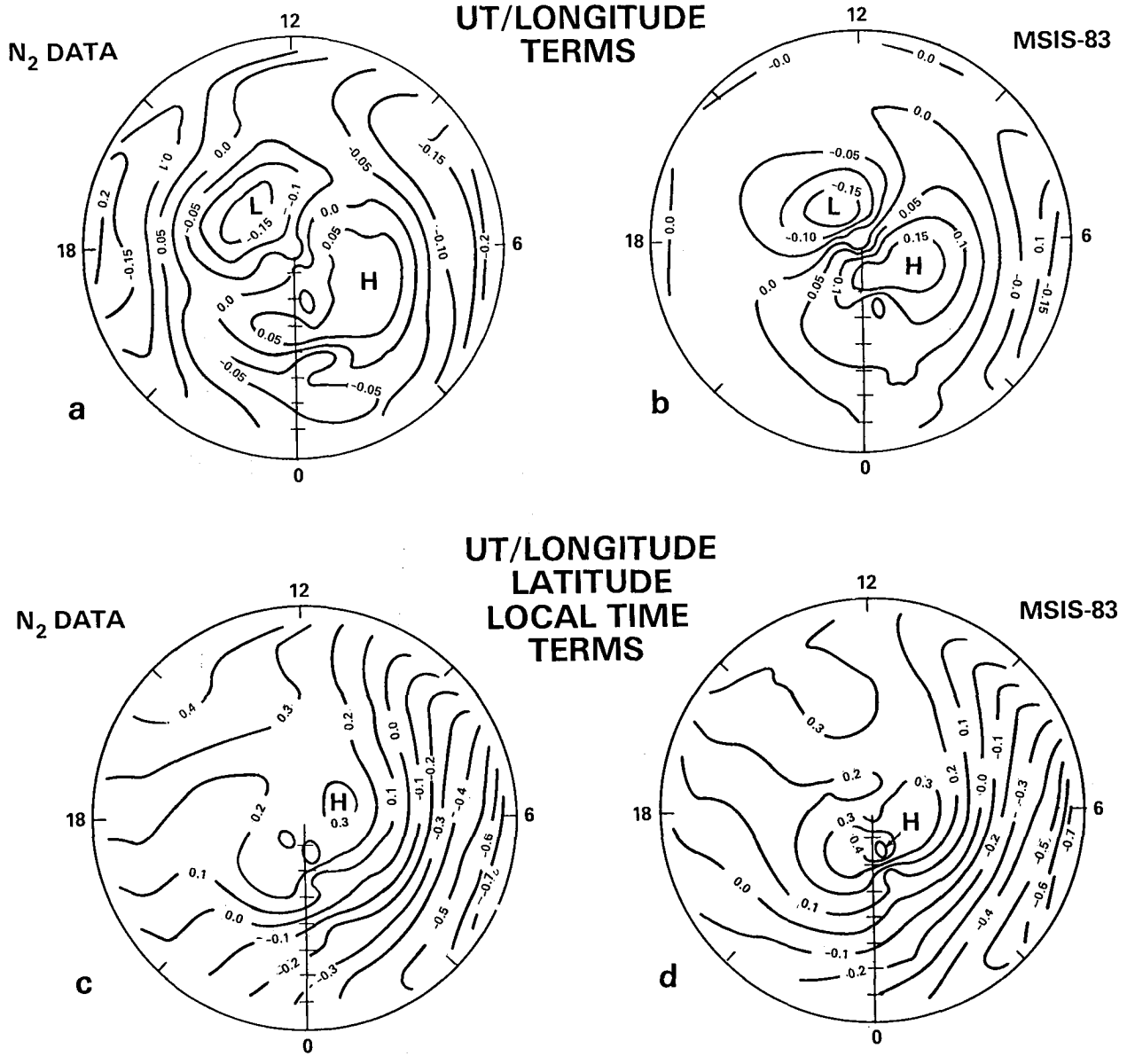

Figure 1. Contour plot in geomagnetic latitude (-90 to -30 degrees) and magnetic local time coordinates of southern hemisphere N_2 data and corresponding MSIS model results for the same data distribution: (a) logarithm of N_2 data divided by the MSIS model omitting the UT/longitude terms of the model; (b) same as panel (a) using full MSIS model N_2 densities in place of data; (c) and (d) same as panels (a) and (b) but dividing by MSIS model omitting the UT/longitude, local time, and time independent latitude terms.

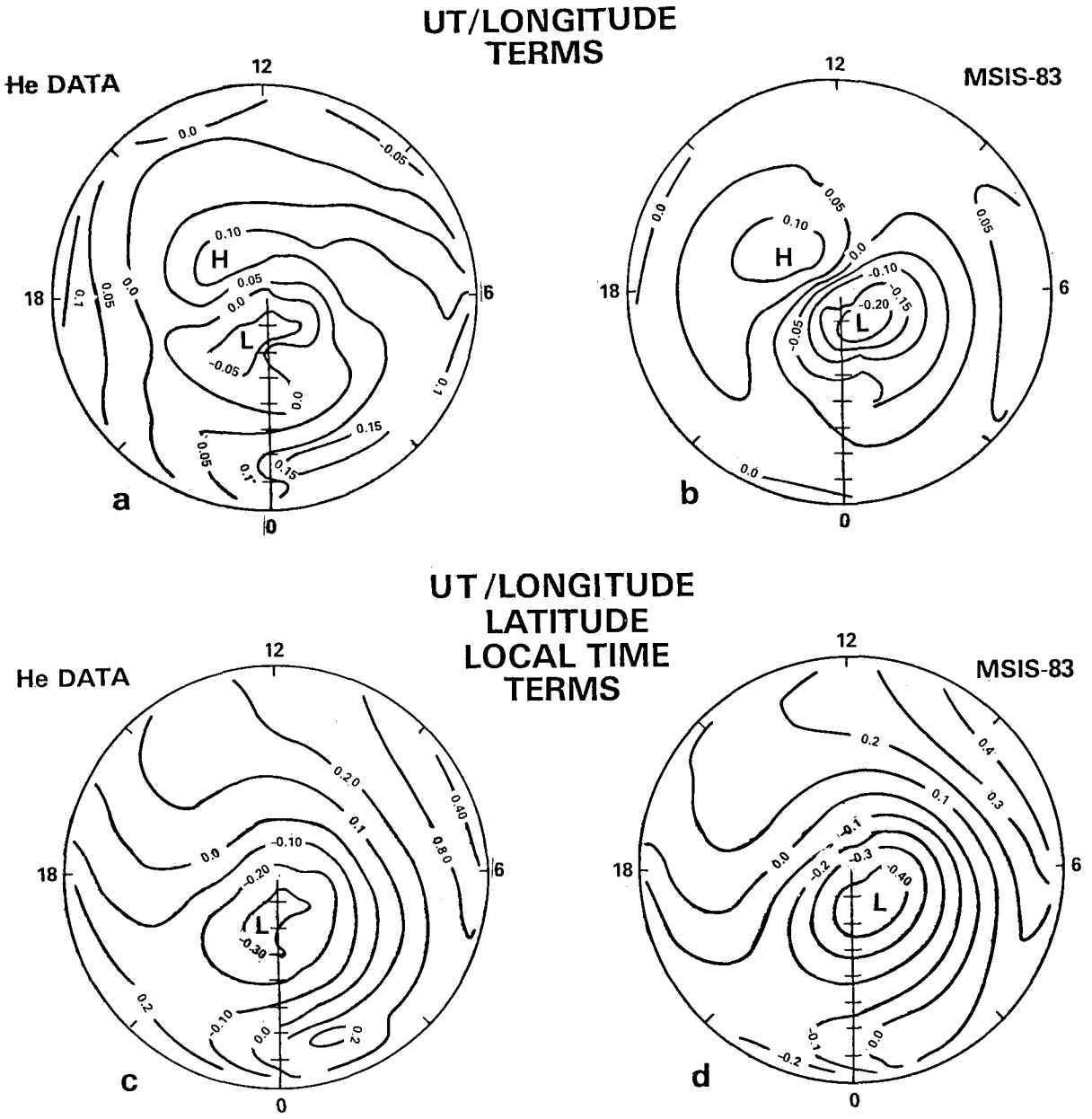

Figure 2. Contour plot in geomagnetic latitude (-90 to -30 degrees) and magnetic local time coordinates of southern hemisphere He data and corresponding MSIS model results for the same data distribution: (a) logarithm of He data divided by the MSIS model omitting the UT/longitude terms of the model; (b) same as panel (a) using full MSIS model He densities in place of data; (c) and (d) same as panels (a) and (b) but dividing by MSIS model omitting the UT/longitude, local time, and time independent latitude terms.

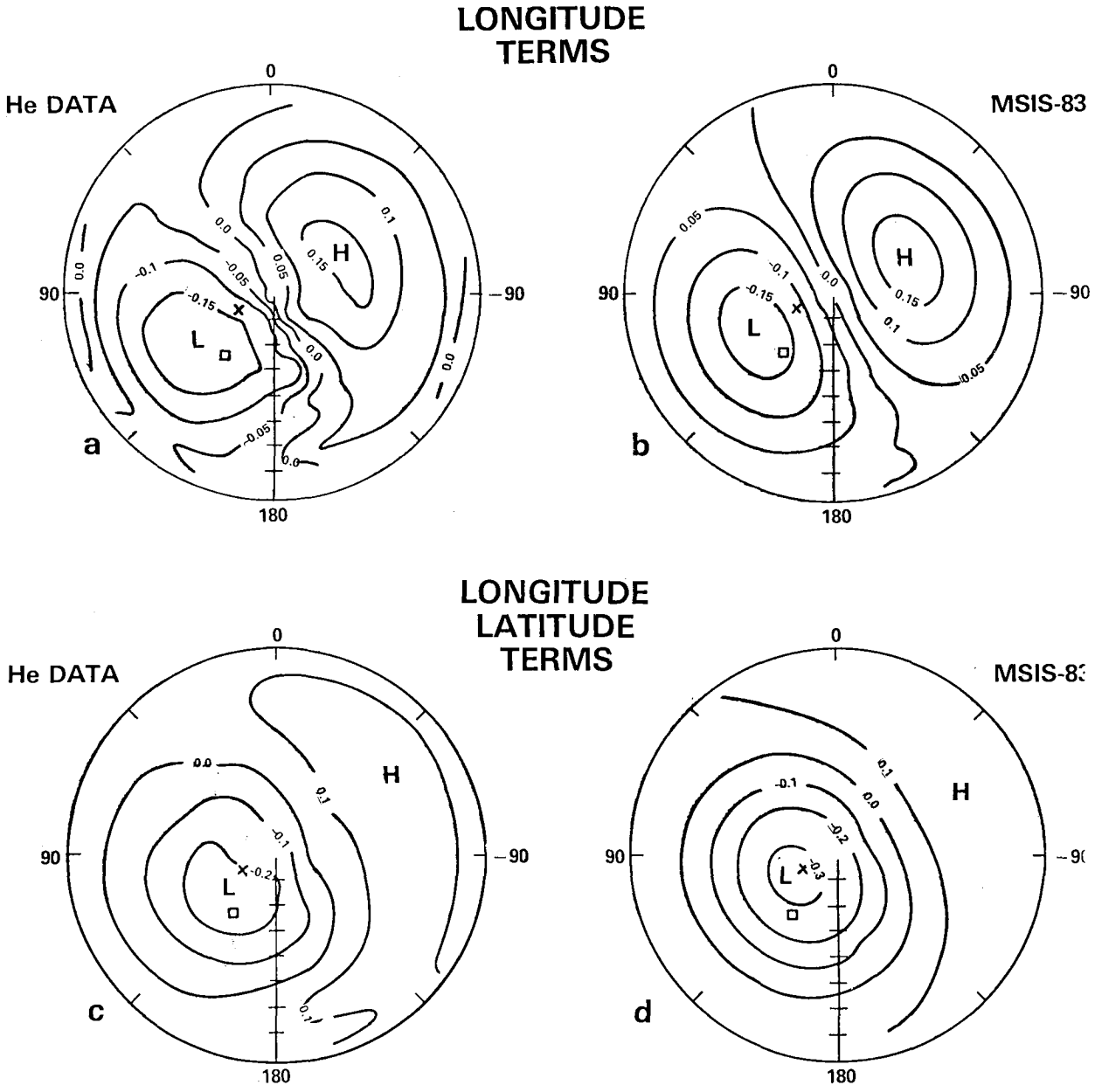

Figure 3. Contour plot in geographic latitude (-90 to -30 degrees) and longitude coordinates of southern hemisphere He data and corresponding MSIS model results for the same data distribution: (a) logarithm of He data divided by the MSIS model omitting the longitude terms of the model; (b) same as panel (a) using full MSIS model He densities in place of data; (c) and (d) same as panels (a) and (b) but dividing by MSIS model omitting the longitude and time independent latitude terms. The x indicates the geomagnetic pole and square the dip pole.

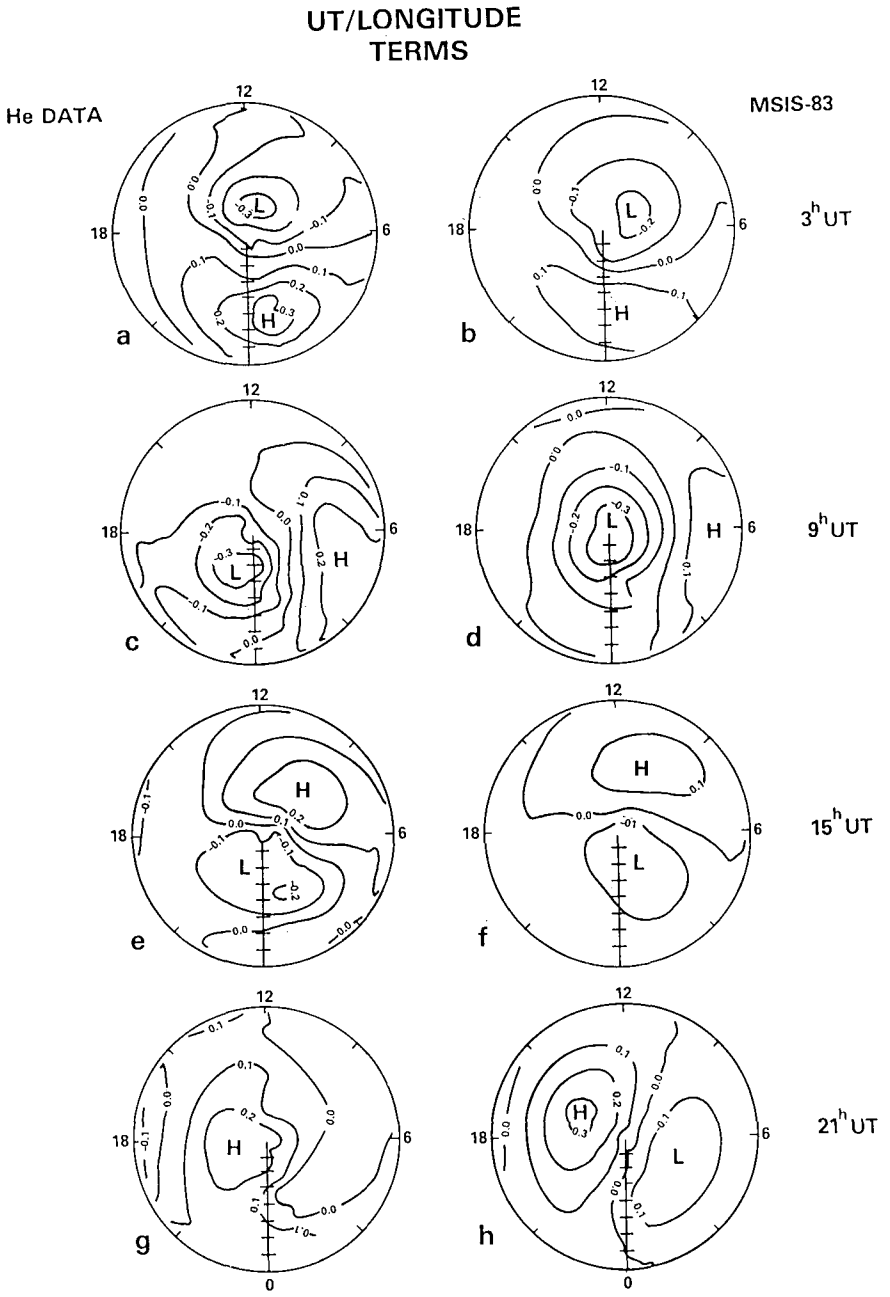

Figure 4. Contour plot in geomagnetic latitude (-90 to -30 degrees) and magnetic local time coordinates of southern hemisphere He data for six hour UT intervals and corresponding MSIS model results for the same data distribution: (a) logarithm of He data divided by the MSIS model omitting the UT/longitude terms of the model for 0 to 6 hrs UT; (b) same as panel (a) using full MSIS model He densities in place of data; (c) and (d) same as panels (a) and (b) for 6 to 12 hours UT; (e) and (f) for 12 to 18 hrs UT; (g) and (h) for 18 to 24 hrs UT.

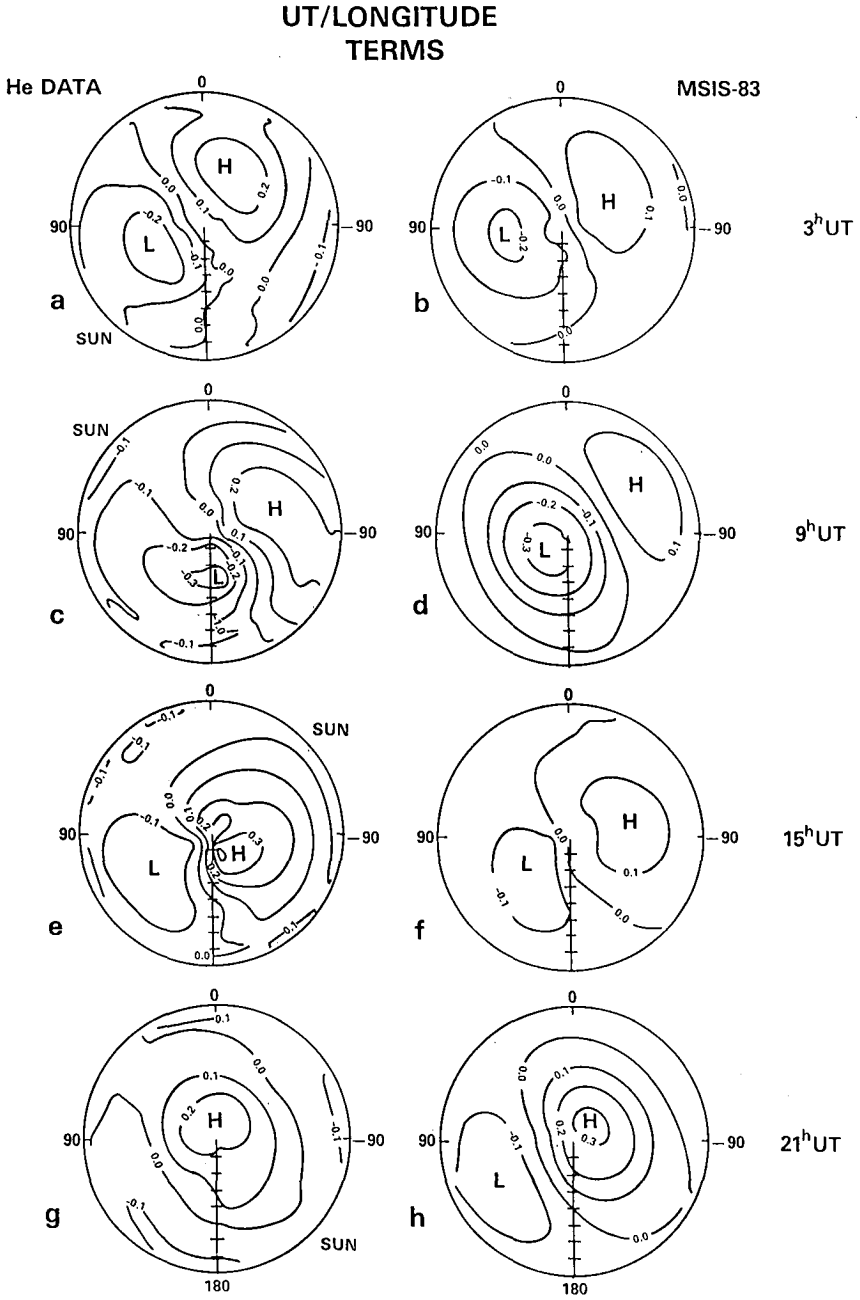

Figure 5. Contour plot in geographic latitude (-90 to -30 degrees) and longitude coordinates of southern hemisphere He data for six hour UT intervals and corresponding MSIS model results for the same data distribution: (a) logarithm of He data divided by the MSIS model omitting the UT/longitude terms of the model for 0 to 6 hours UT; (b) same as panel (a) using full MSIS model He densities in place of data; (c) and (d) same as panels (a) and (b) for 6 to 12 hours UT; (e) and (f) for 12 to 18 hrs UT; (g) and (h) for 18 to 24 hrs UT.

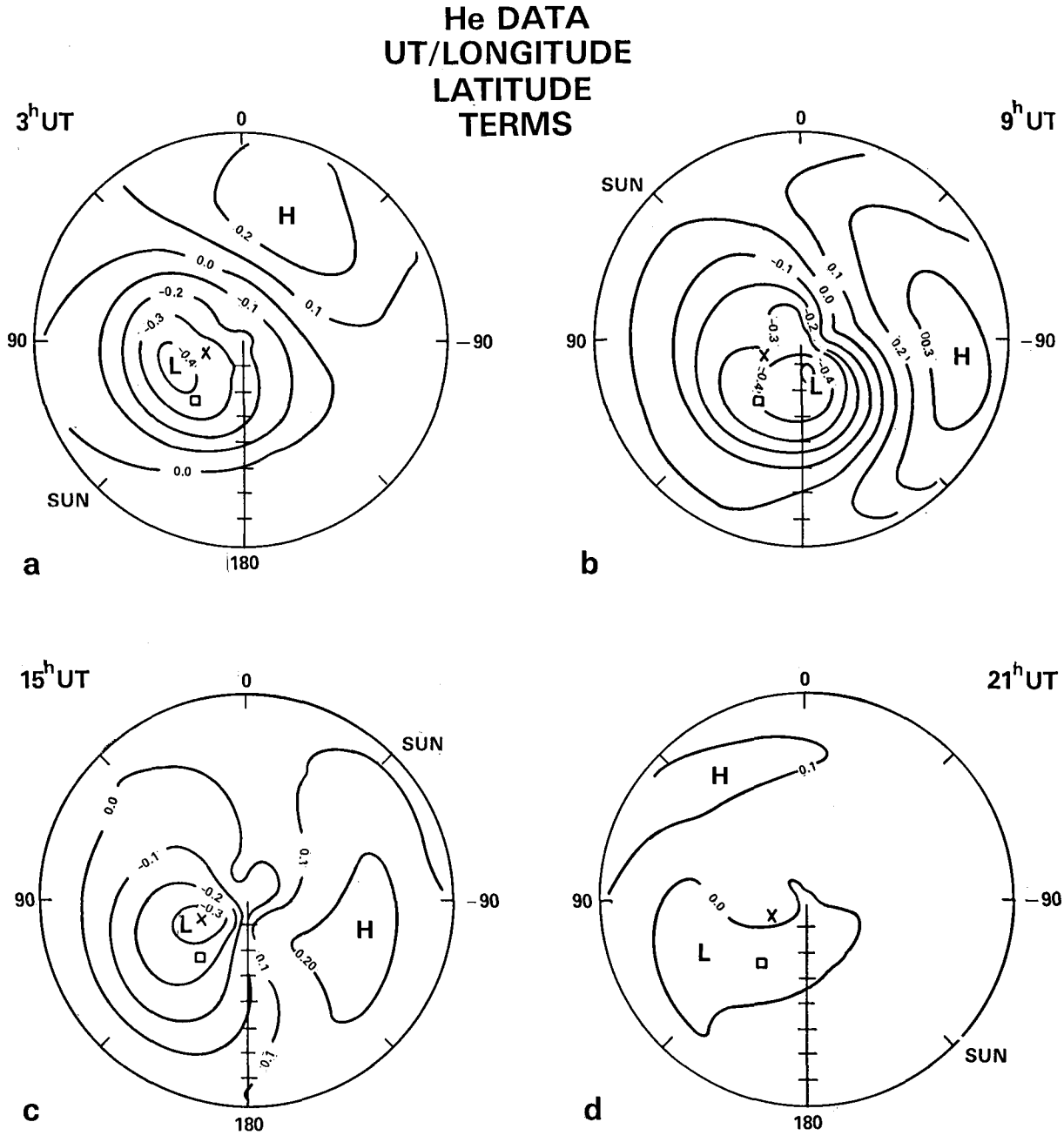

Figure 6. Contour plot in geographic latitude (-90 to -30 degrees) and longitude coordinates of southern hemisphere He data for six hour UT intervals. Contours indicate the logarithm of He data divided by the MSIS model omitting the UT/longitude and time independent latitude terms of the model for (a) 0 to 6 hrs UT; (b) 6 to 12 hrs UT; (c) 12 to 18 hrs UT; and (d) for 18 to 24 hrs UT.

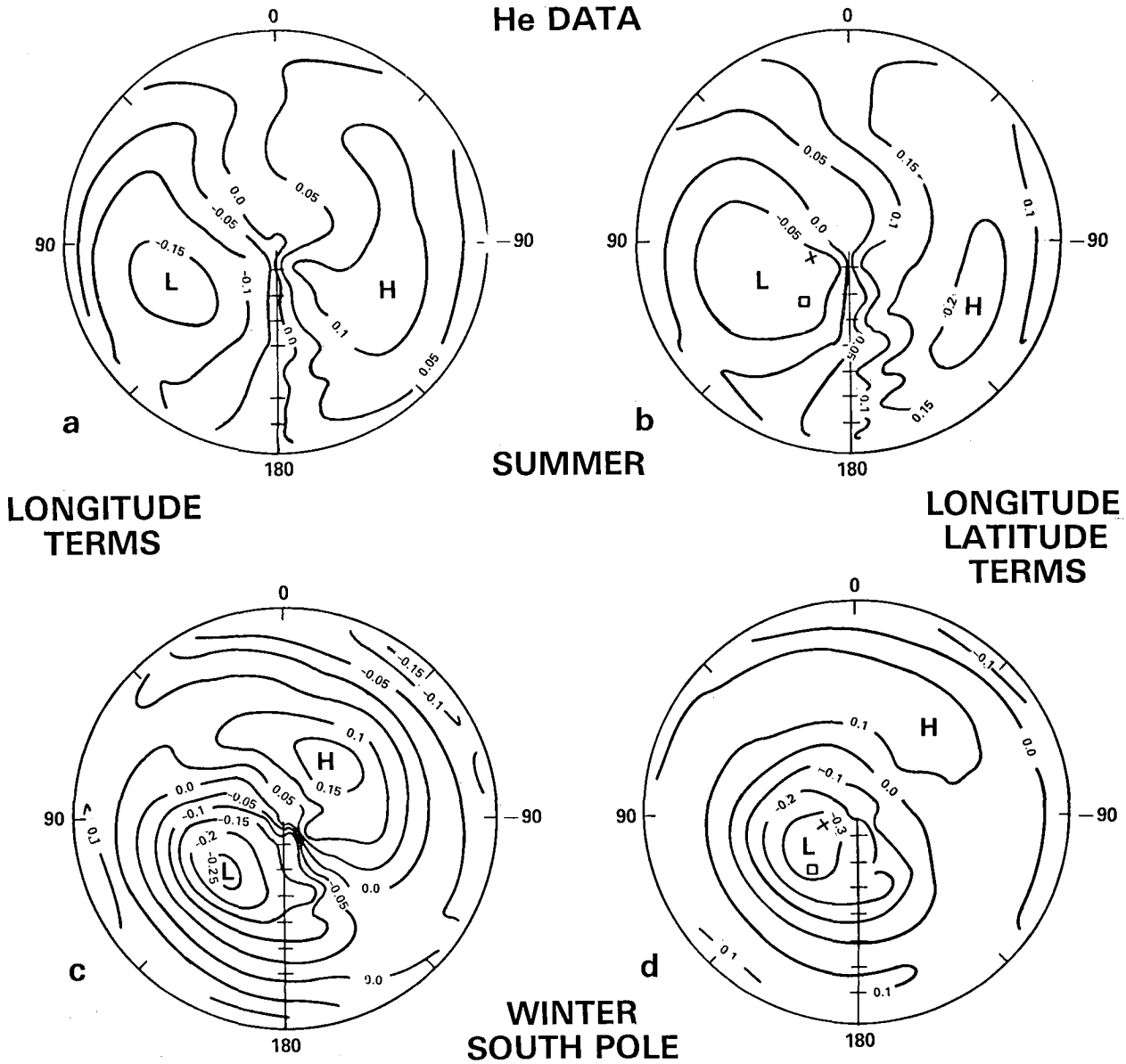

Figure 7. Contour plot in geographic latitude (-90 to -30 degrees) and longitude coordinates of southern hemisphere He data: (a) logarithm of He data divided by the MSIS model omitting the longitude terms of the model for summer data; (b) same as panel (a) but dividing by MSIS model omitting the longitude and time independent latitude terms; (c) and (d) same as (a) and (b) but for winter data.

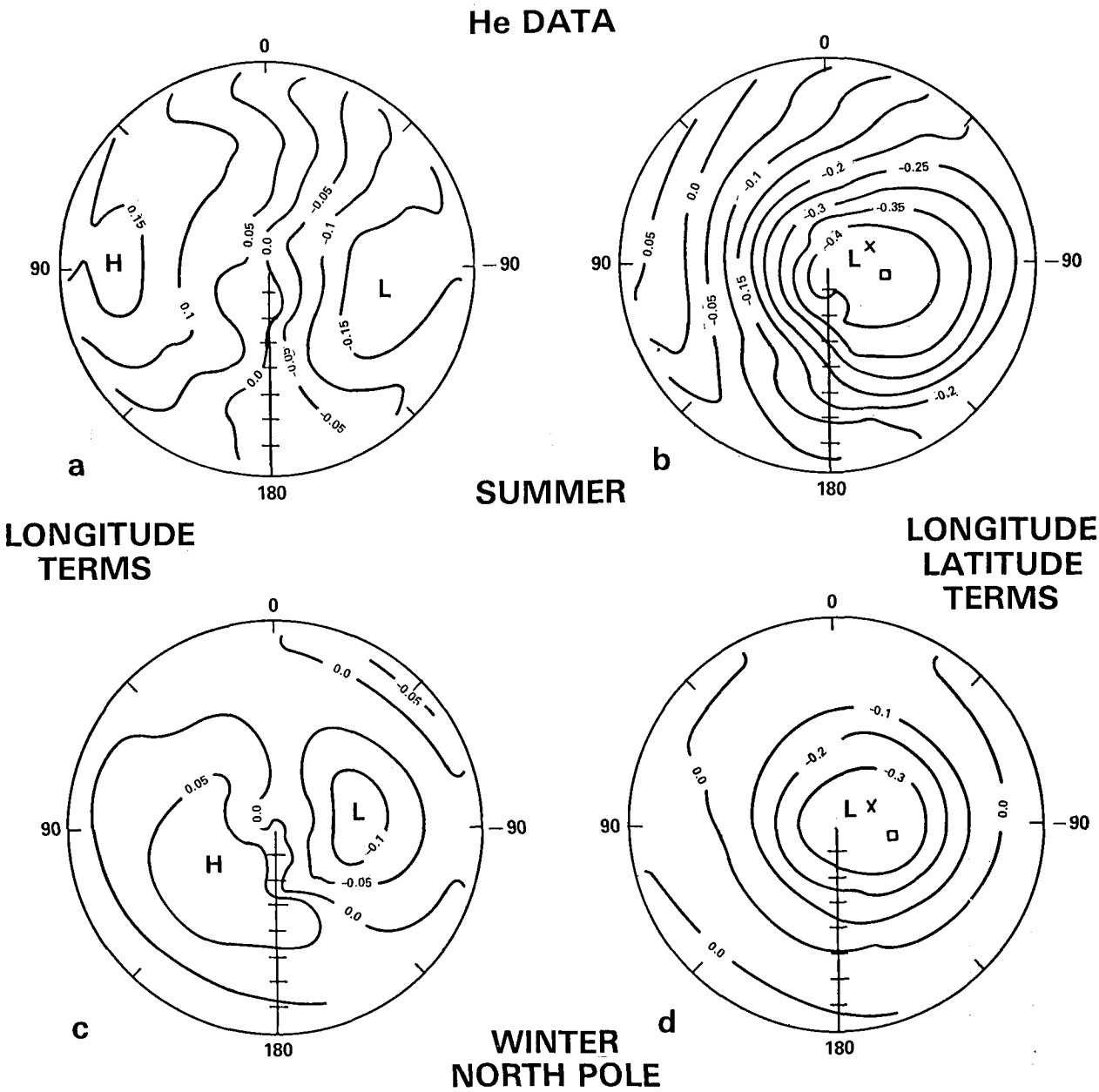

Figure 8. Contour plot in geographic latitude (-90 to -30 degrees) and longitude coordinates of northern hemisphere He data: (a) logarithm of He data divided by the MSIS model omitting the longitude terms of the model for summer data; (b) same as panel (a) but dividing by MSIS model omitting the longitude and time independent latitude terms; (c) and (d) same as (a) and (b) but for winter data.

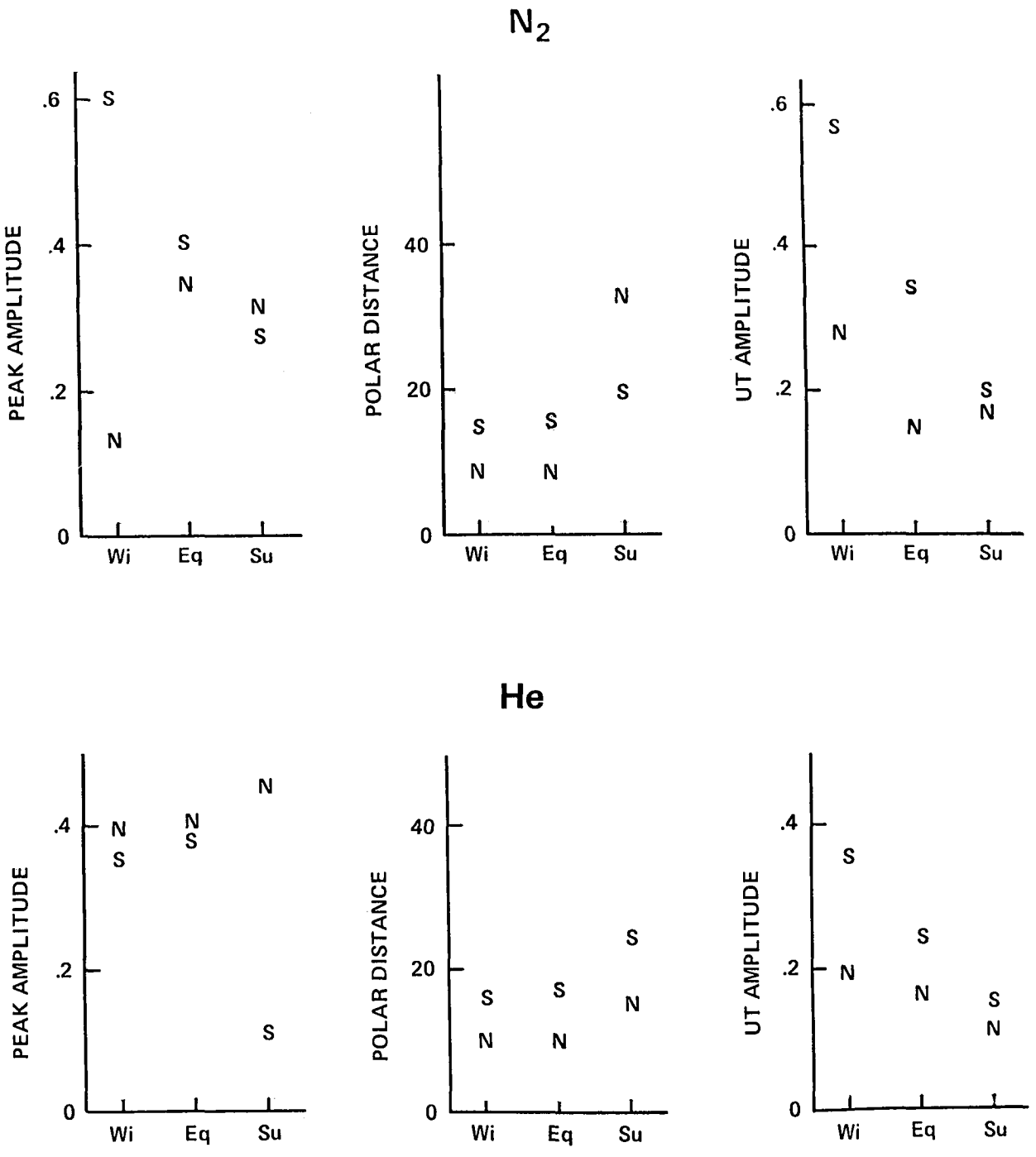

Figure 9. Magnitude of the polar peak, angular distance from the geographic pole, and amplitude of the UT variation at the geographic pole as a function of season for He and N_2 data. N indicates northern hemisphere and S indicates southern hemisphere.