

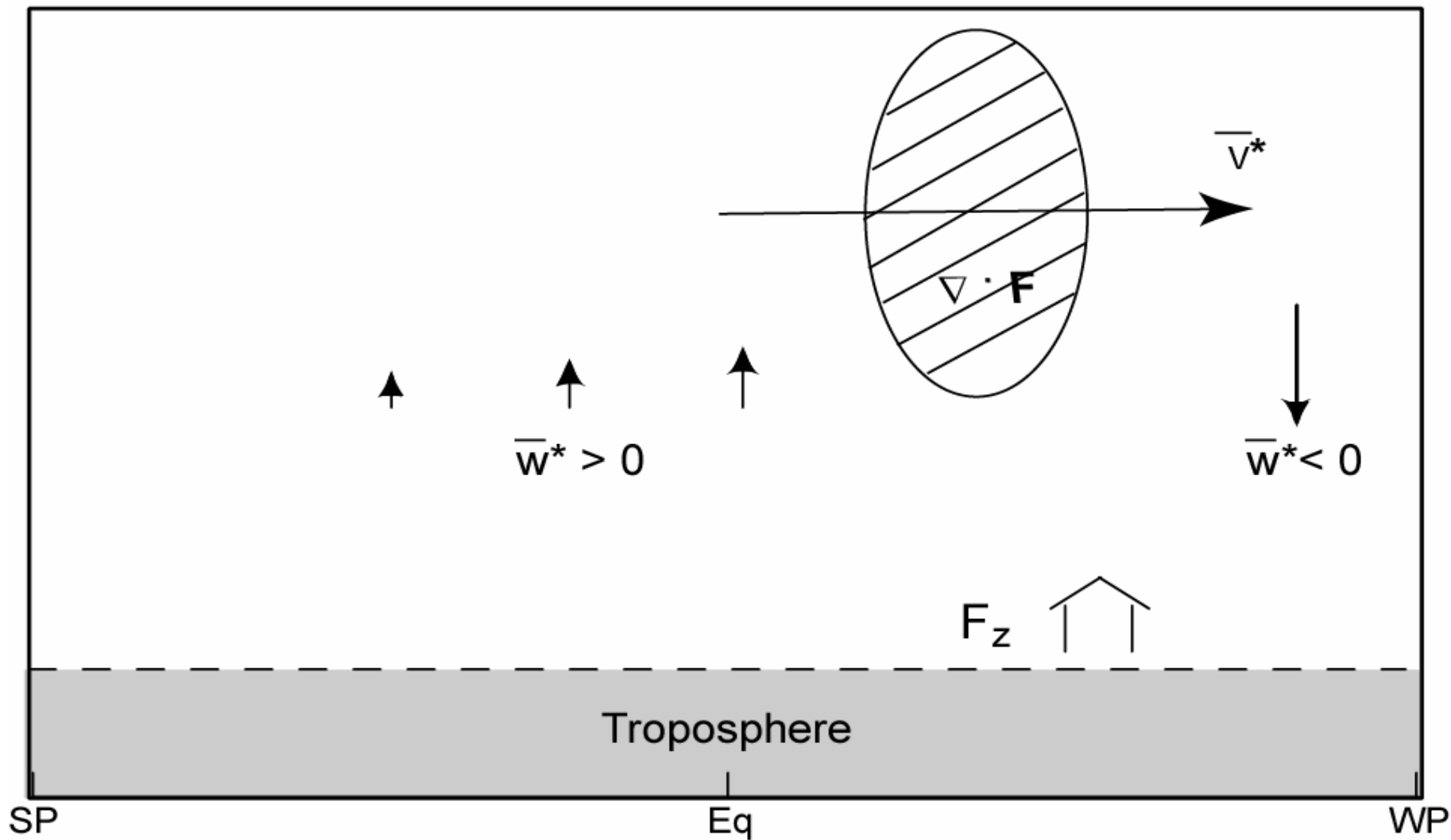
Evidence of the Solar Cycle in the General Circulation of the Stratosphere and Its Influence on the Troposphere

Murry Salby
University of Colorado

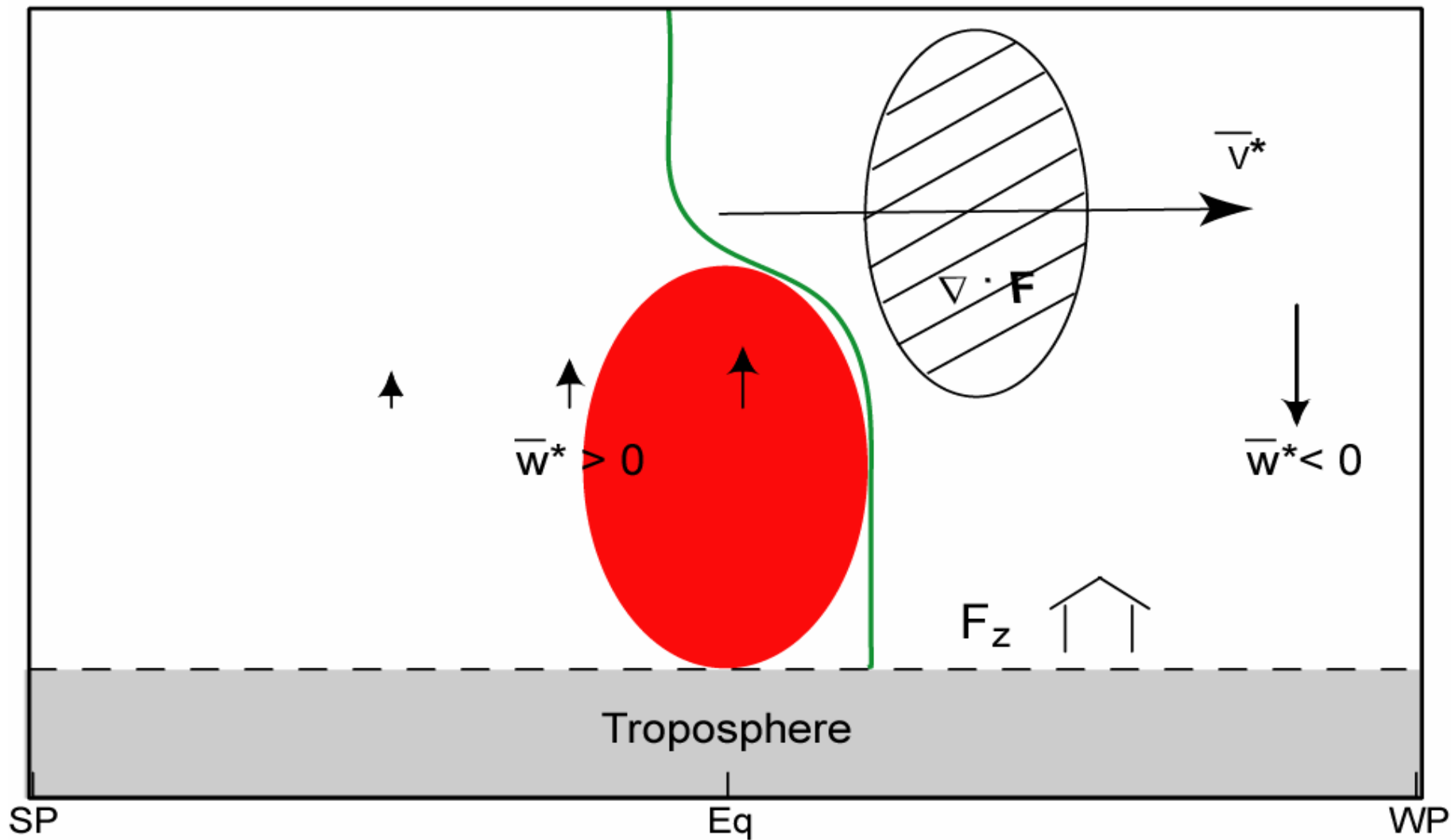
Patrick Callaghan
Atmospheric Systems and Analysis

- Interannual Variability in the Stratosphere
- Systematic Variations
- Interaction with the Troposphere

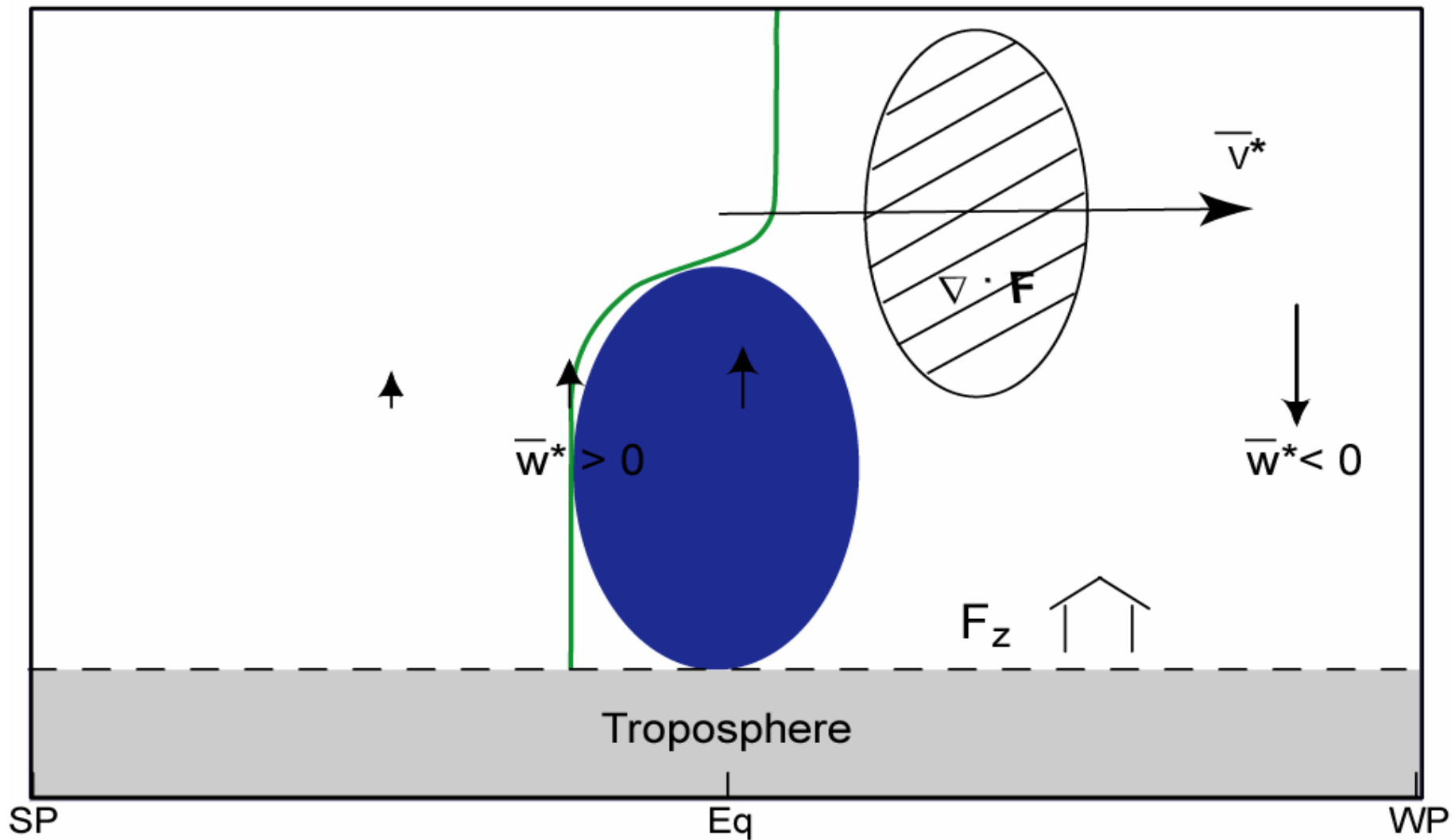
Residual Mean Circulation



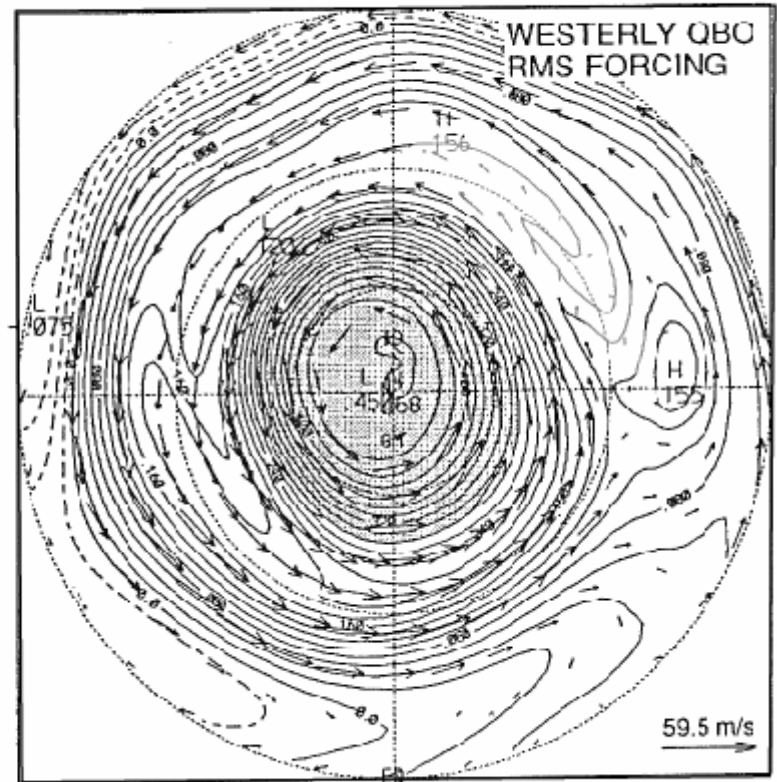
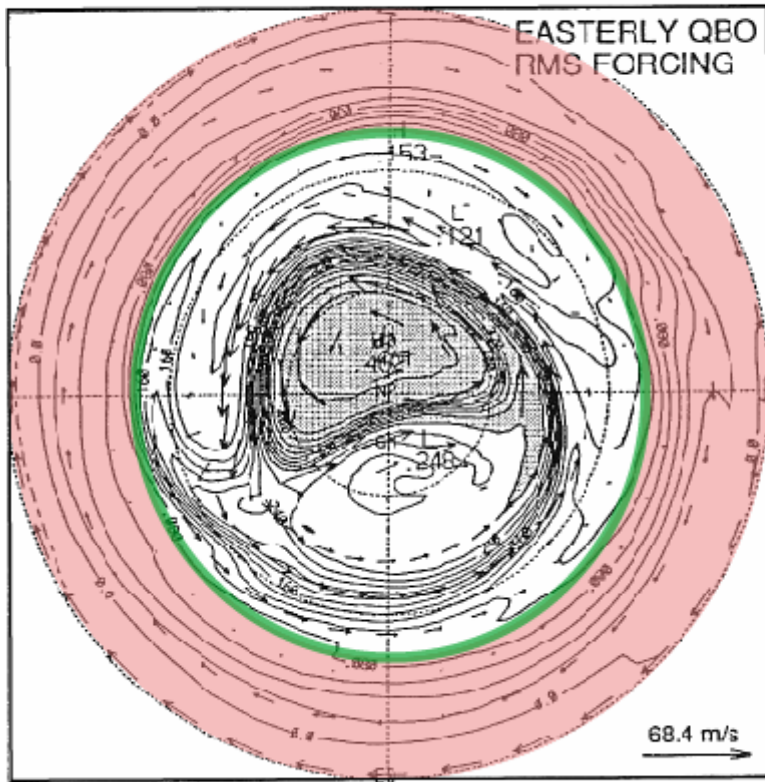
Residual Mean Circulation

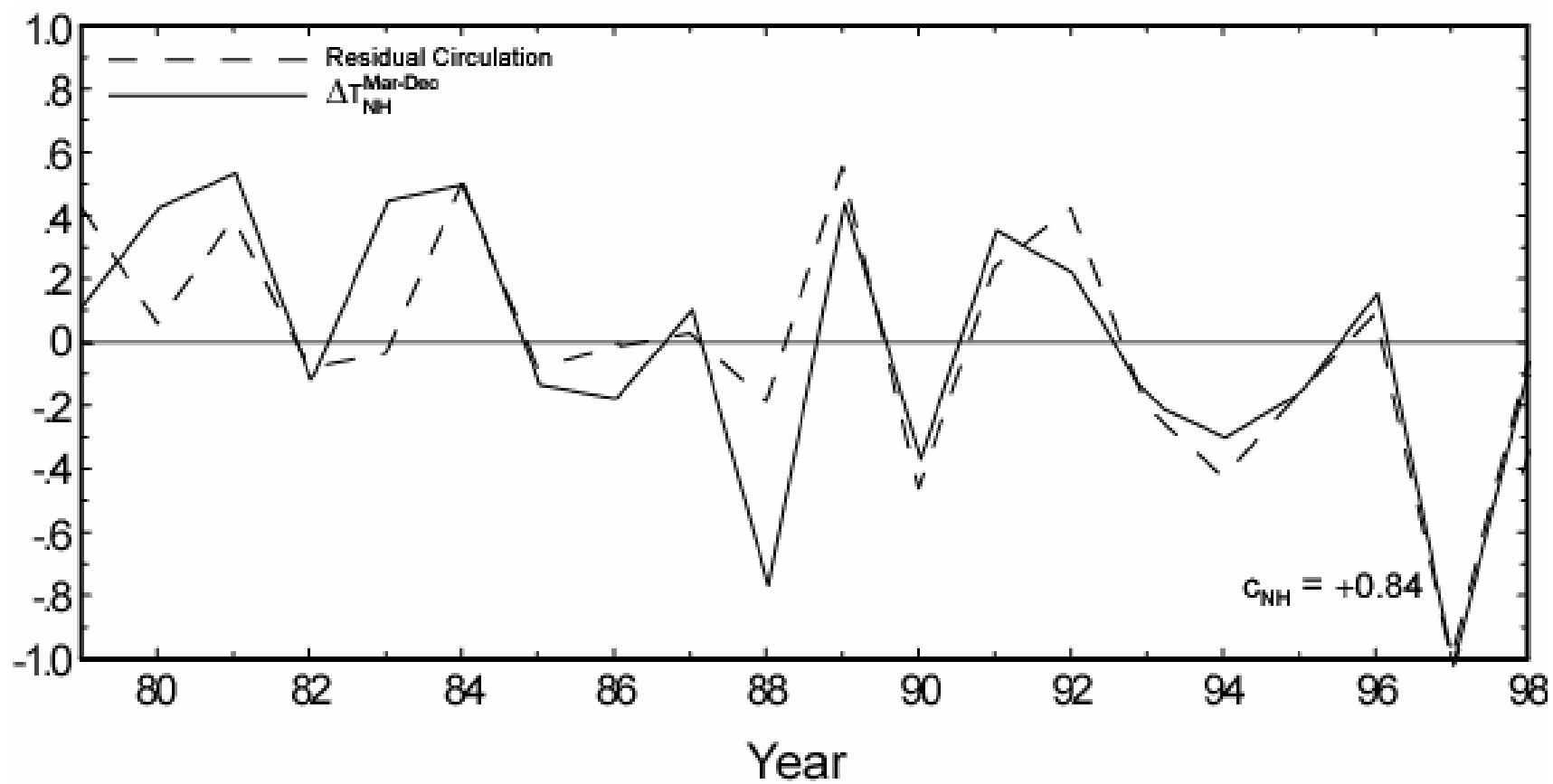


Residual Mean Circulation

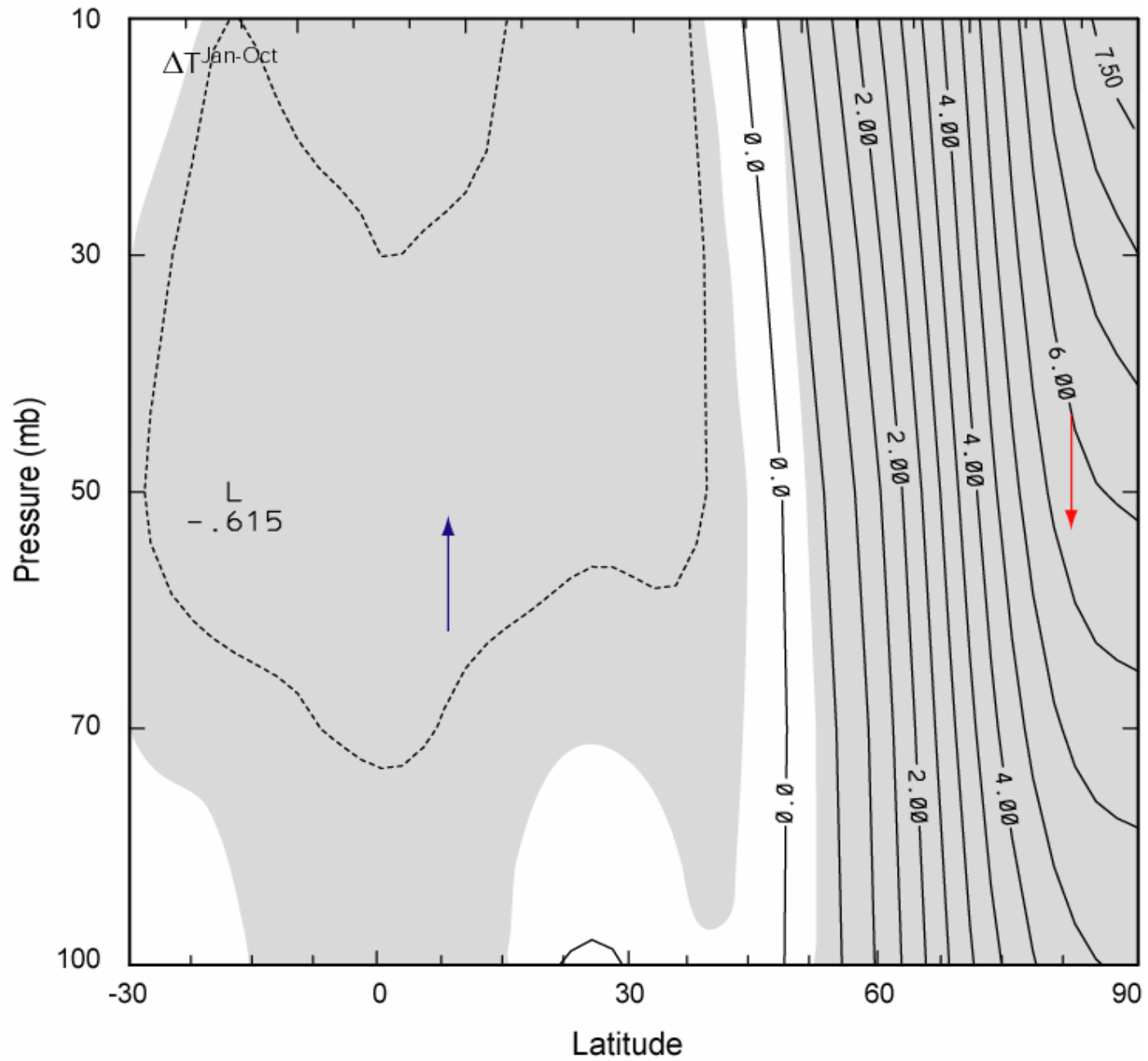


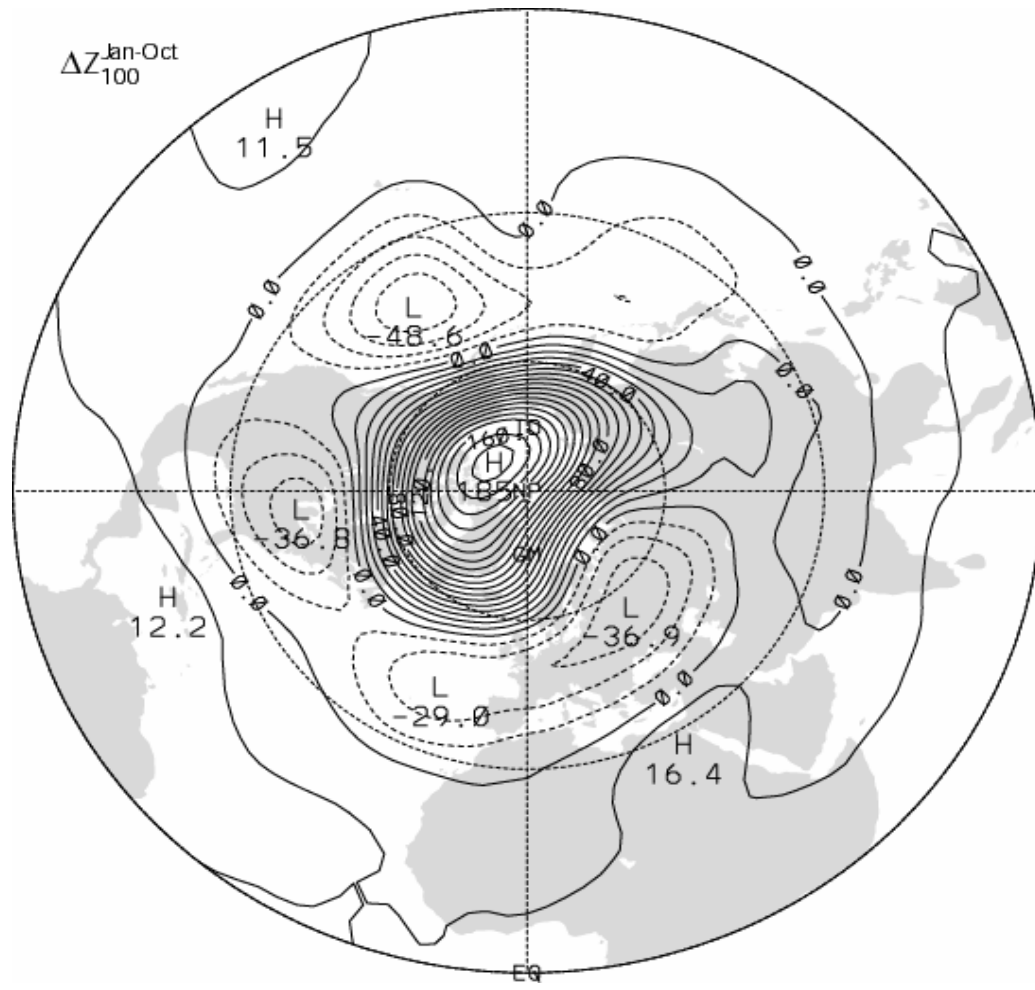
POTENTIAL VORTICITY

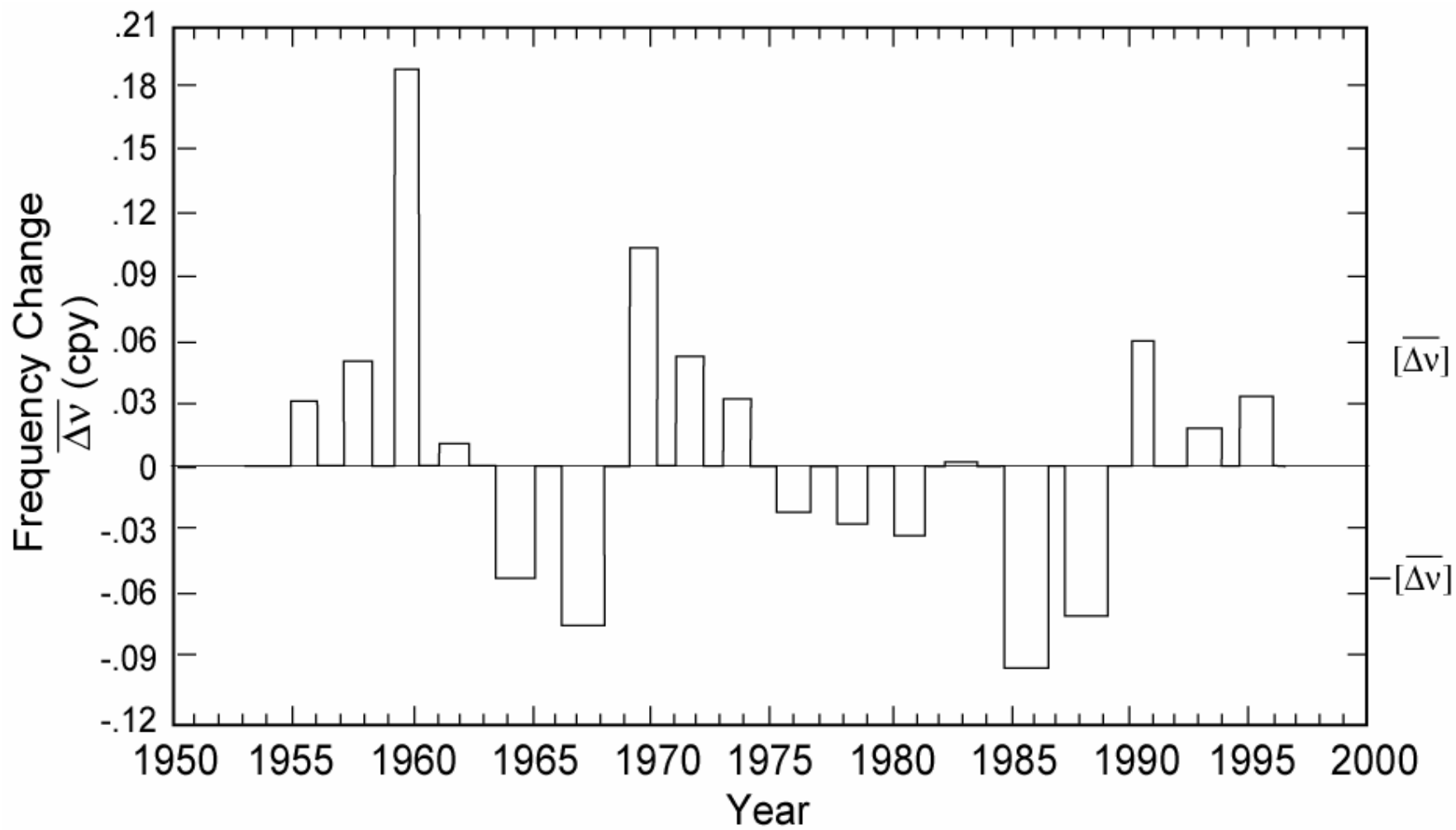


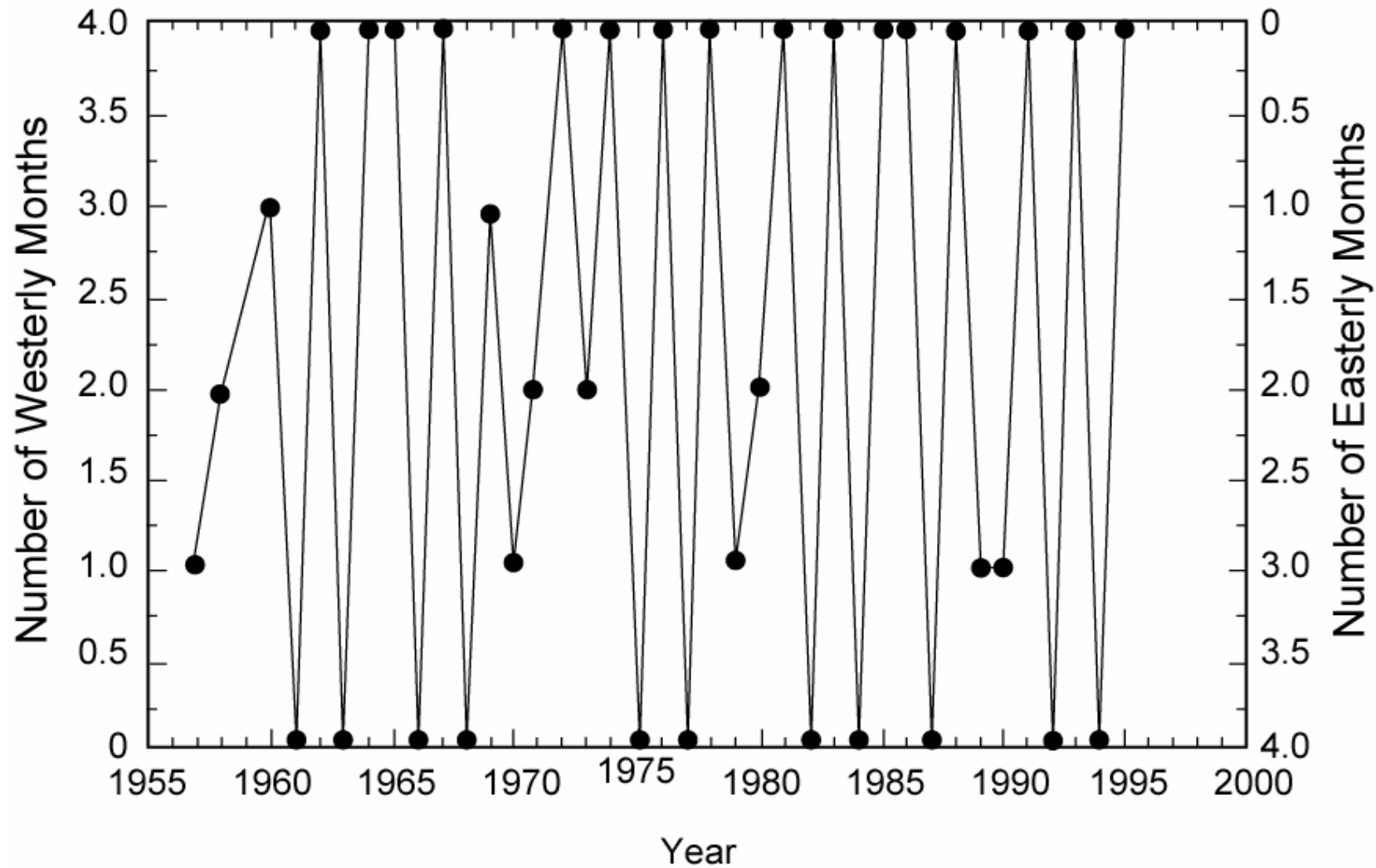


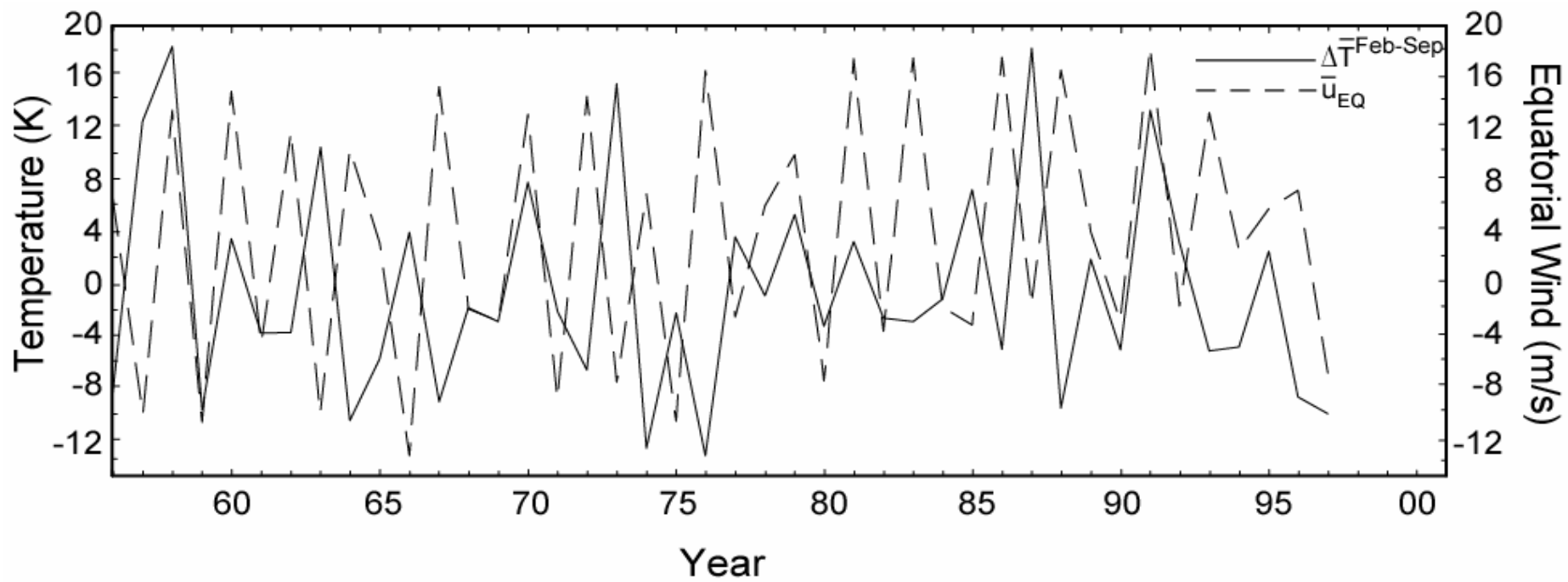
Anomalous Temperature (K)

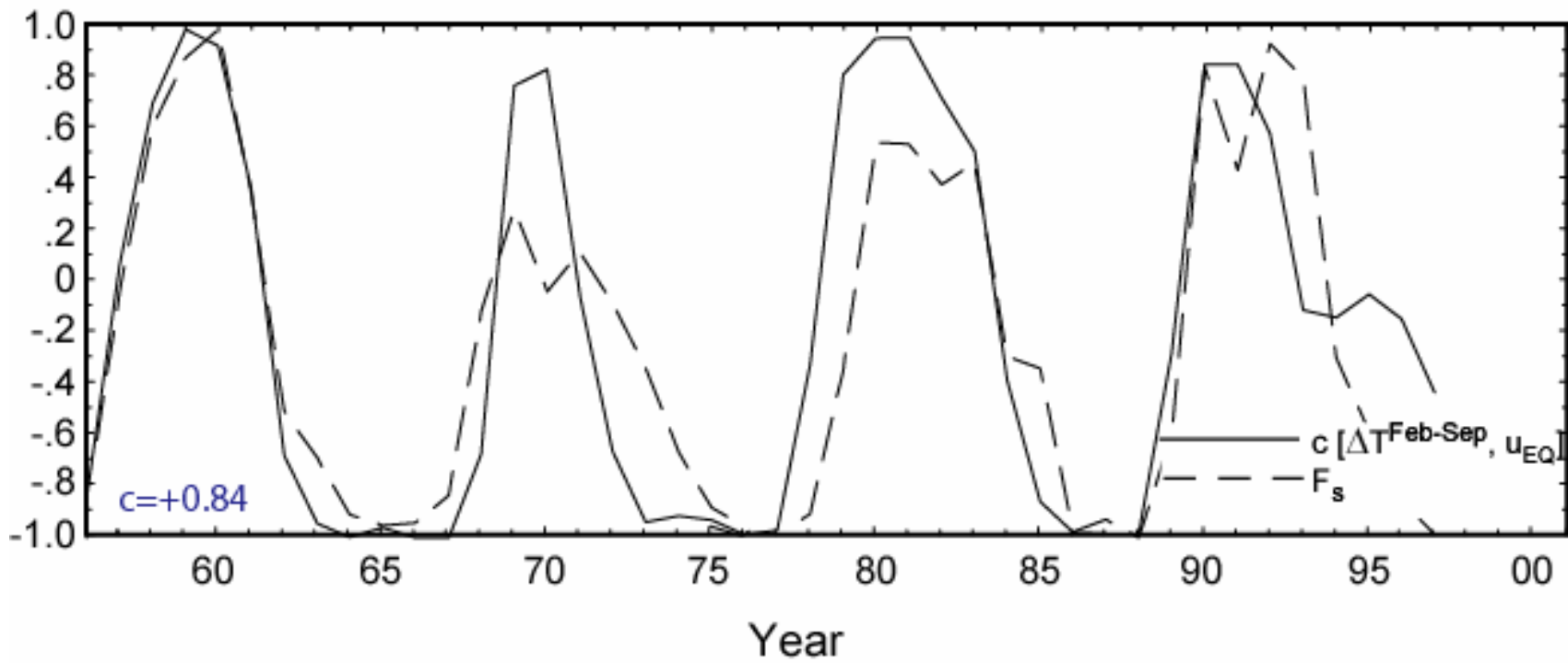




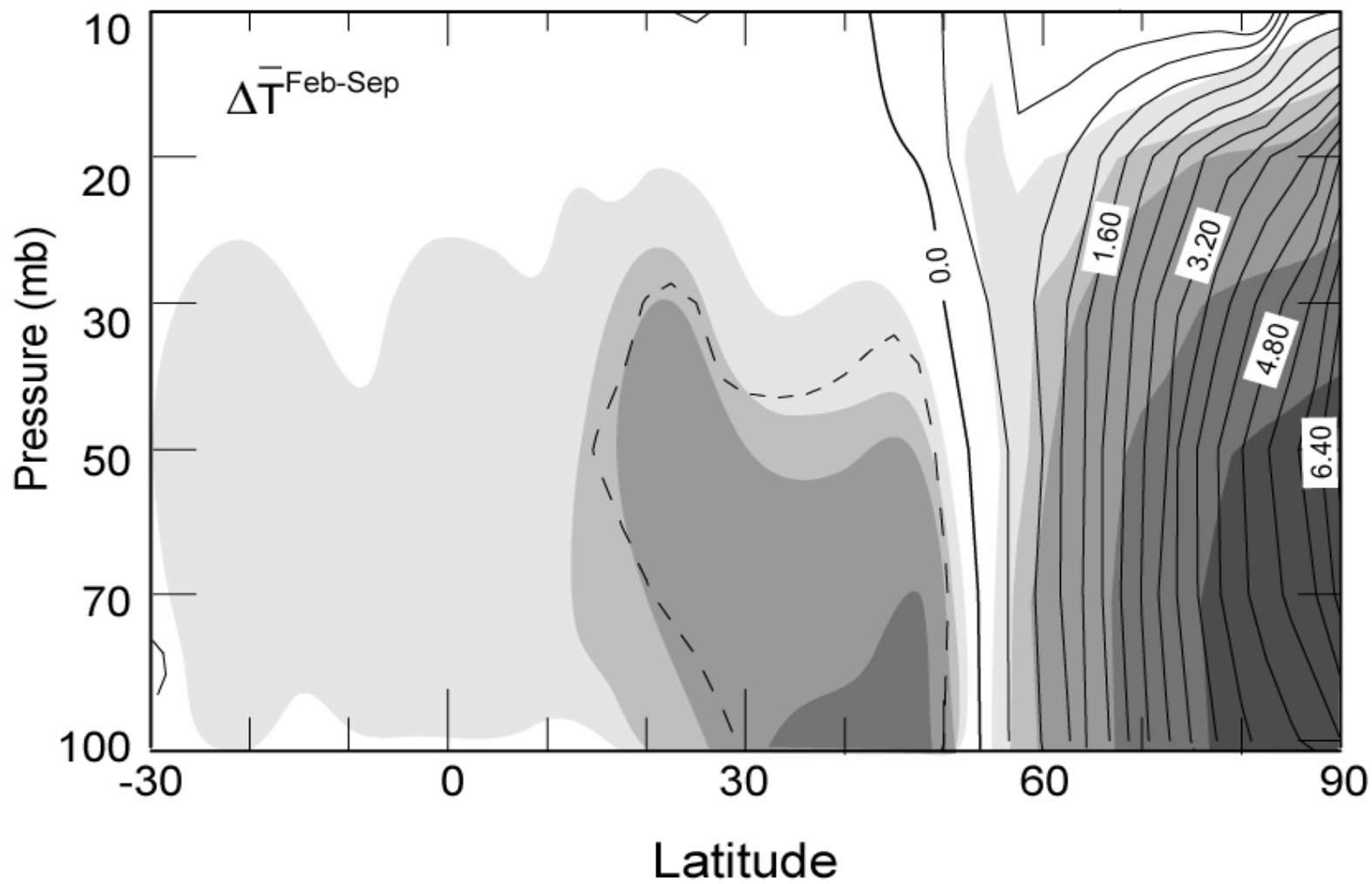




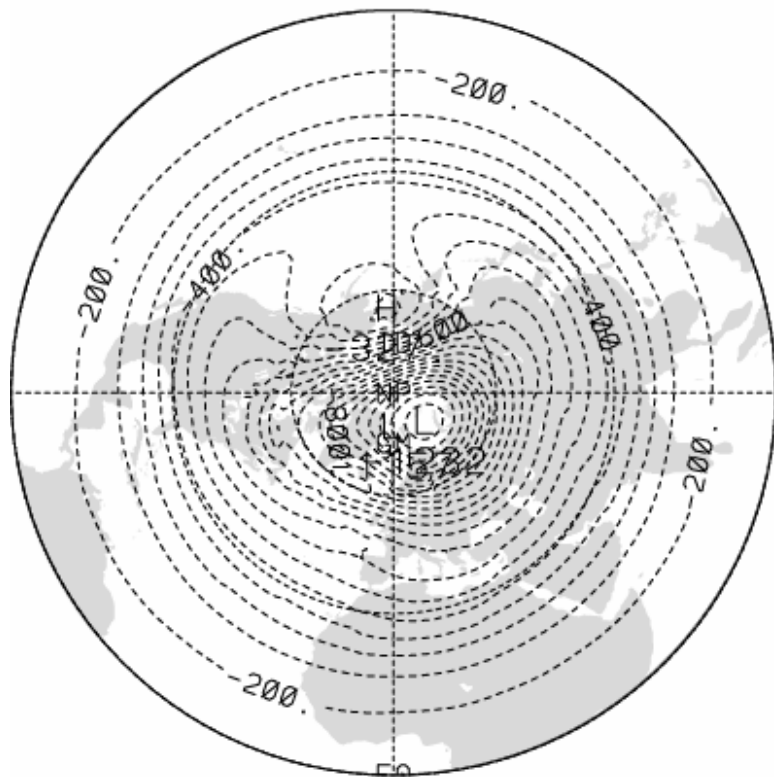




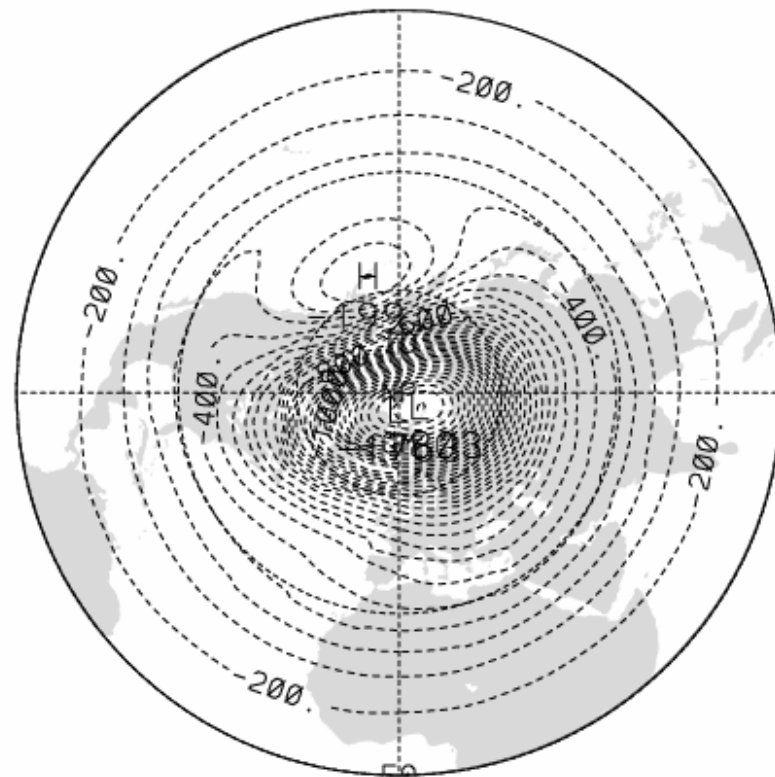
Anomalous Temperature



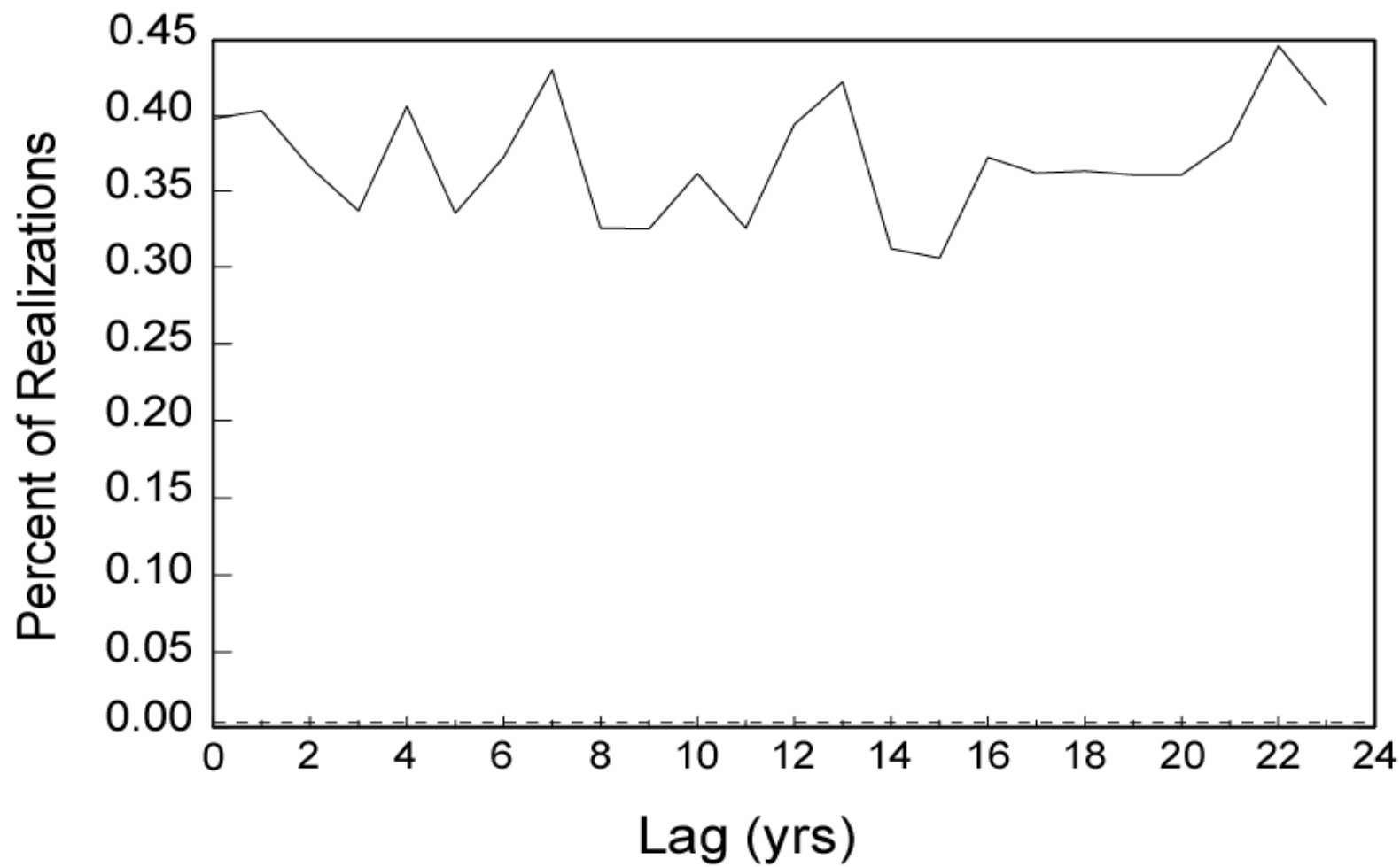
$\Delta Z_{30}^{\text{Feb-Sep}}$



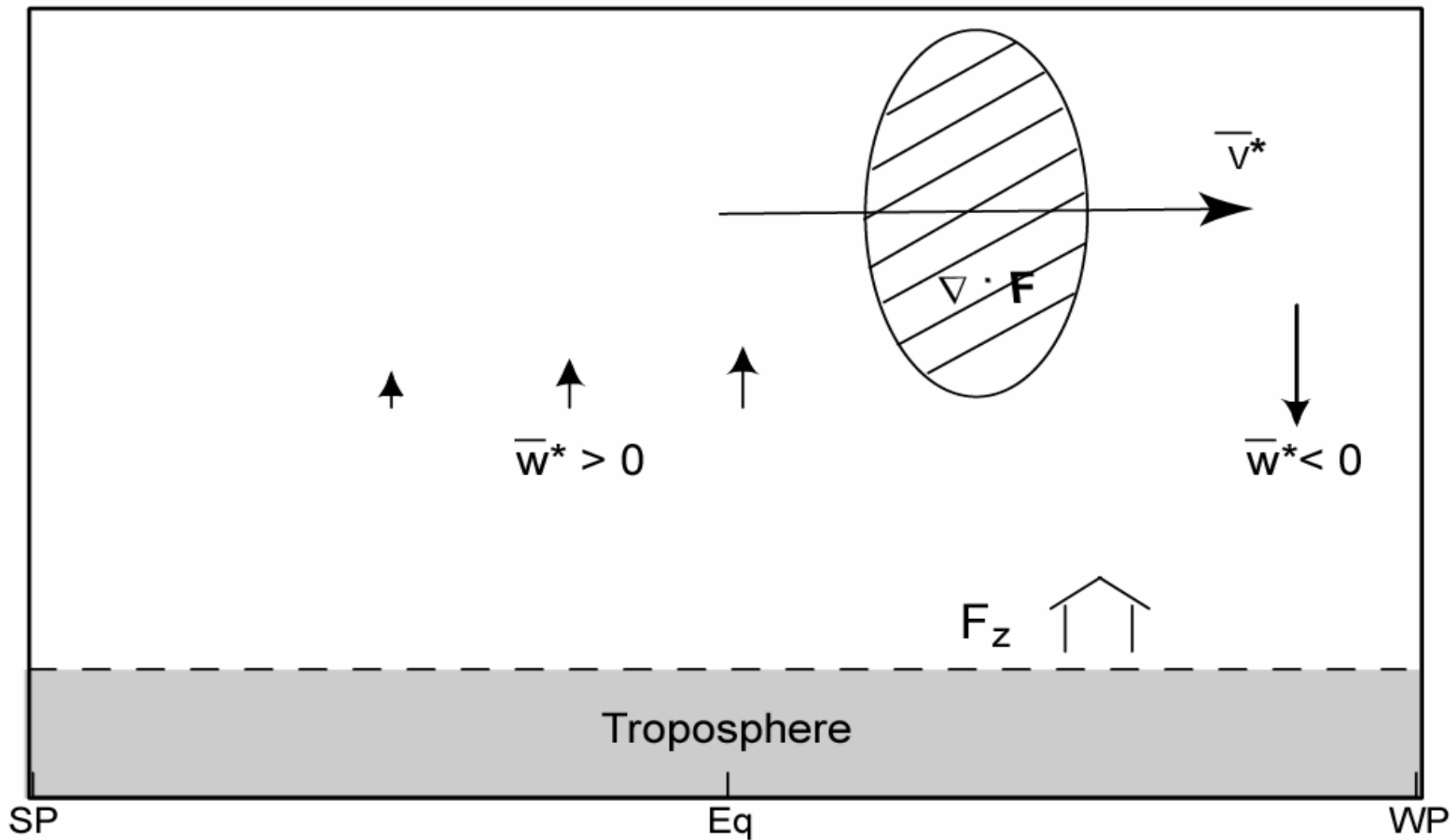
(a) $F_s < 0$
 $\bar{u}_{\text{EQ}} < 0$

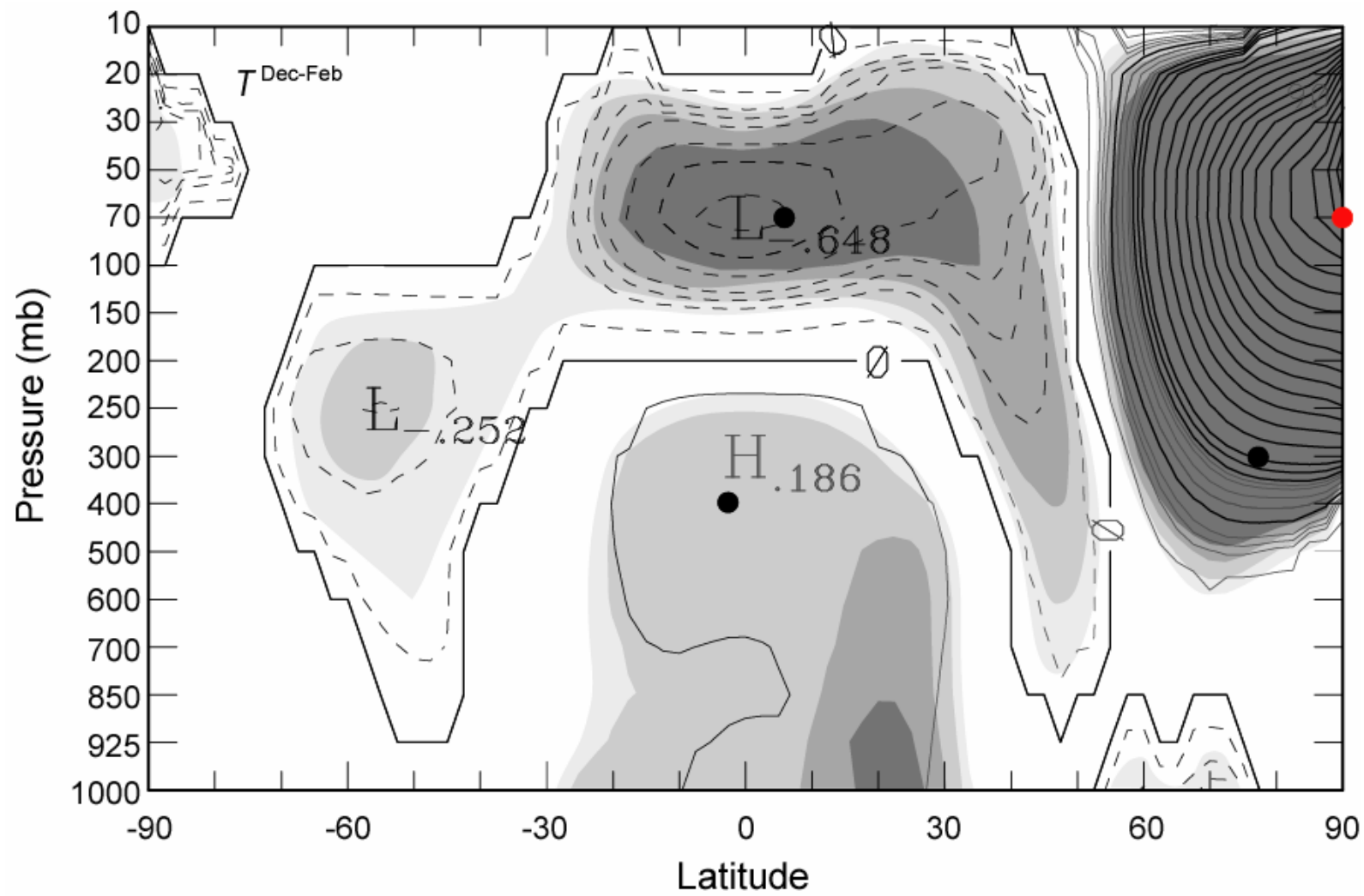


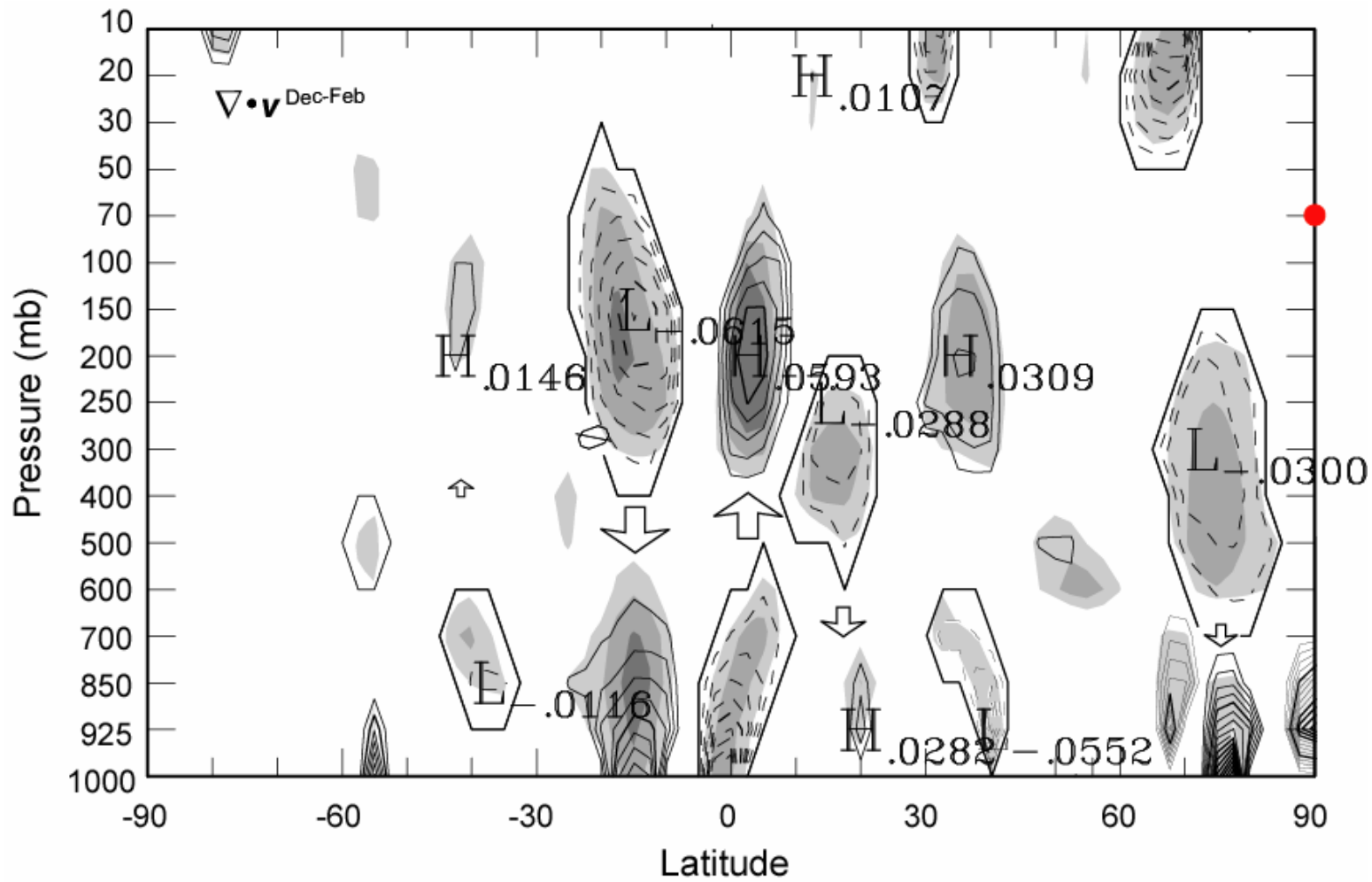
(b) $F_s > 0$
 $\bar{u}_{\text{EQ}} < 0$



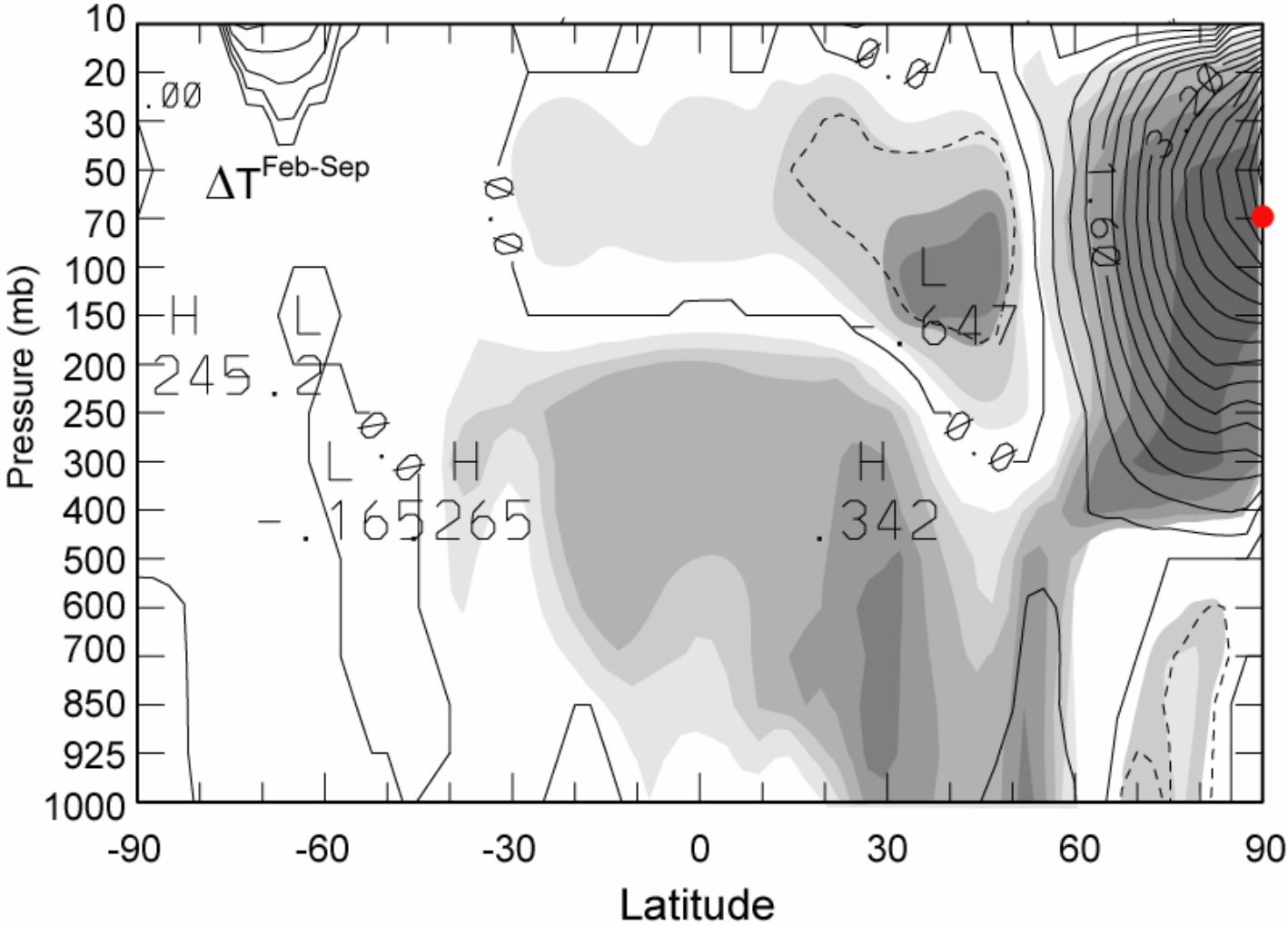
Residual Mean Circulation







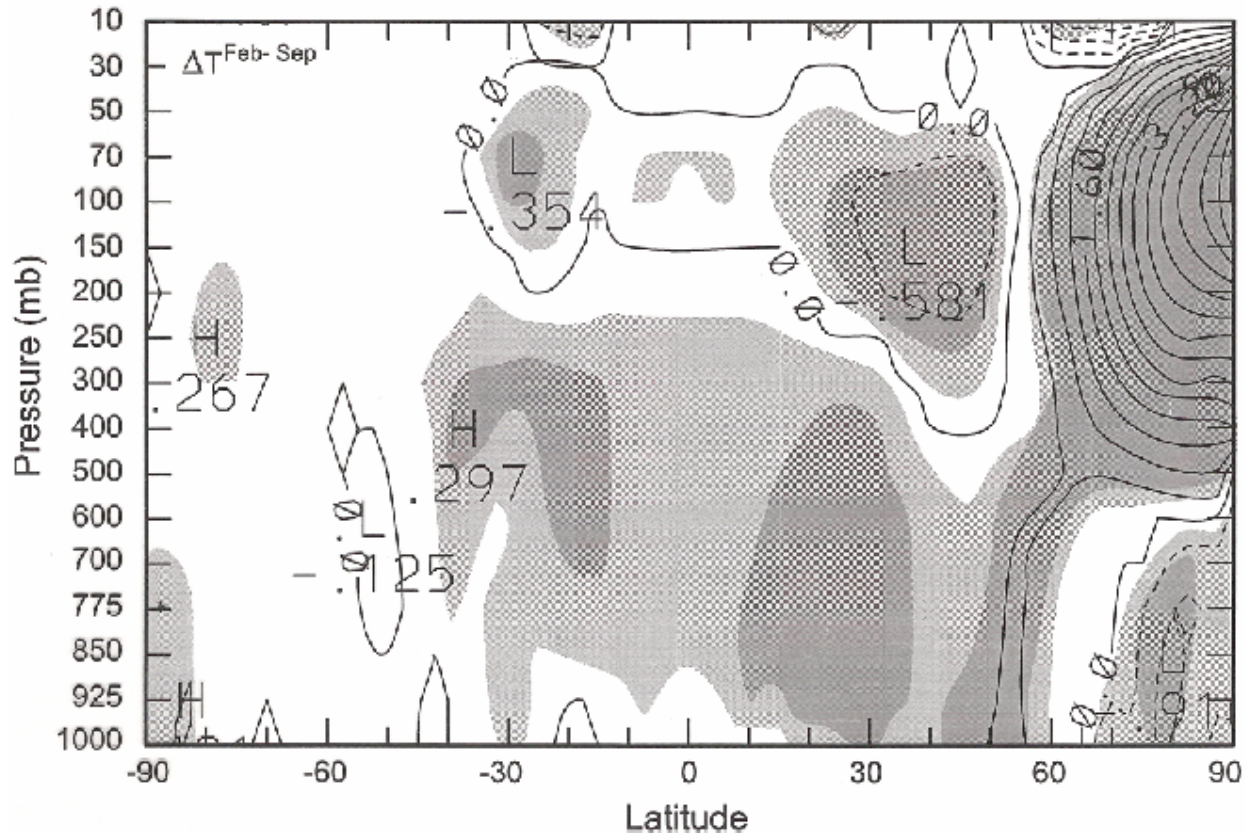
Anomalous Temperature

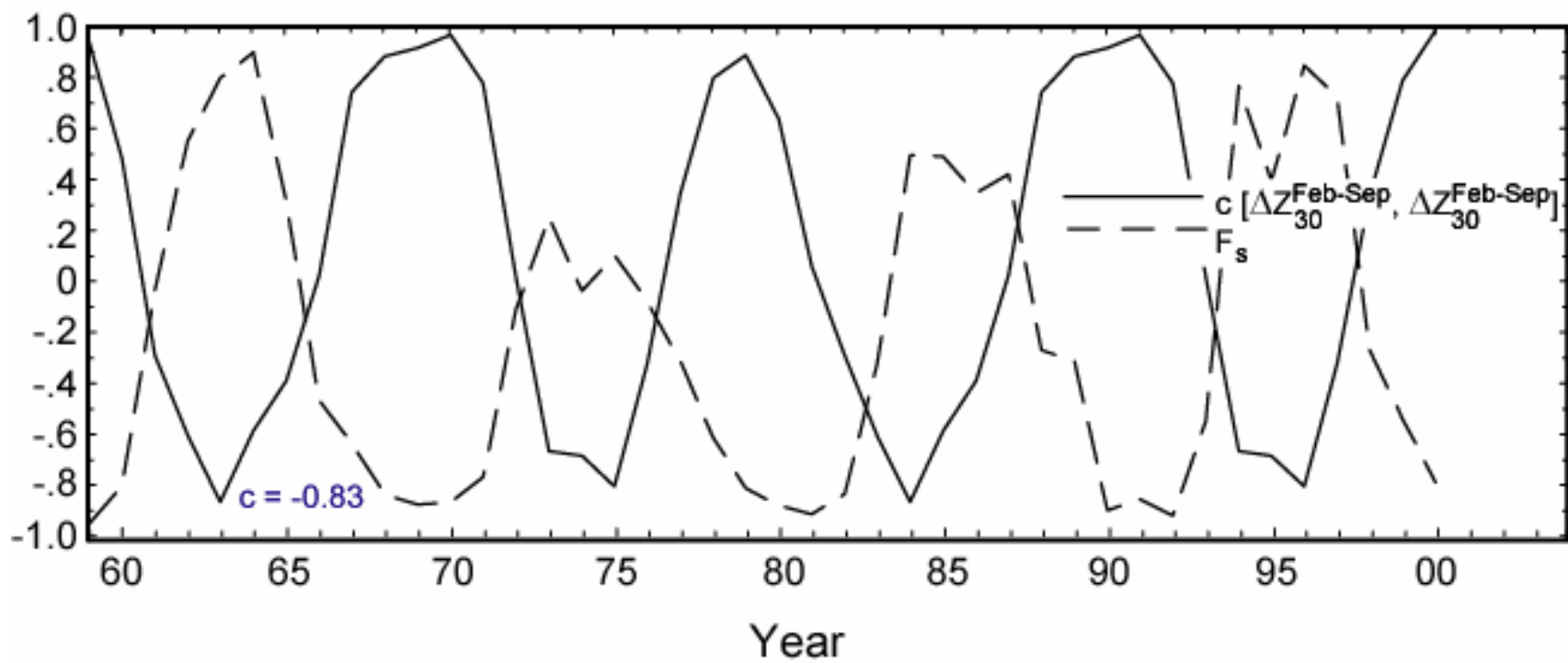


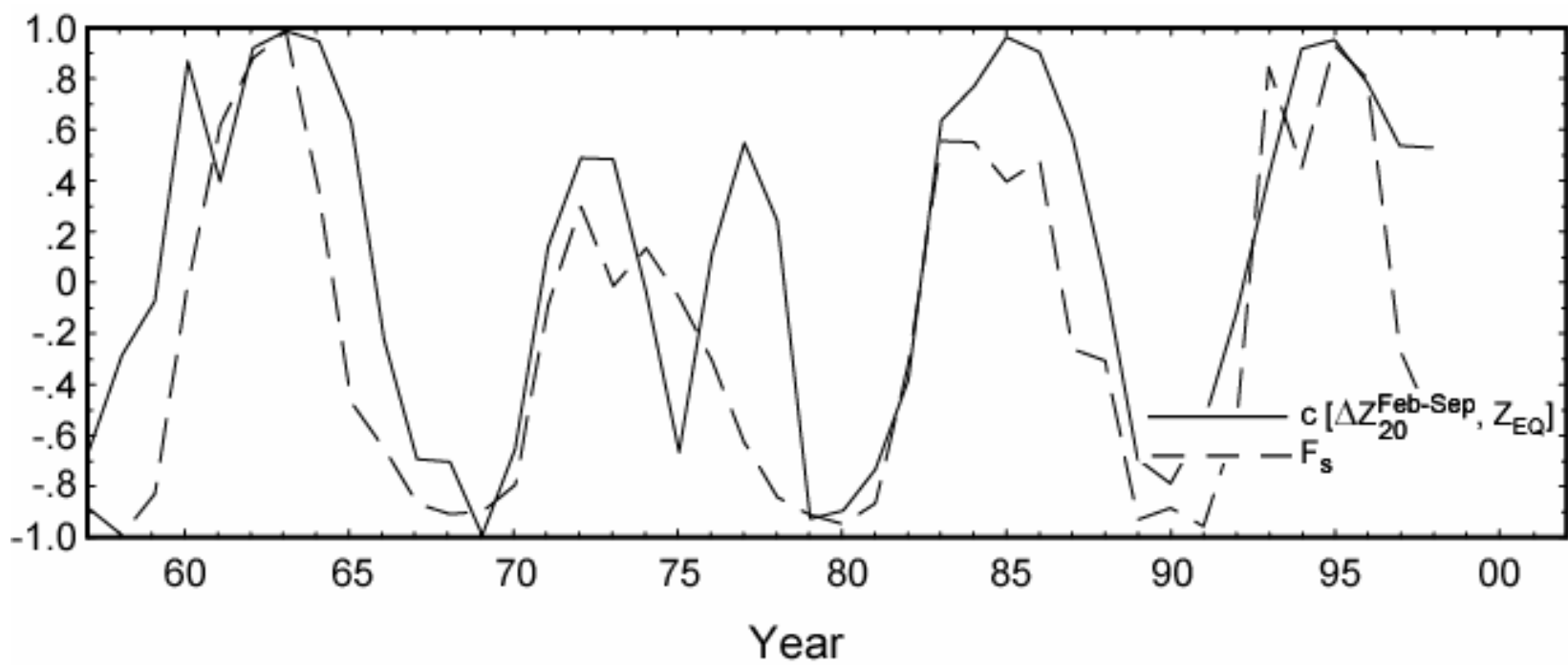
Conclusions

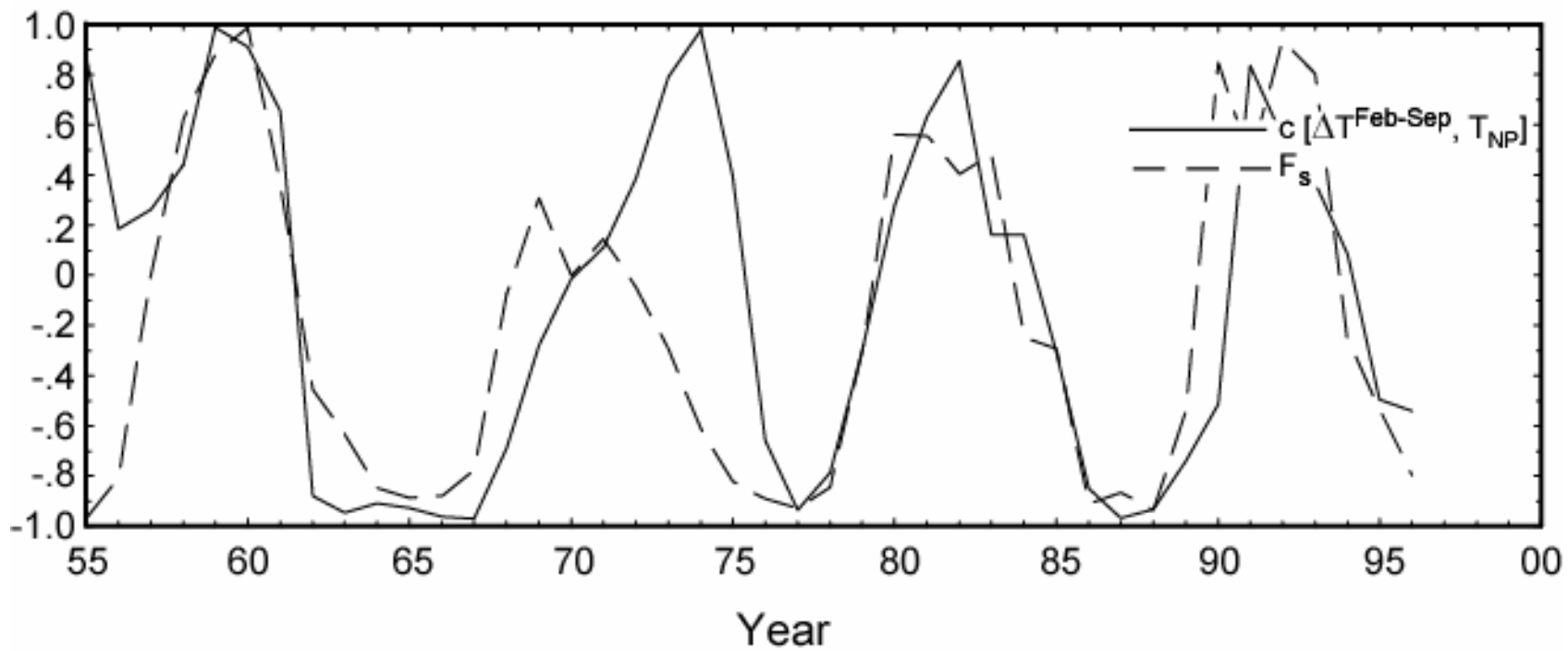
- Modulation of QBO phase wrt winter accounts for the large amplitude of the solar signature (~ 10 K) when polar temperature is stratified against equatorial wind (Labitzke and van Loon, 1987).
Stratifying data rectifies the HF (carrier) oscillation, leaving a systematic drift through all phases of SC, one which is then as large as the std deviation of polar temperature.
- Structure of anomalous temperature reflects the Residual Mean Circulation.
- Signature of anomalous downwelling over winter pole penetrates well into the troposphere. Accompanying it at subpolar latitudes is signature of anomalous upwelling and of an intensification of the Hadley circulation.
- Very similar behavior operates coherently with the QBO and solar activity.

Anomalous Temperature (K)

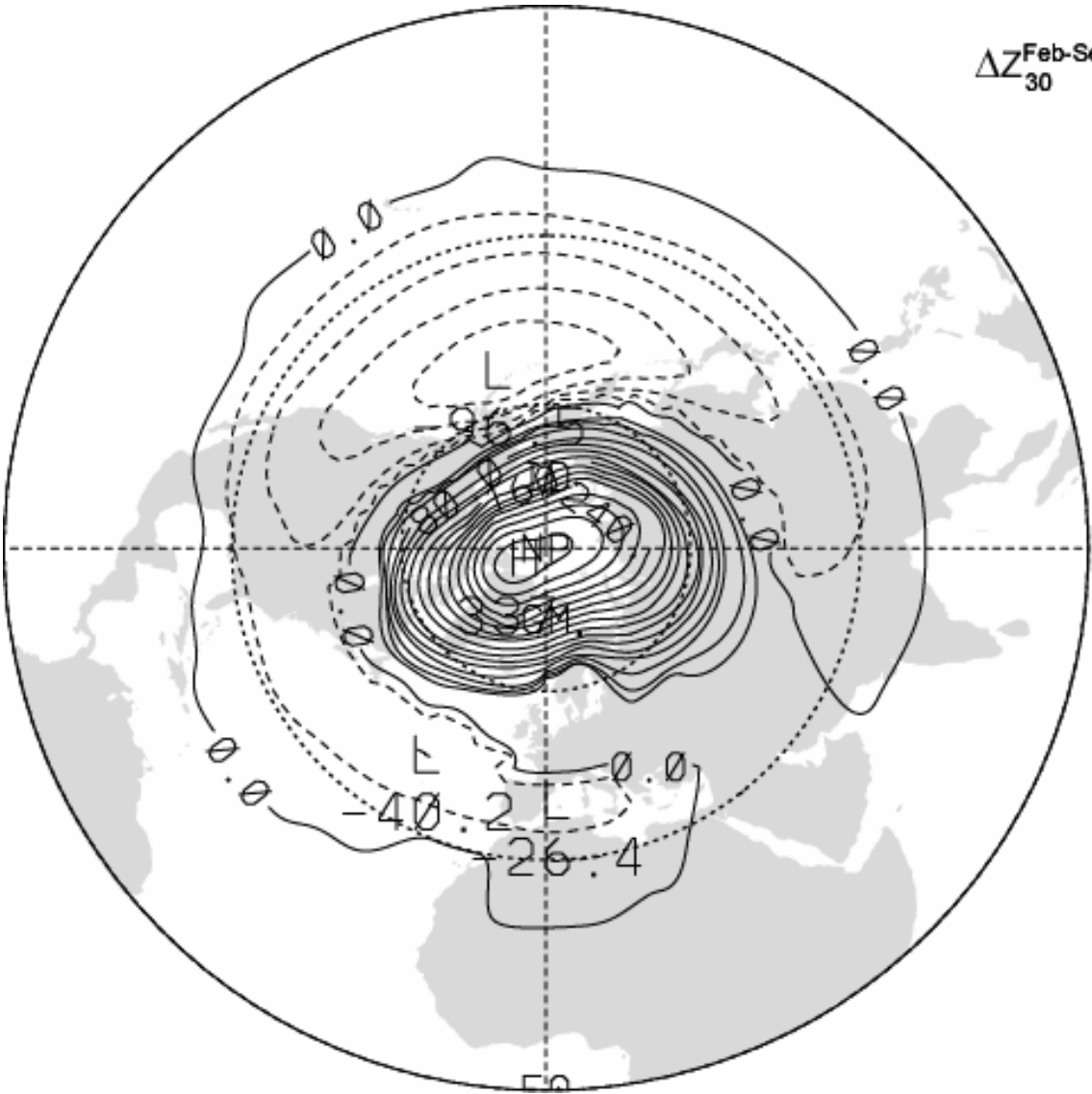


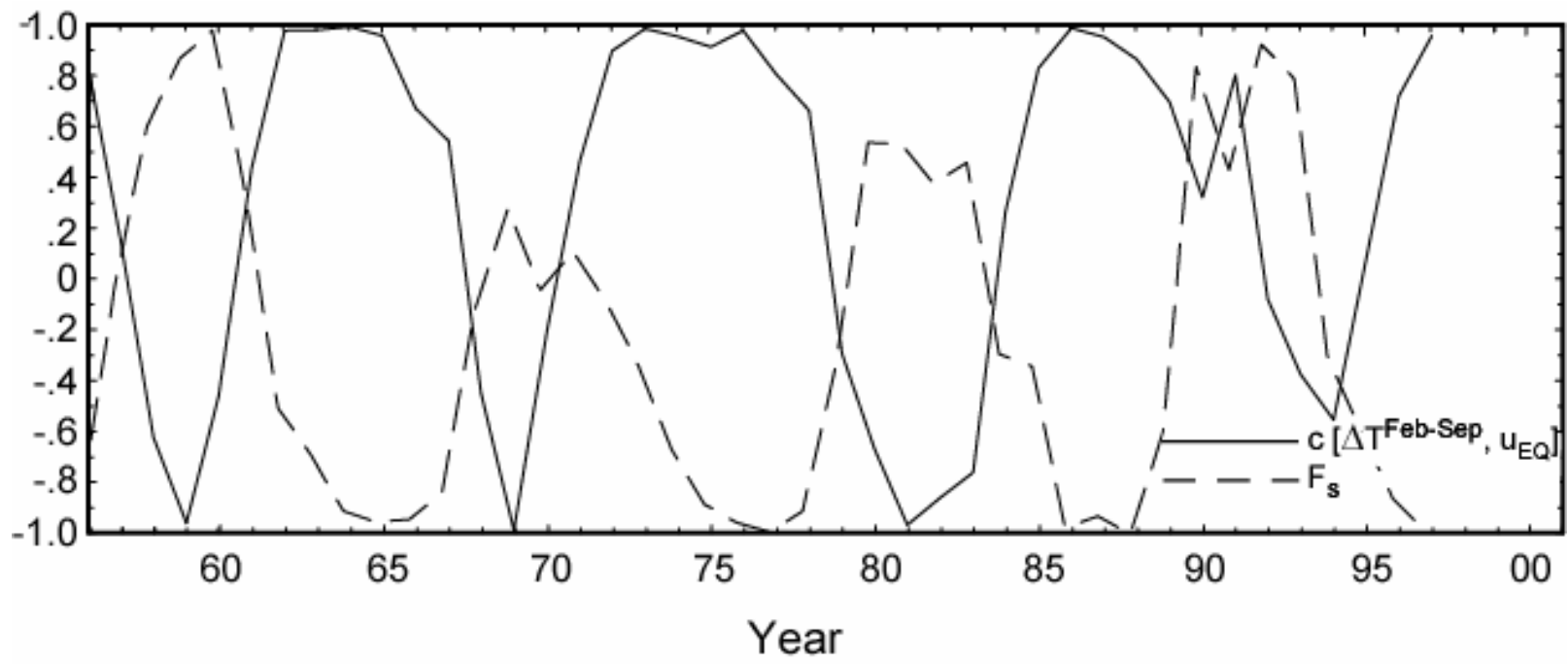




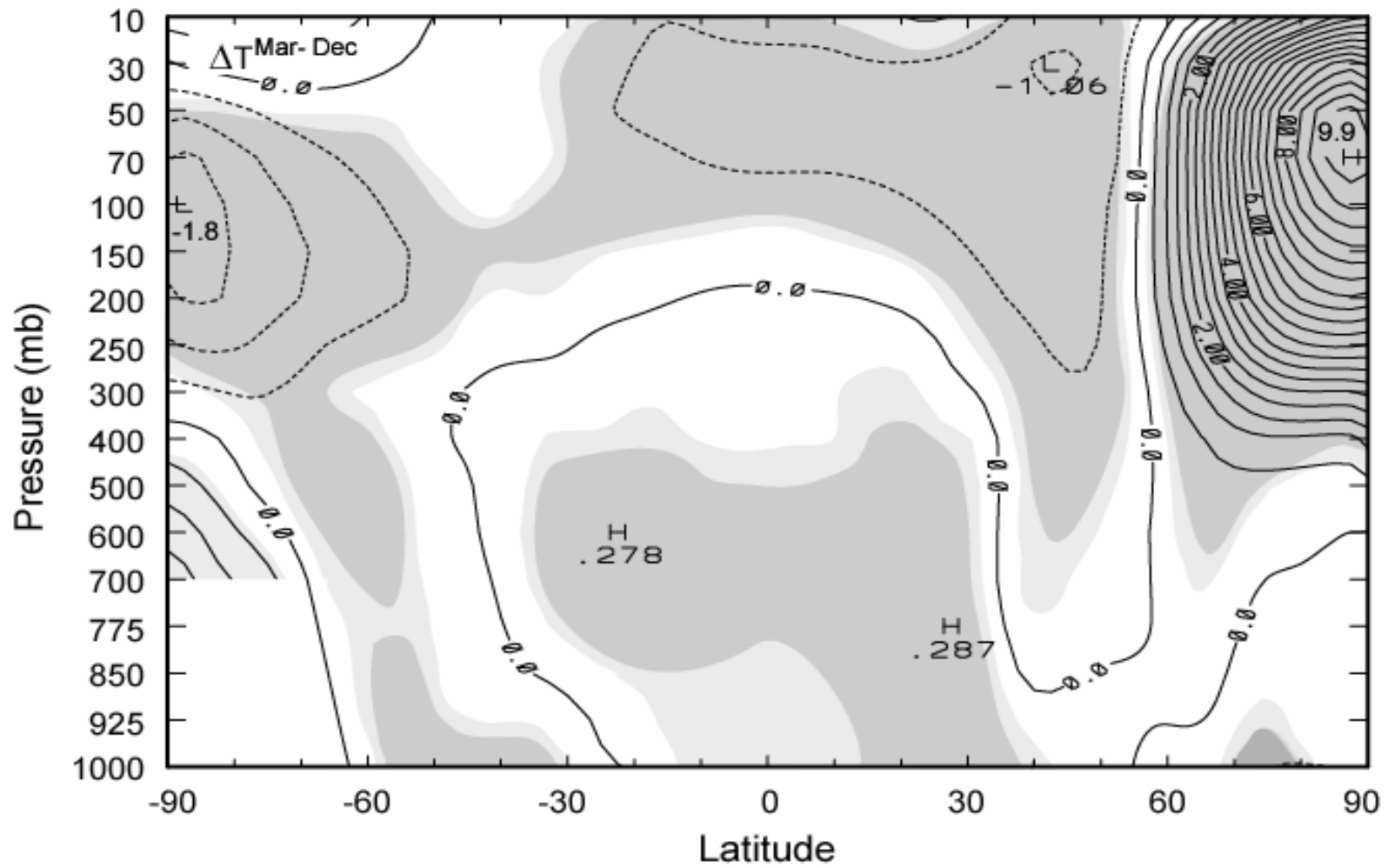


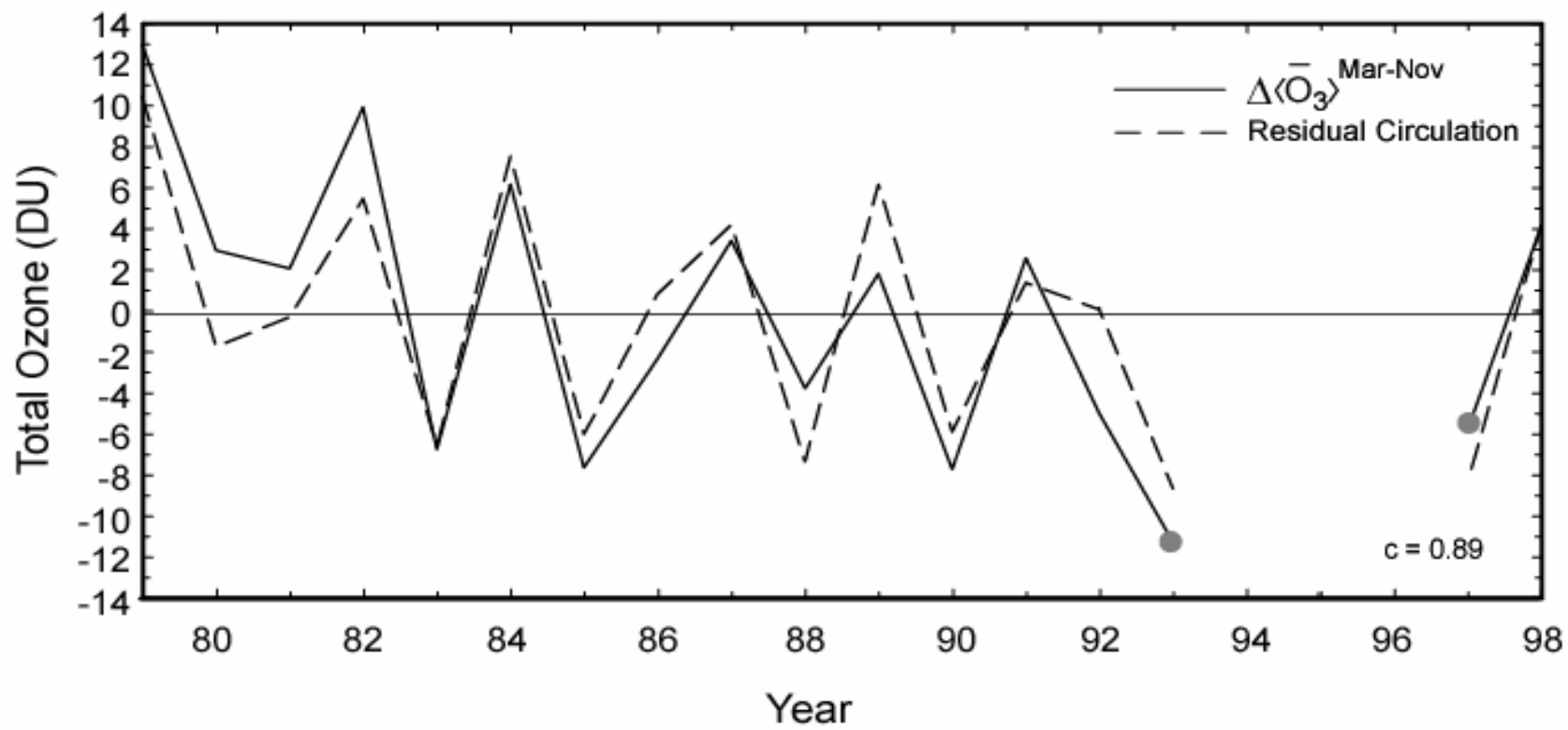
$\Delta Z_{30}^{\text{Feb-Sep}}$



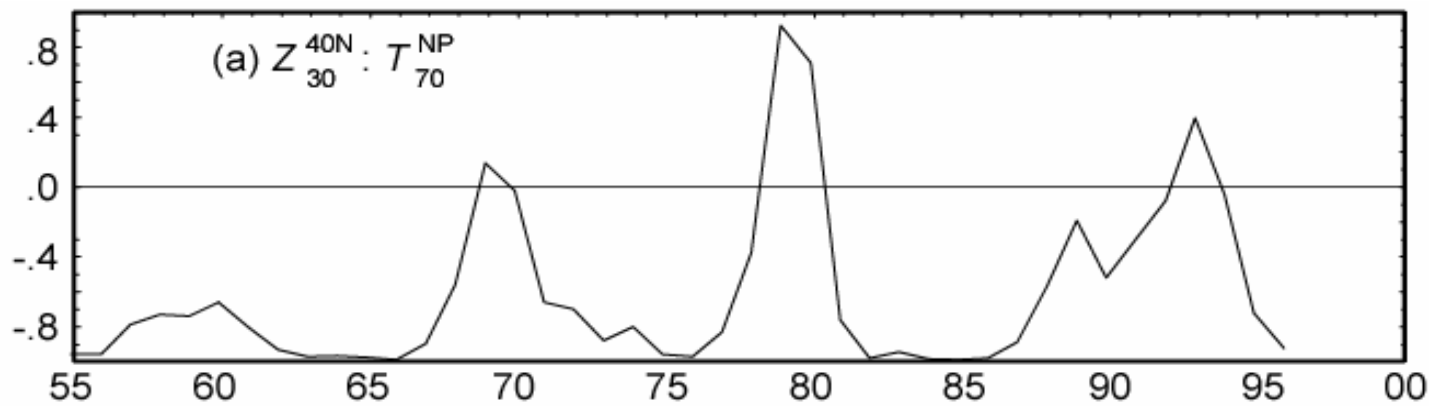


Anomalous Temperature (K)



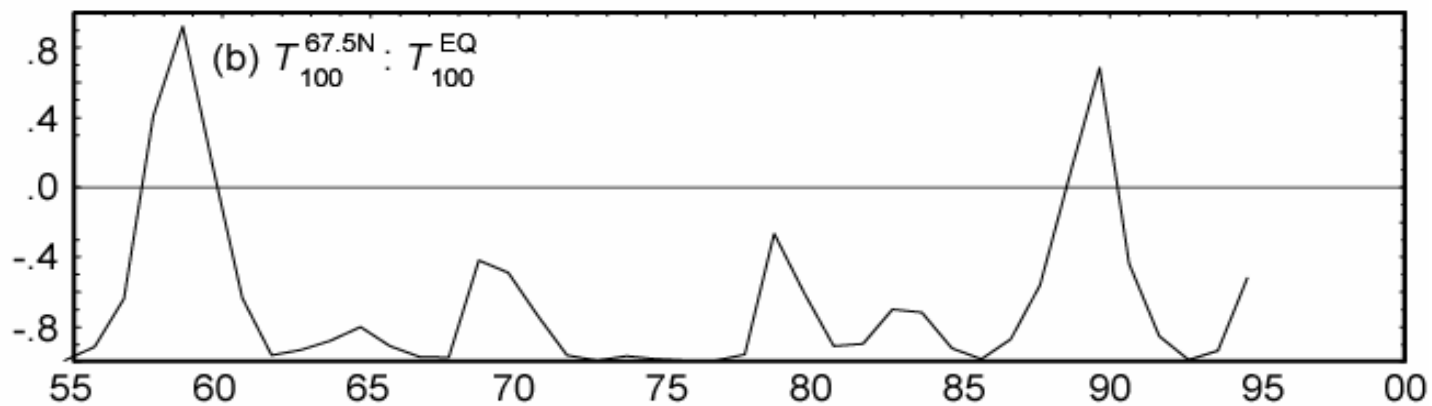


Running Correlation



YEAR

Running Correlation



W-E (1000MB GPH OF JAN)

