

Effects of the Equatorial Ionosphere Anomaly on the Inter-Hemispheric Circulation in the Thermosphere

Liyong Qian¹, Alan G. Burns¹, Wenbin Wang¹,

Stanley C. Solomon¹, Yongliang Zhang², and V. Hsu³

¹High Altitude Observatory, National Center for Atmospheric Research,
Boulder, Colorado, USA

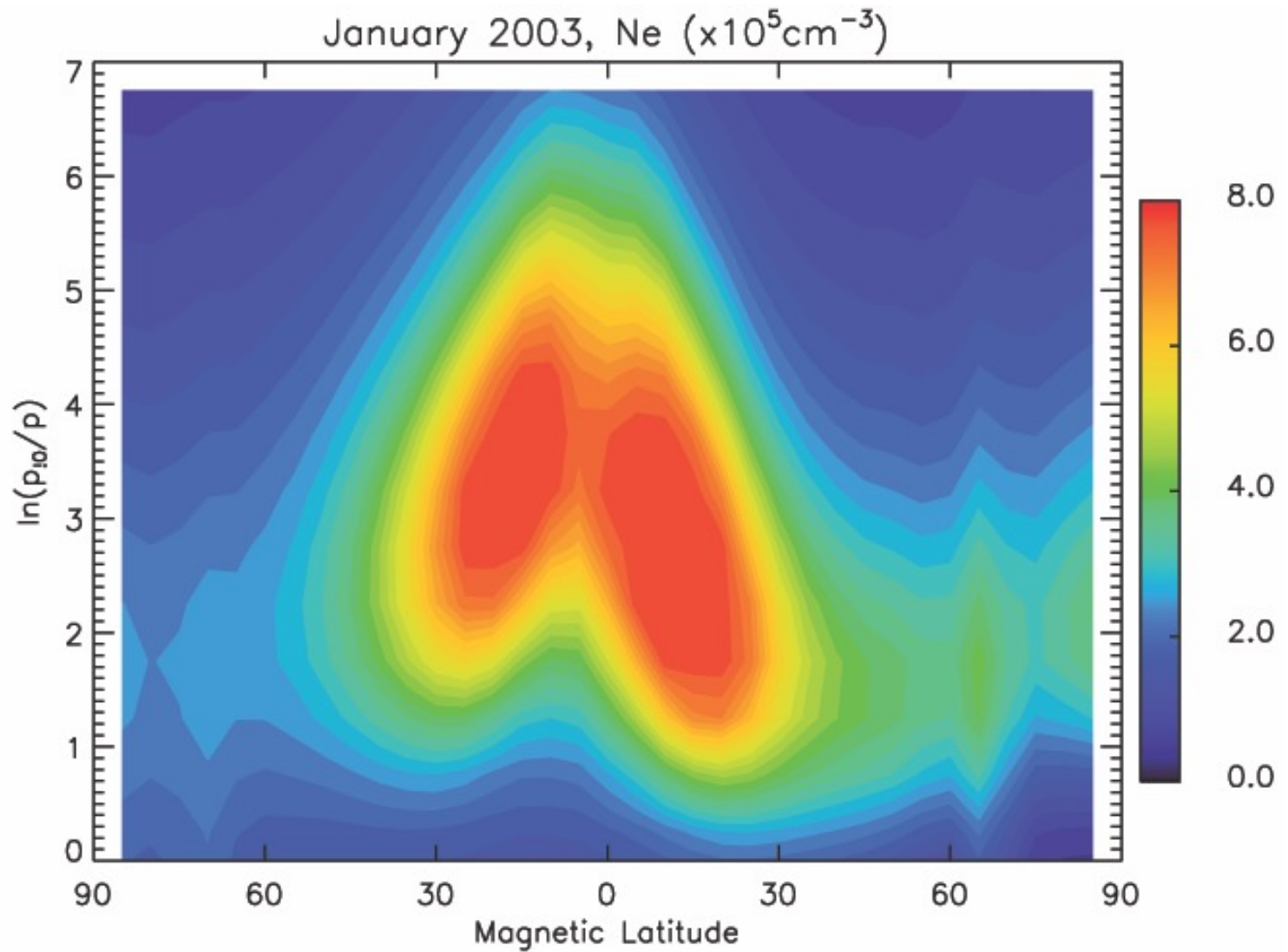
²Applied Physics Laboratory, Johns Hopkins University, Laurel,
Maryland, USA

³Department of Aerospace Engineering Sciences, University of Colorado
at Boulder, Colorado, USA

The High Altitude Observatory (HAO) at the National Center for Atmospheric Research (NCAR).

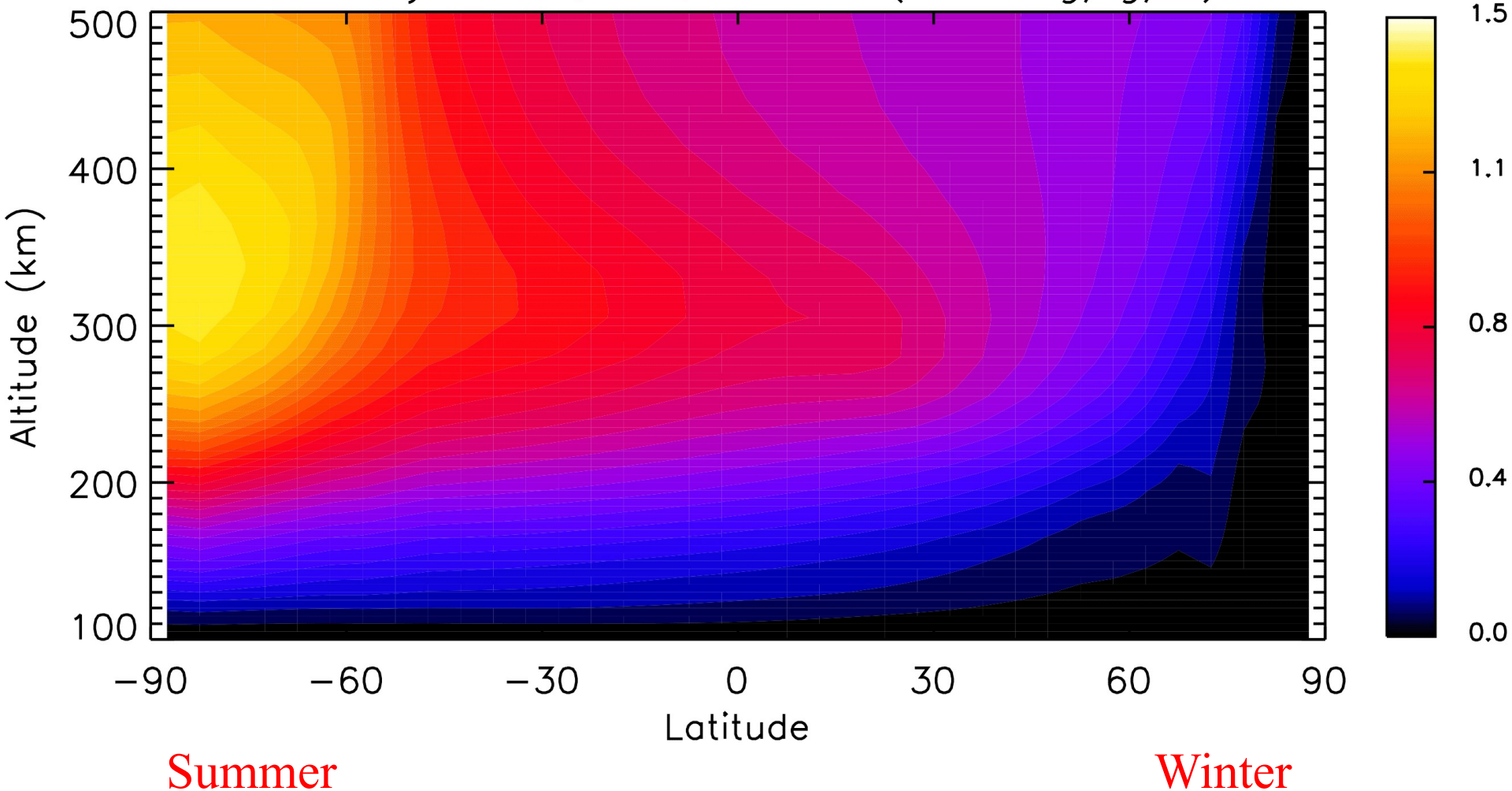
The National Center for Atmospheric Research is sponsored by the National Science Foundation. Any opinions, findings and conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Equatorial Ionization Anomaly



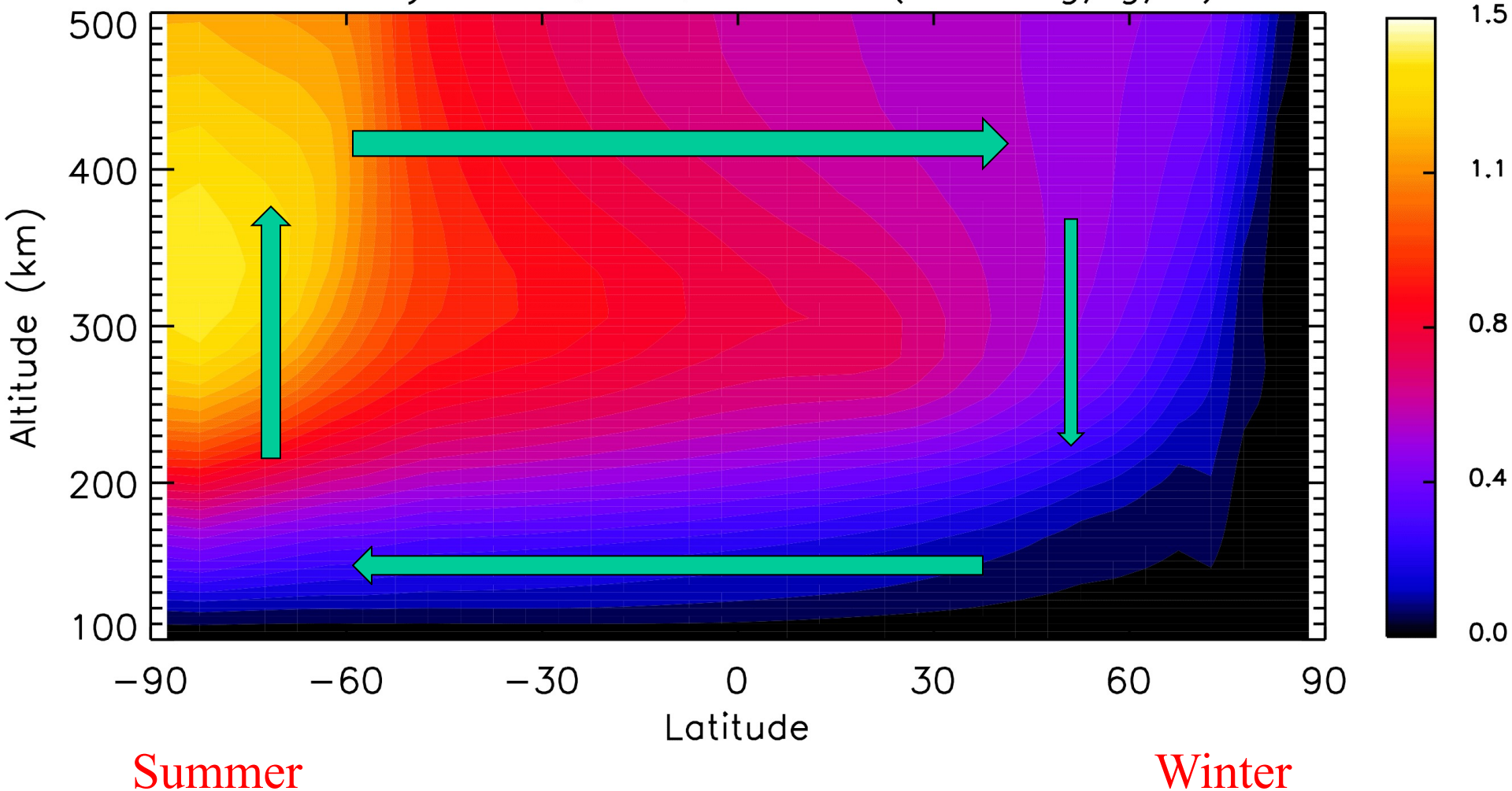
Daily Average Solar Heating

January 2003, zm, Q_{solar} ($\times 10^5 \text{erg/g/s}$)



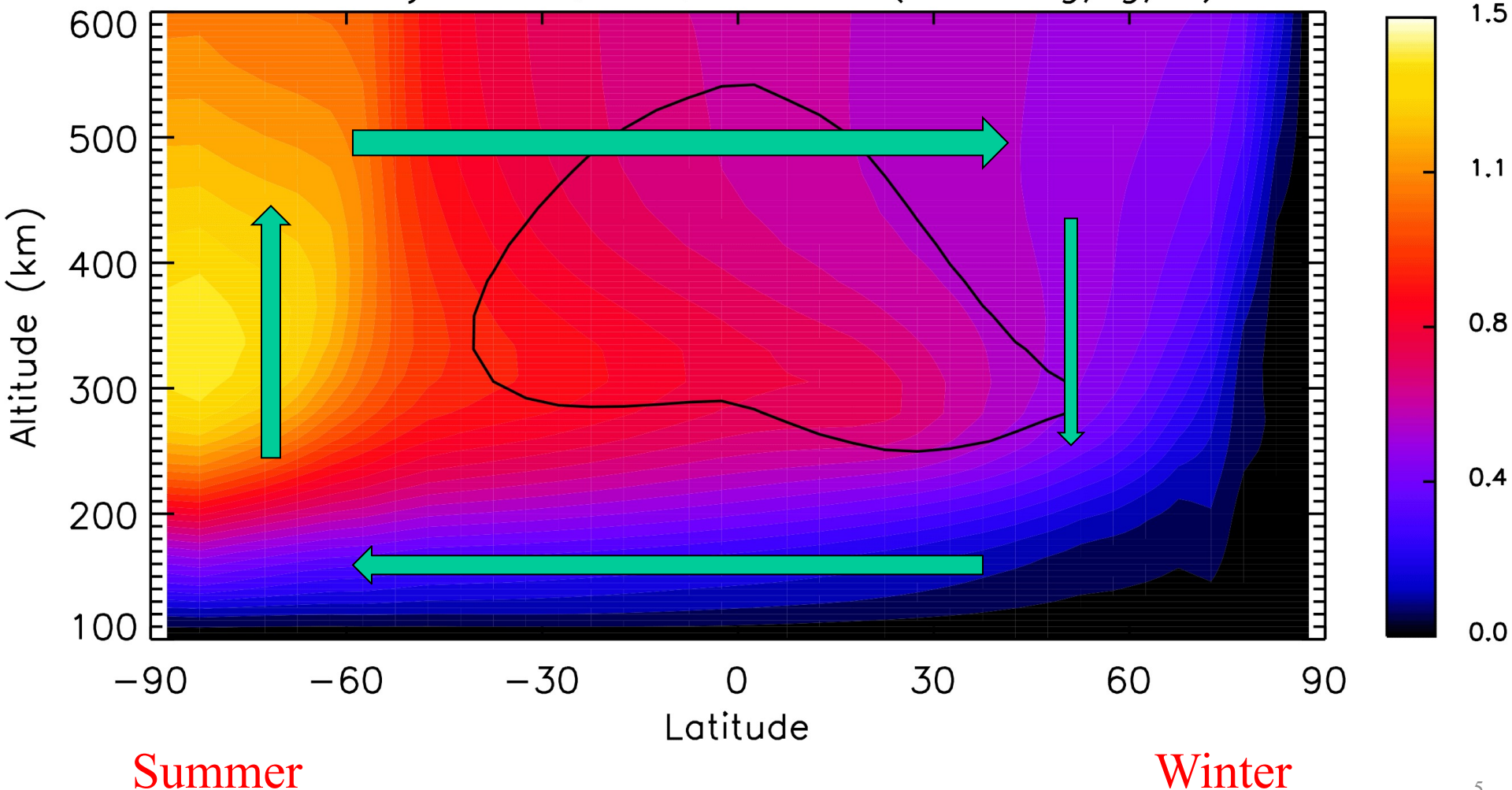
Inter-Hemispheric Circulation

January 2003, z_m , Q_{solar} ($\times 10^5 \text{ erg/g/s}$)

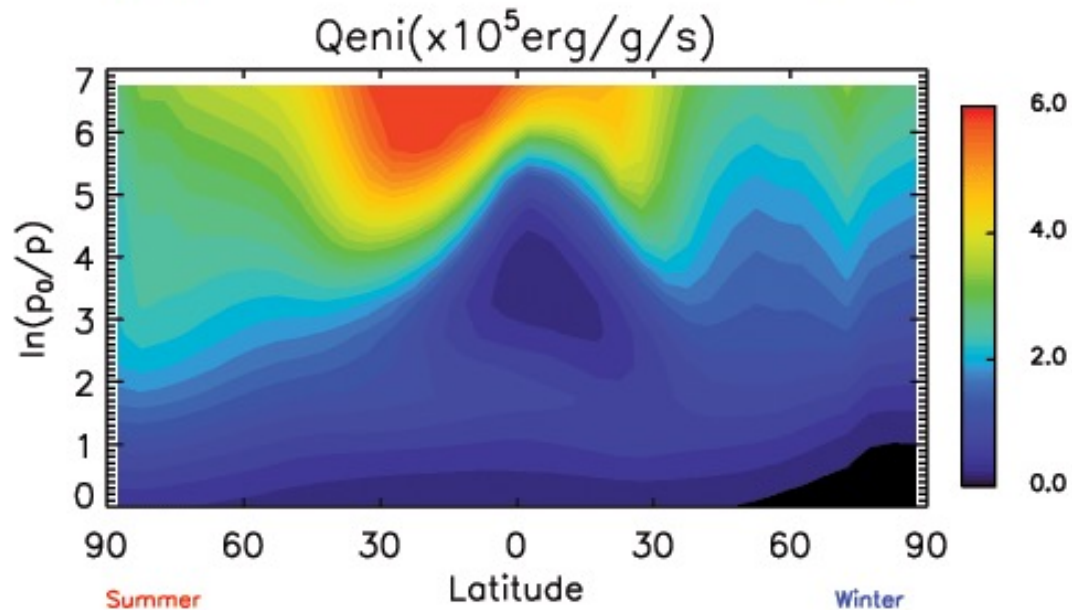
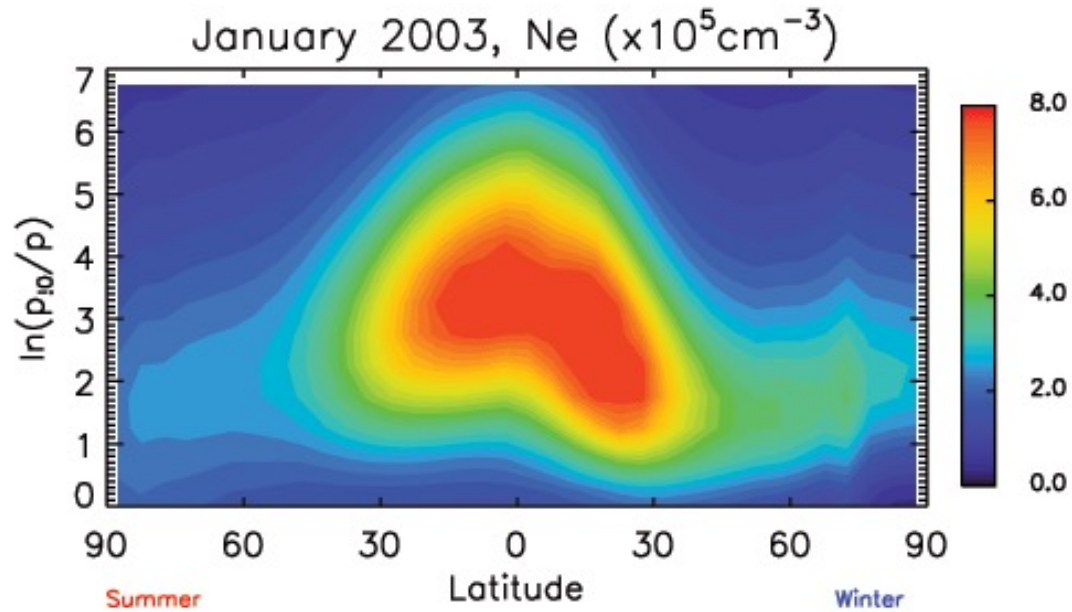


How Does the Equatorial Ionization Anomaly (EIA) Affect this Circulation?

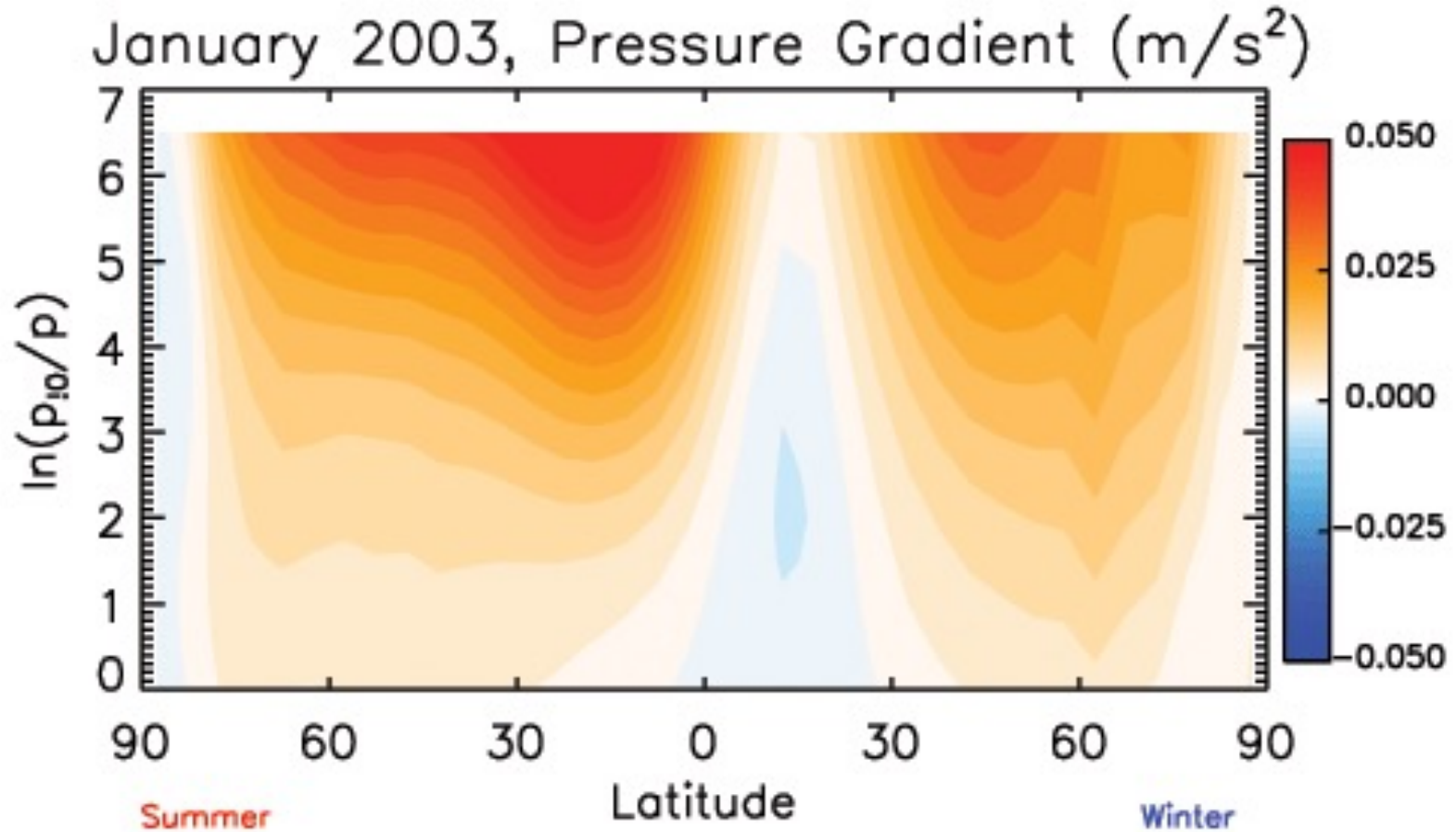
January 2003, z_m , Q_{solar} ($\times 10^5 \text{ erg/g/s}$)



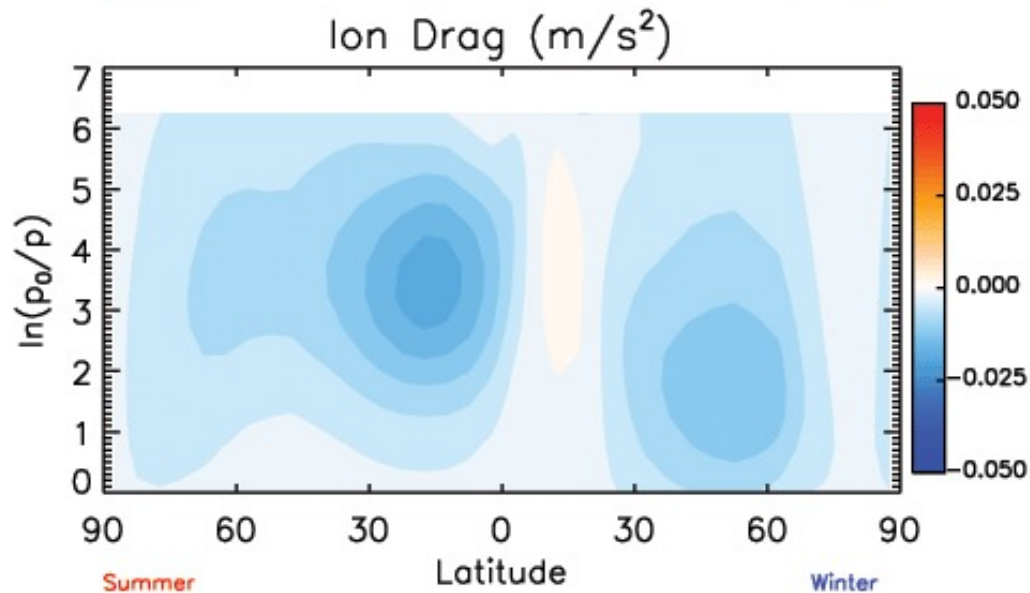
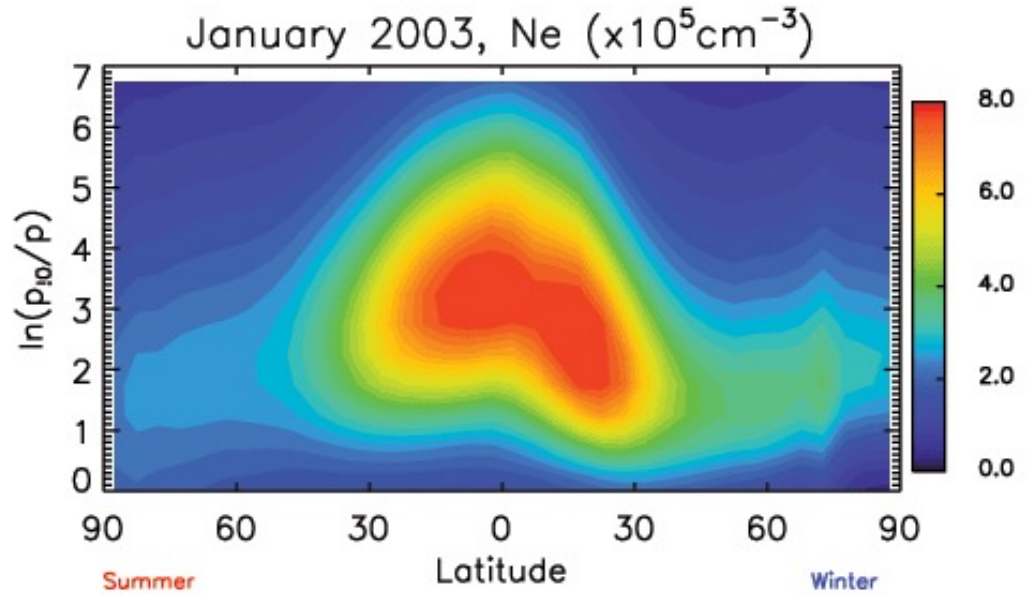
The EIA and Plasma-Neutral Collisional Heating



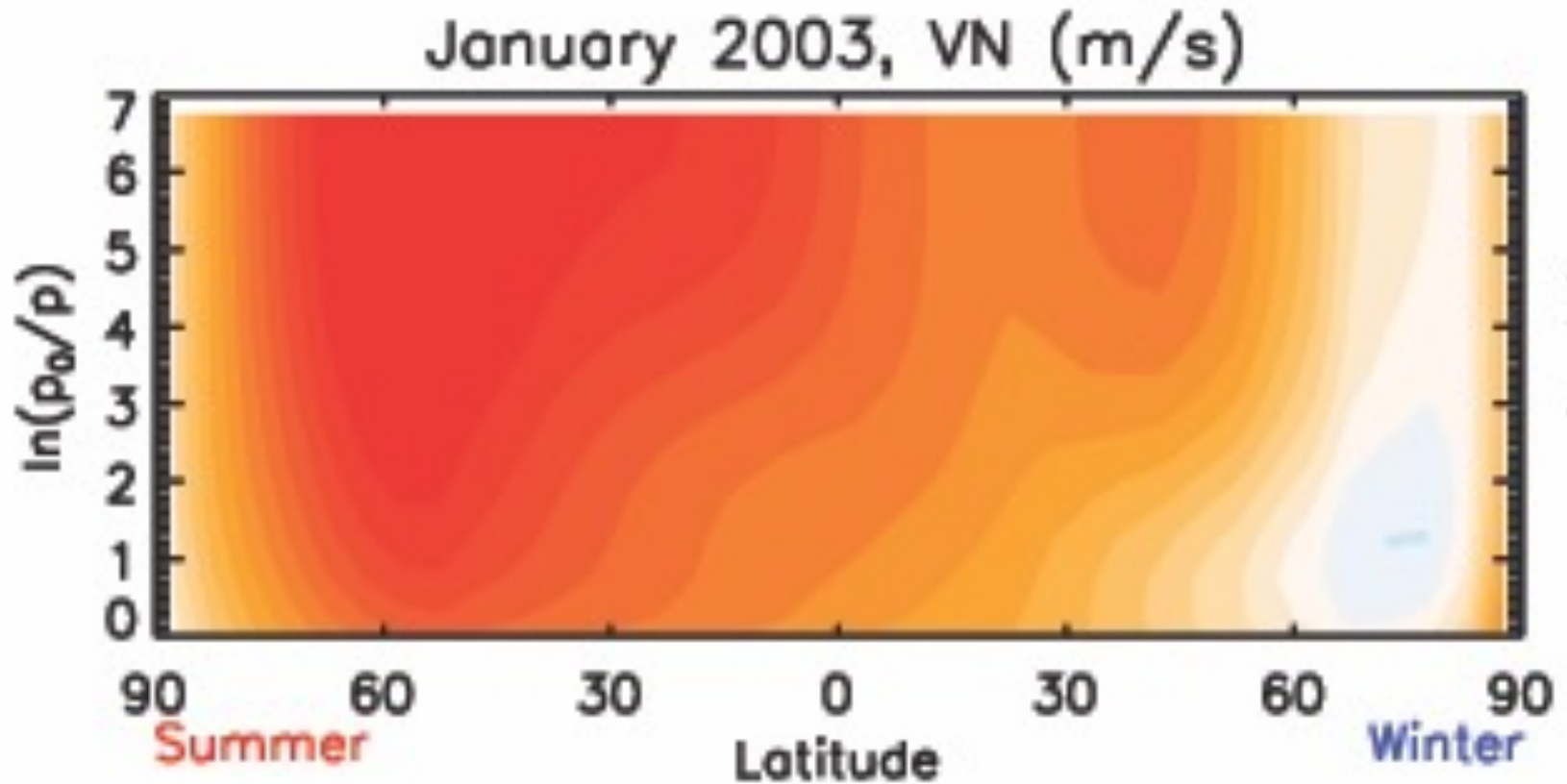
Meridional Pressure Gradient



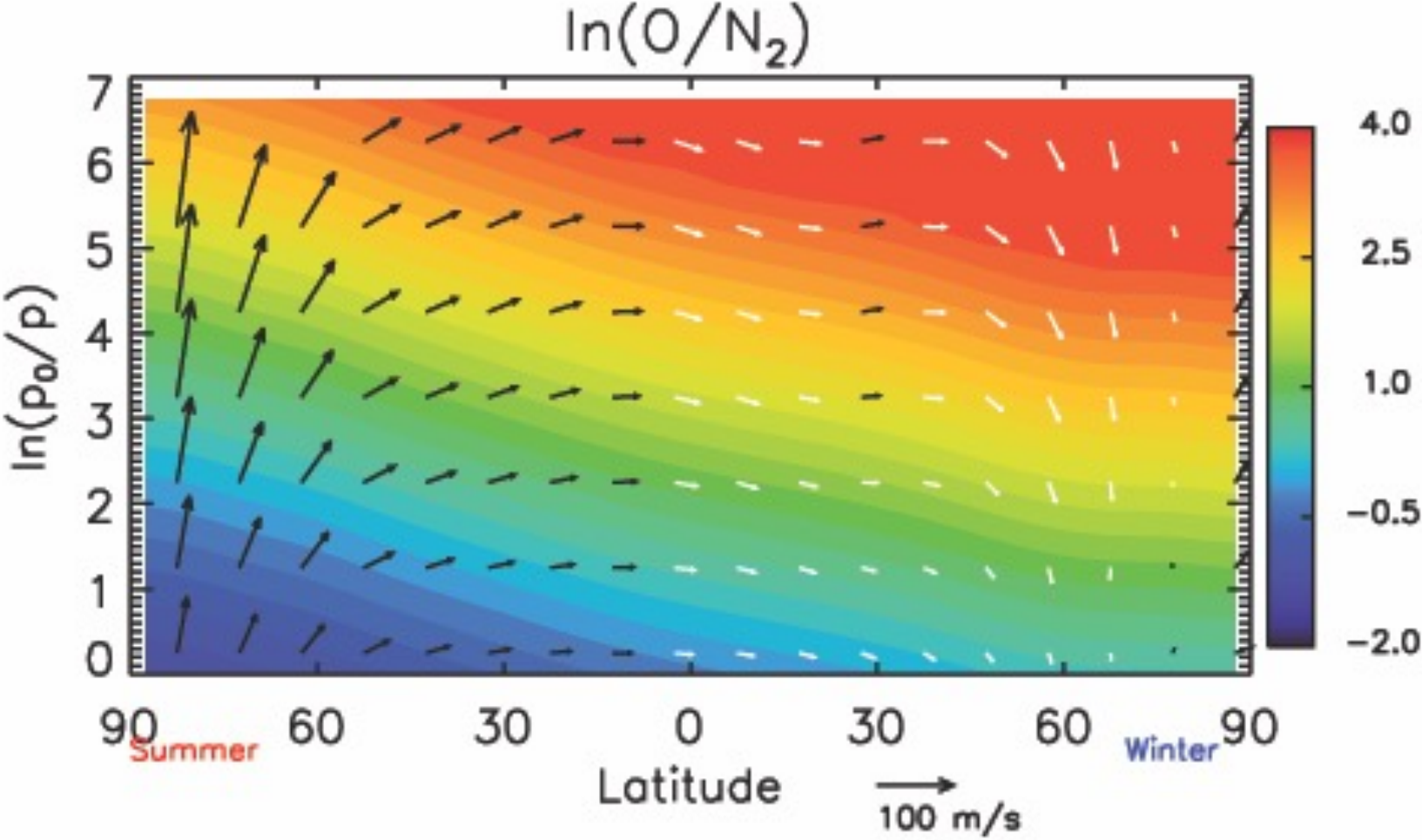
The EIA and Ion Drag



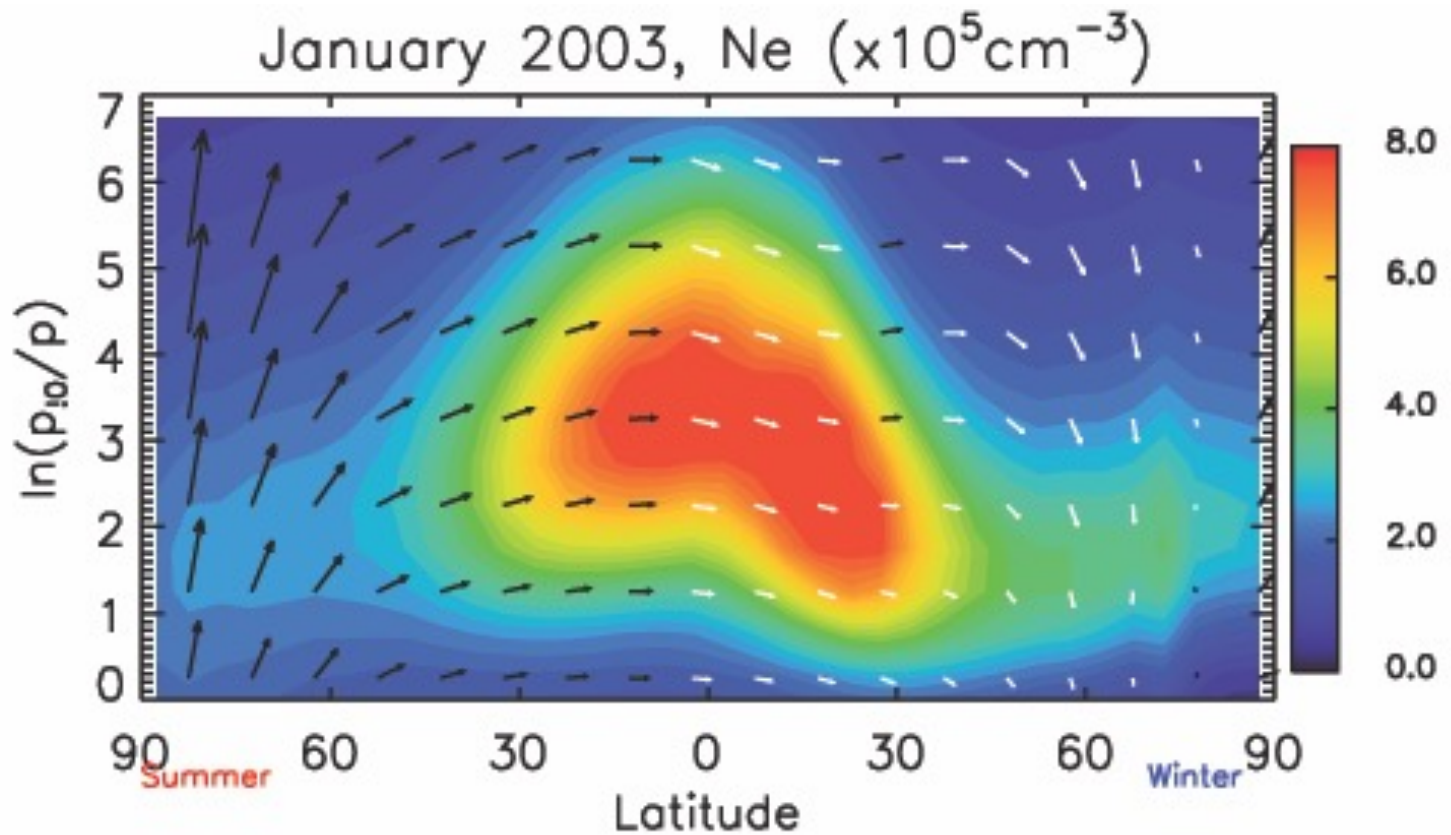
Meridional Wind



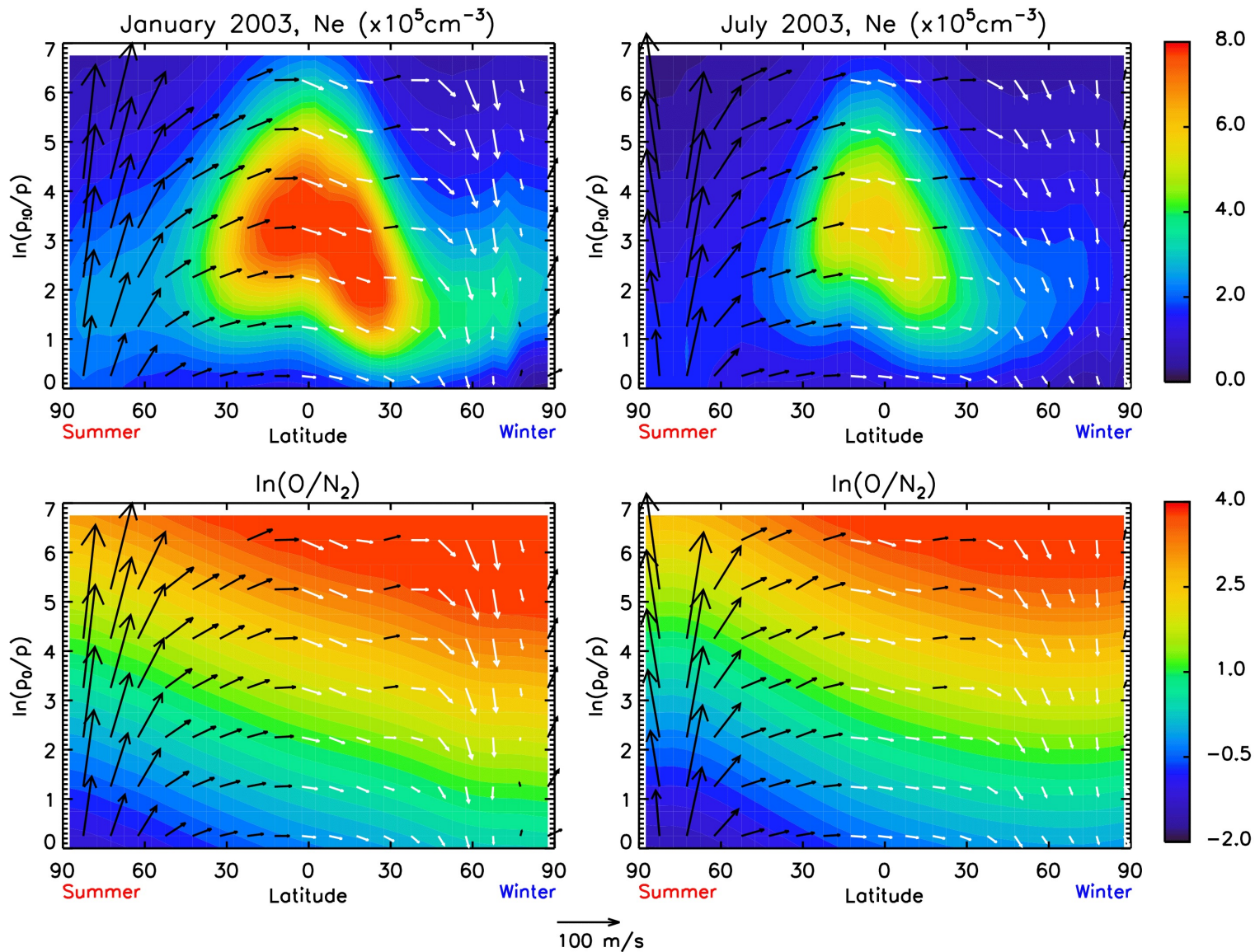
Summer-to-Winter Gradient of Composition



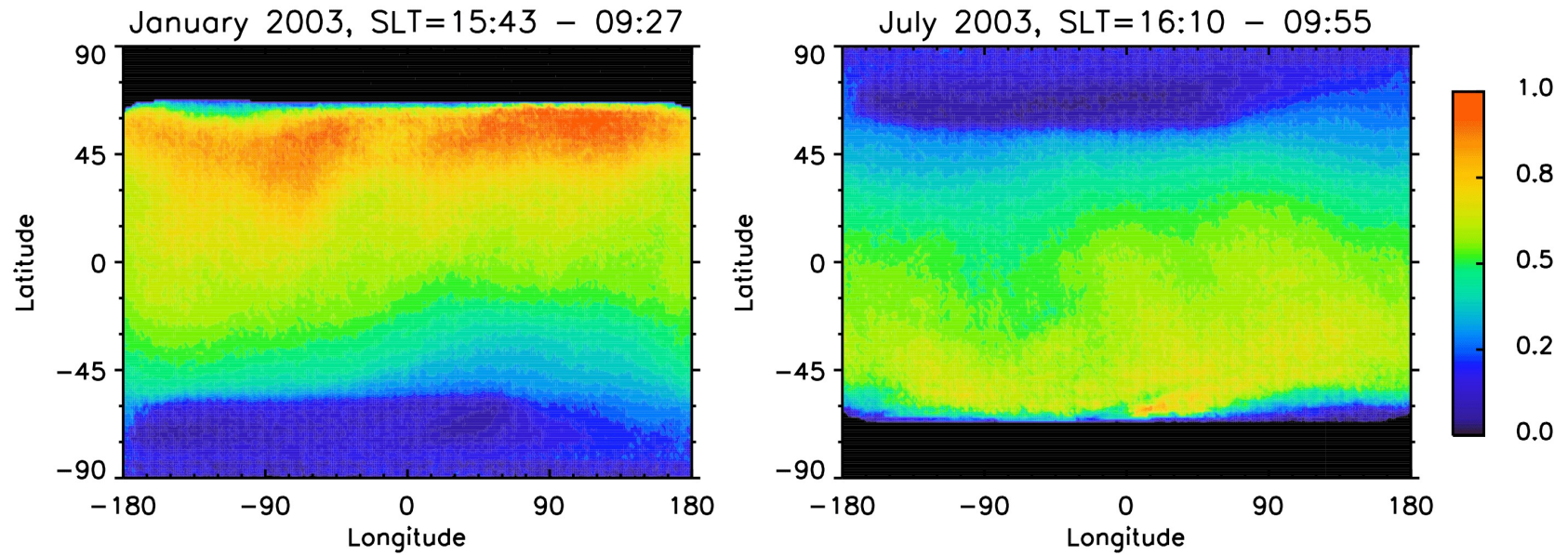
Ionosphere Winter Anomaly



Ionosphere Annual Anomaly



TIMED/GUVI O/N₂



Conclusions

- (1) The EIA affects the summer-to-winter meridional wind through plasma-neutral collisional heating and ion drag;
- (2) The wind is suppressed as it encounters the EIA in the summer hemisphere, accelerates again in the winter hemisphere after passing the EIA, then converges in sub-auroral regions.
- (3) Therefore, the EIA affects summer-to-winter latitudinal gradient of thermospheric composition, ionosphere winter anomaly, ionosphere annual anomaly.
- (4) Any lower atmospheric processes that affect the EIA can therefore affect the mid-latitude thermosphere and ionosphere.