Atmospheric and Space Weather Systems Interaction

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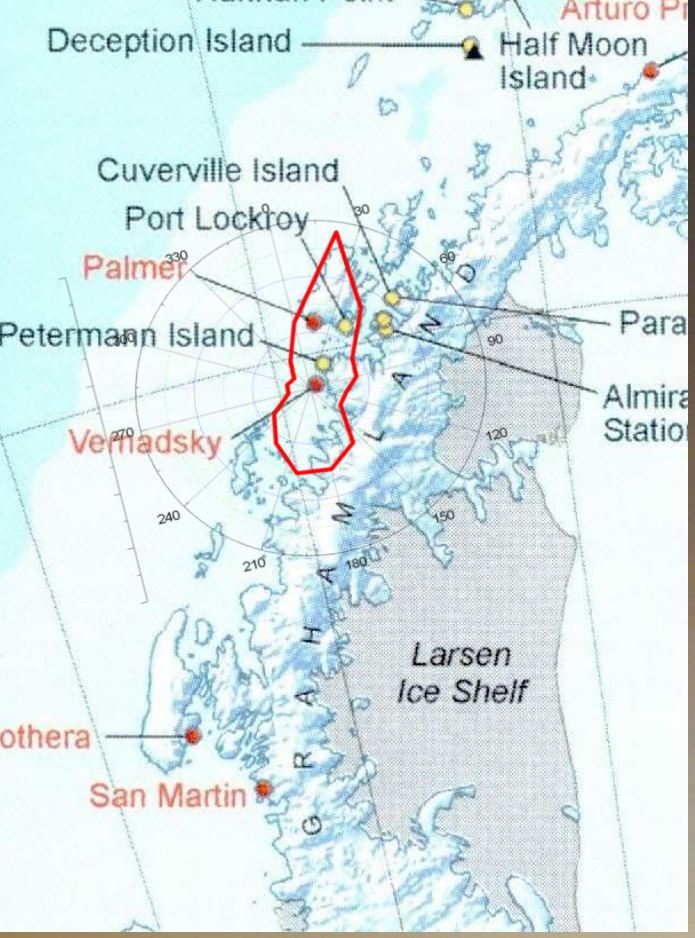
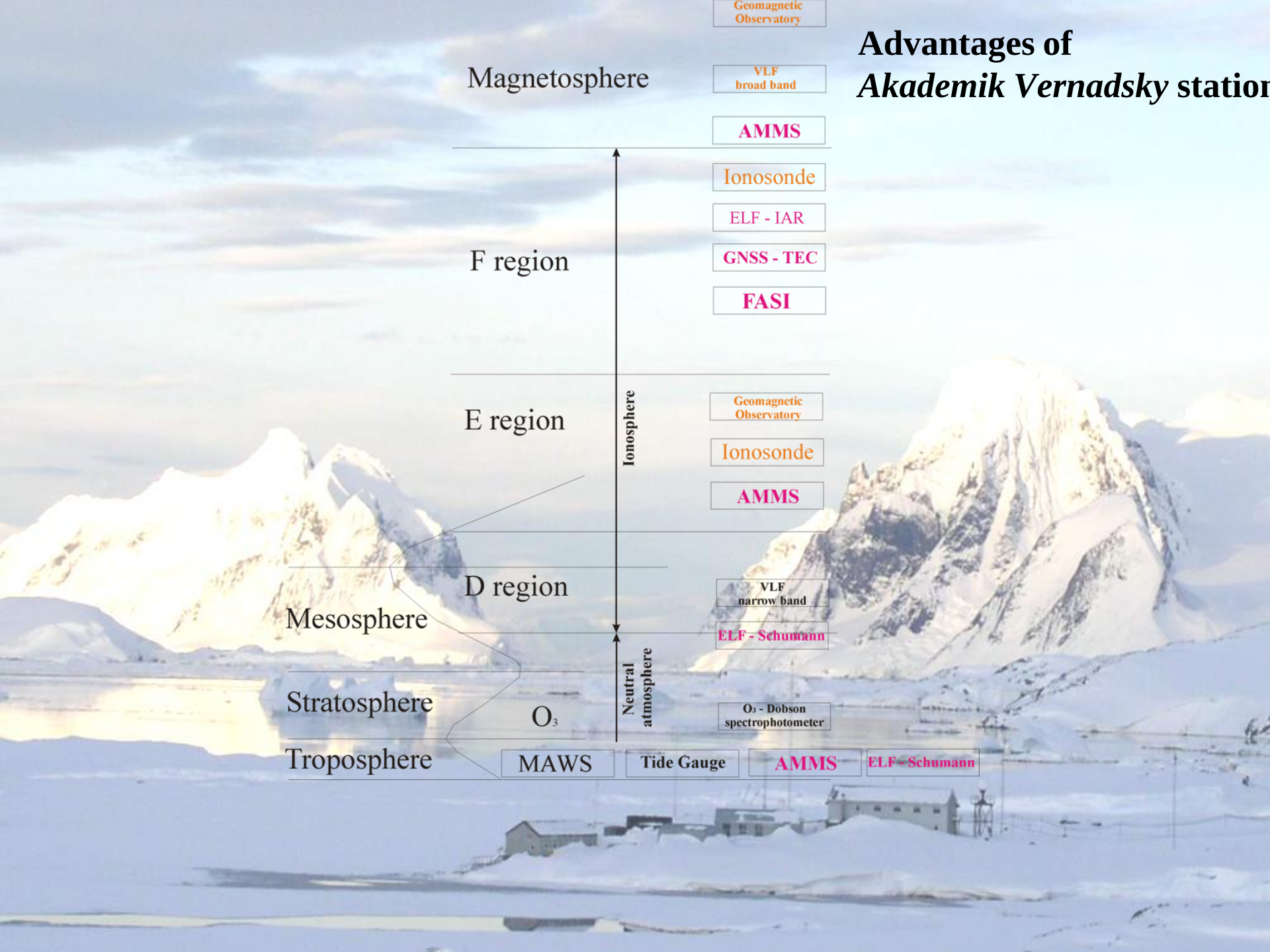
Antarctic Peninsula is a very suitable area for experimental investigations of troposphere-to-ionosphere energy transfer because this place characterized by the extremely high cyclonic activity, quiet background of mid-latitude ionospheric disturbances, magnetic anomaly, and rapid variations in the total ozone content. Analysis of long-term data sets obtained at *Akademik Vernadsky* station (former *Faraday*) has allowed to discover numerous facts showing the weather impact on the dynamics of middle and upper atmosphere. Among them are the correlation between atmospheric fronts and occurrence of sporadic structures in the E and F ionospheric regions, influence of large-scale cyclones on the ozone hole location and geometry, impact of the ozone layer on the troposphere-to-ionosphere energy transfer, etc.



Advantages of Antarctic Peninsula for investigation of troposphere-ionosphere interaction

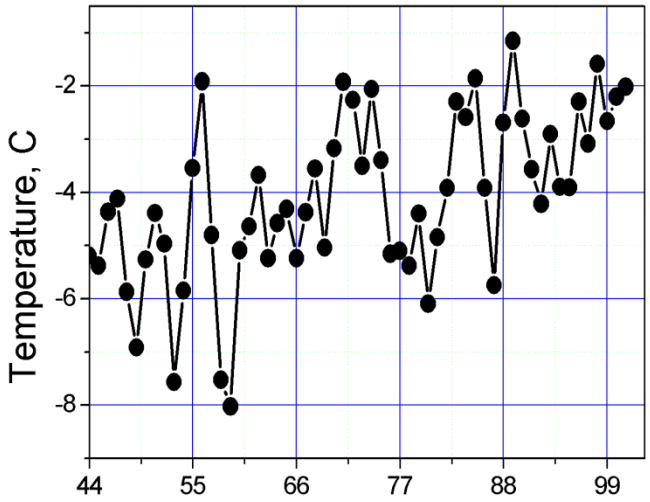
- Unique interference conditions
- Big difference between geographic and geomagnetic latitudes
- High cyclonic activity should generate the atmospheric gravity waves which able to propagate to ionospheric heights
- Because of middle geomagnetic latitudes there is quiet background of ionospheric and geomagnetic variations at this region
- Quick variations of total ozone content at spring time
- Geomagnetic anomaly
- Weddell sea anomaly

Advantages of *Akademik Vernadsky* station

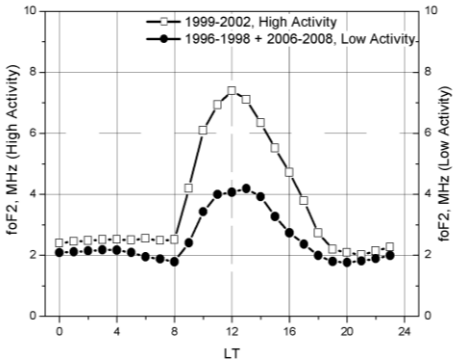


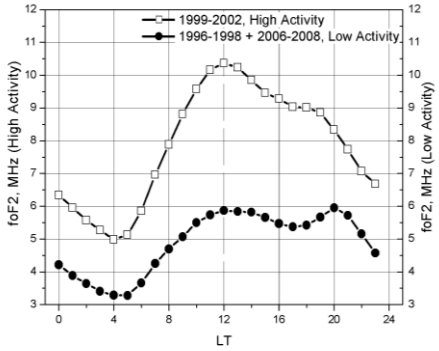
Background variations of the environment parameters at the *Vernadsky* station

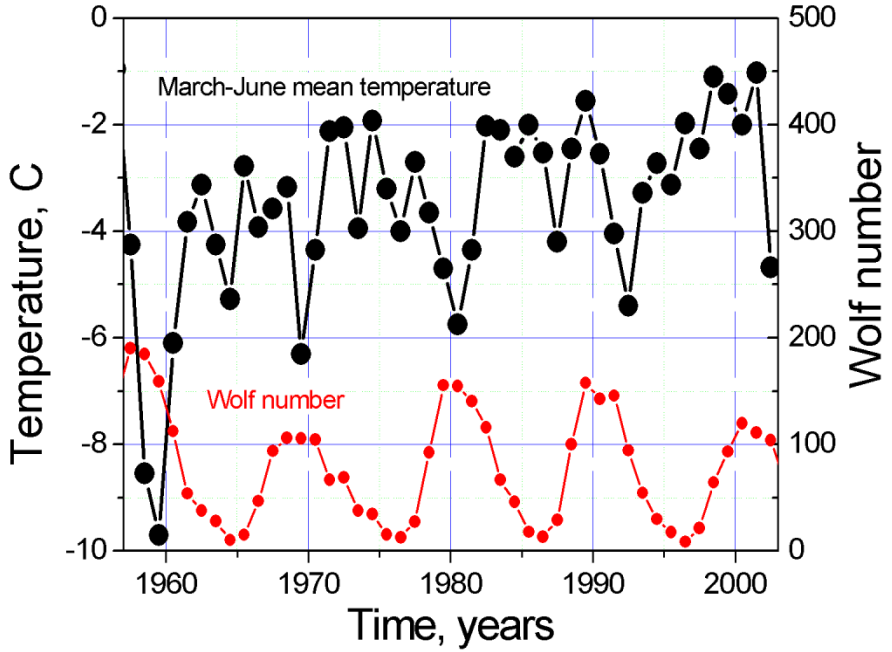
Surface temperature



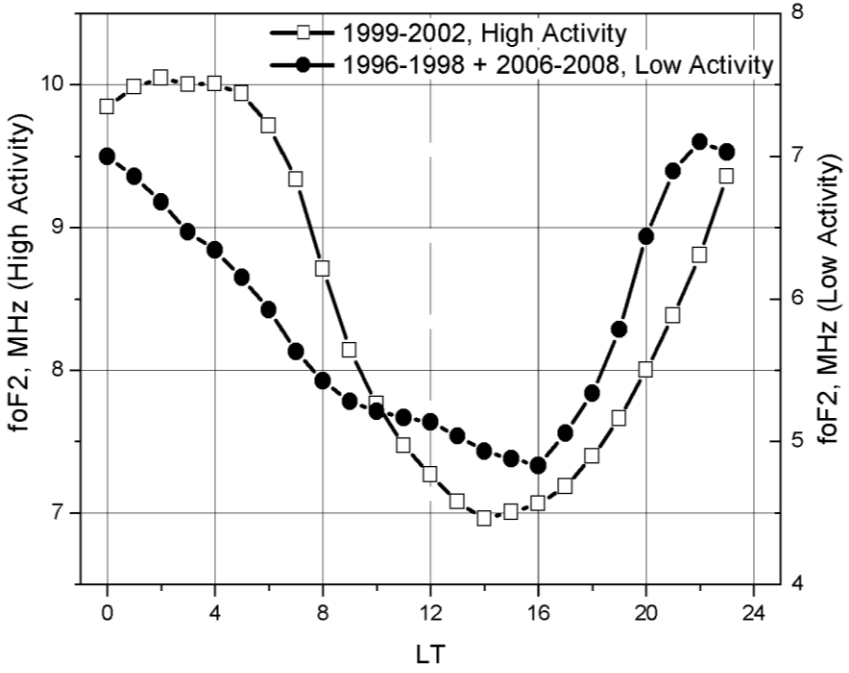
Critical frequency of the ionosphere



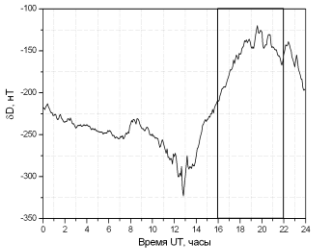


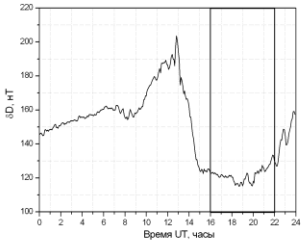


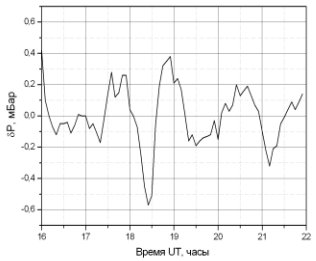
Weddell sea anomaly

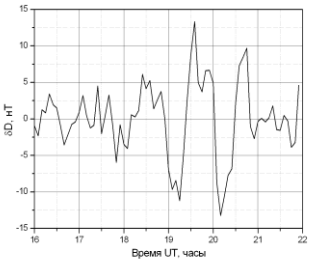


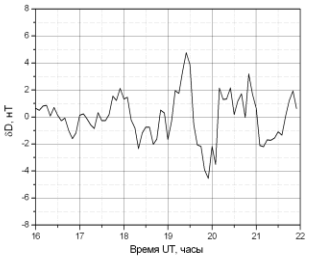
Excitation of MHD waves by AGW of tropospheric origin

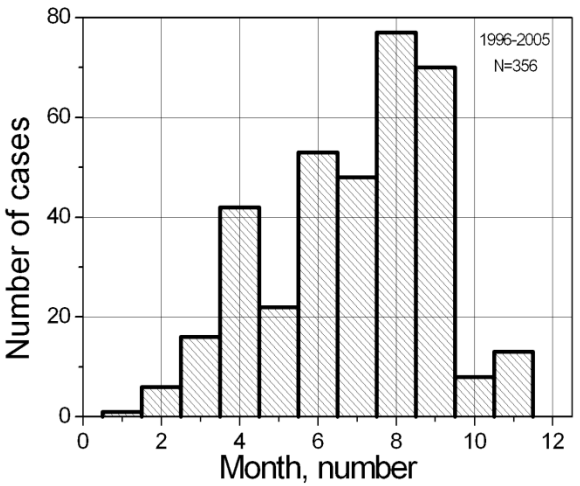


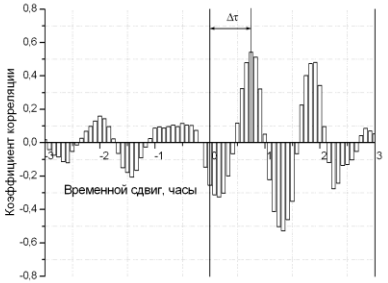


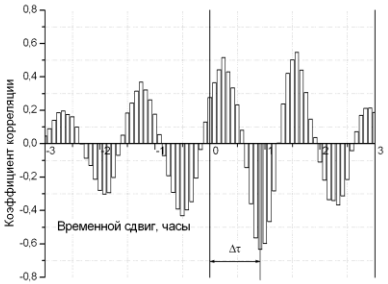


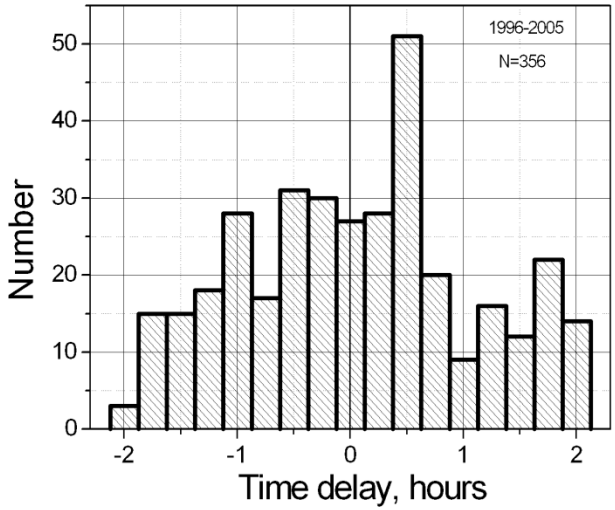


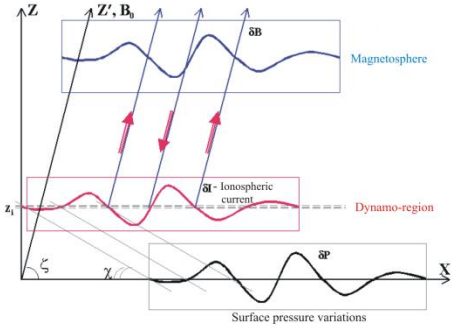


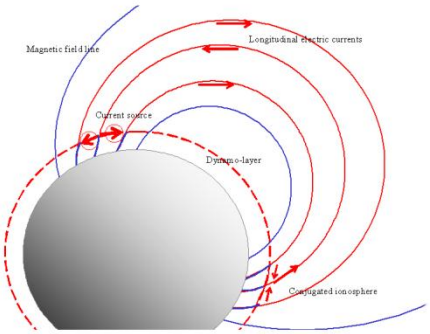




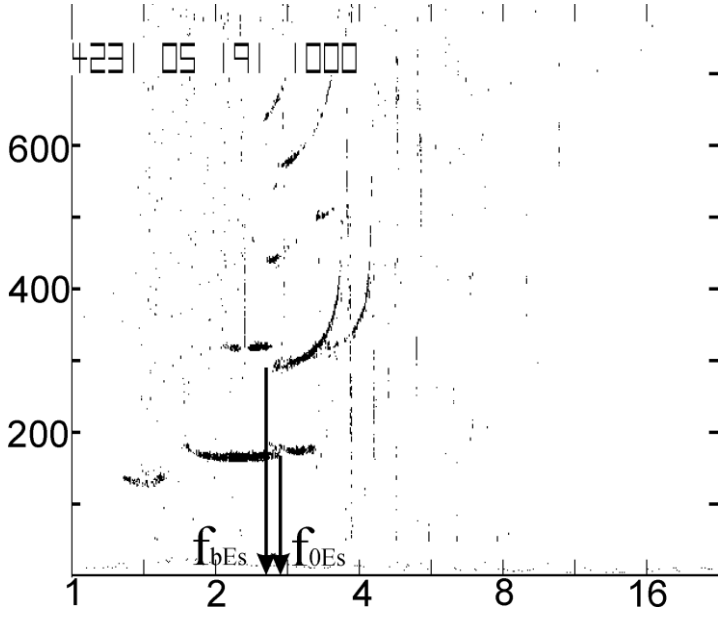


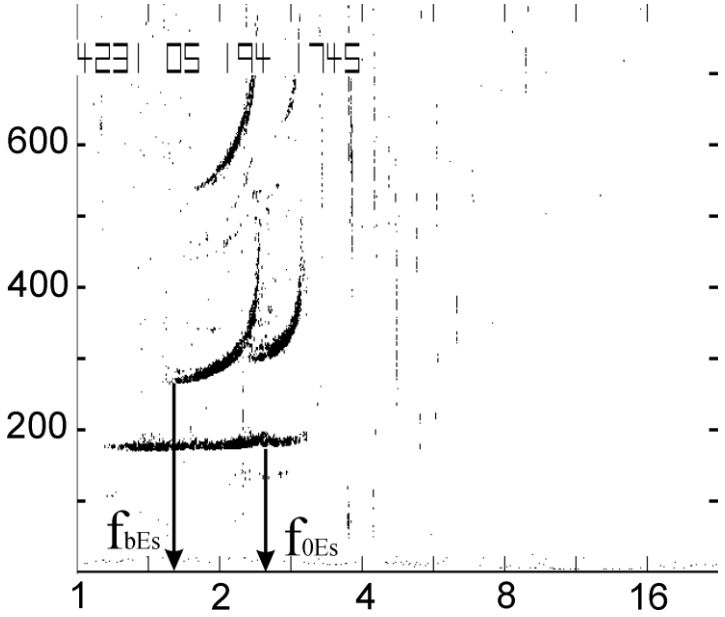


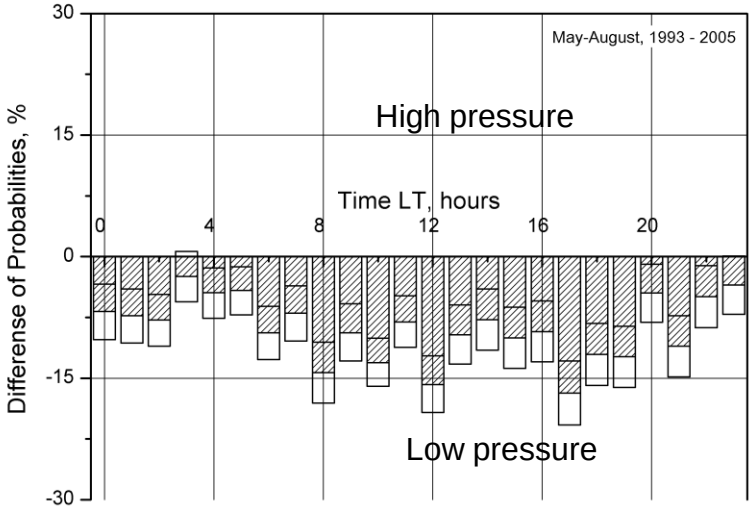




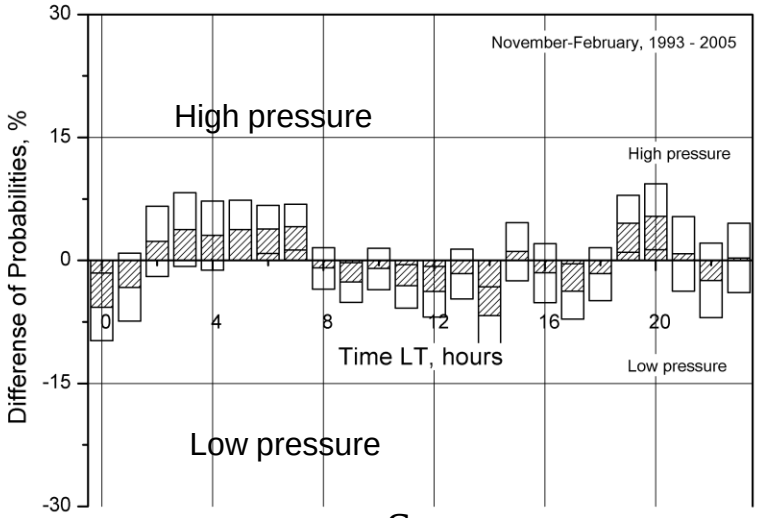
Sporadic E-layers. Daily variations of sporadic E layers dependence on the surface pressure. Difference of conditional probabilities





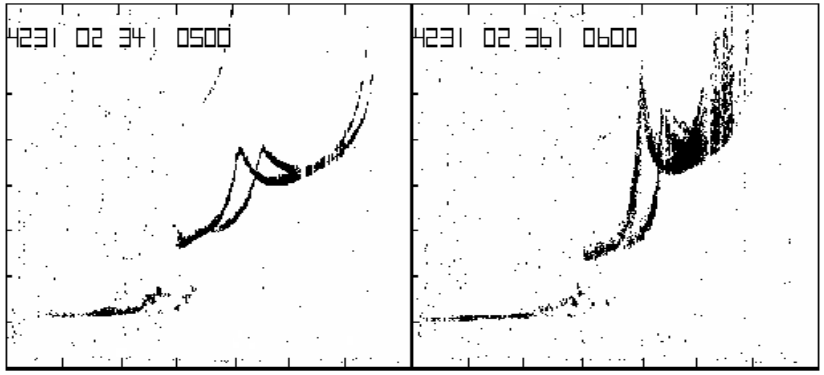


Winter



Summer

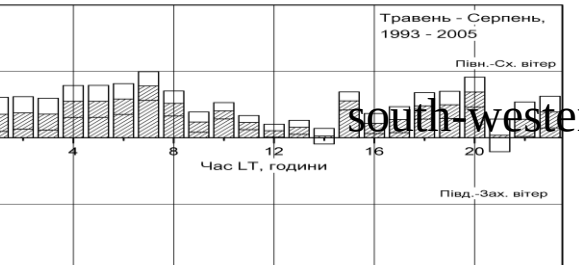
Daily variations of spread-F dependence on the surface pressure and wind. Difference of conditional probabilities



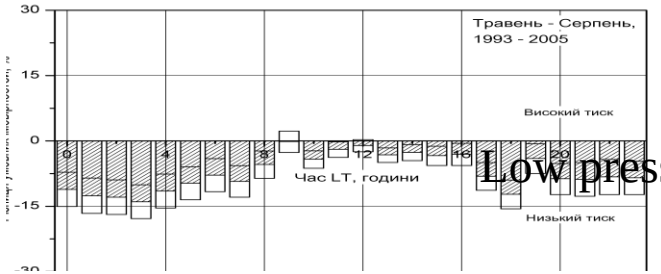
Spread - F

north-easter

High pressure

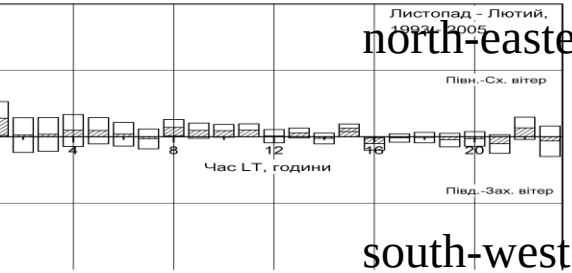


south-wester

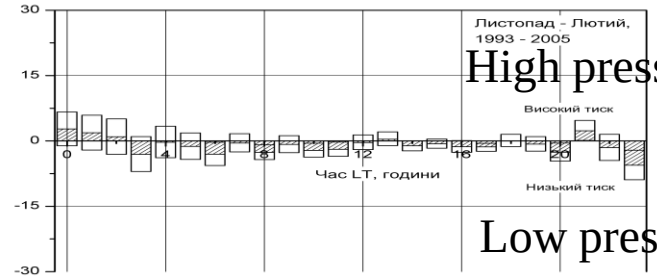


Low pressure

Winter



north-easter



High pressure

south-wester

Low pressure

Summer

The role of ozone layer in the troposphere-to-ionosphere energy transfer

September 11 – October 5, 1995-2004

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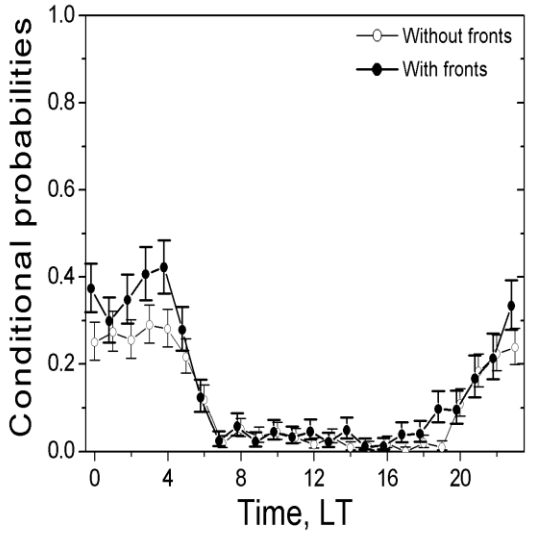
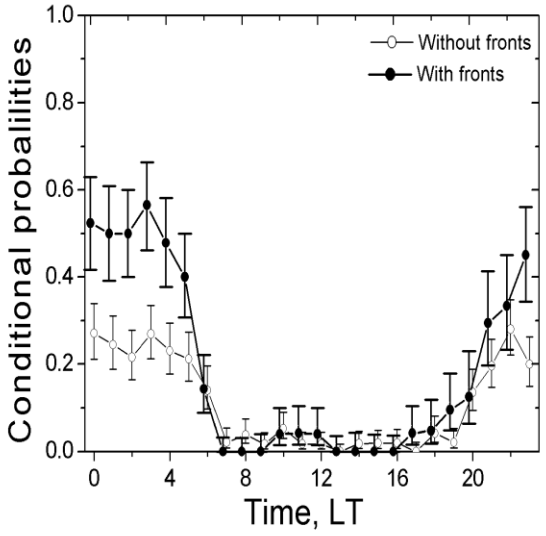
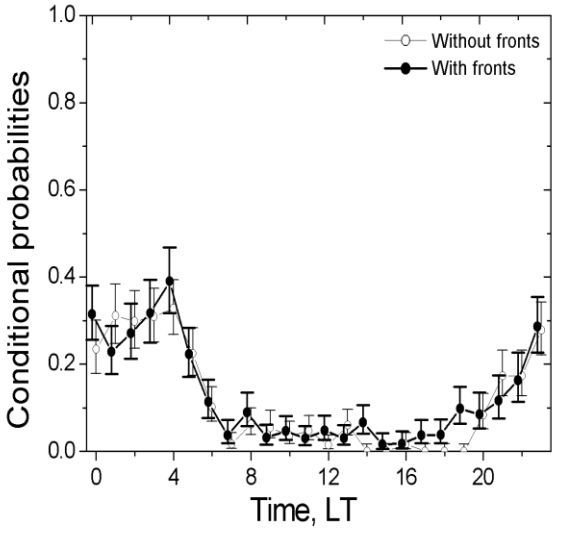
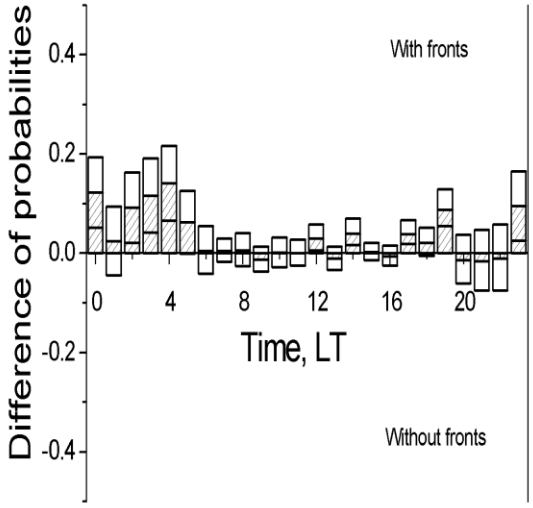
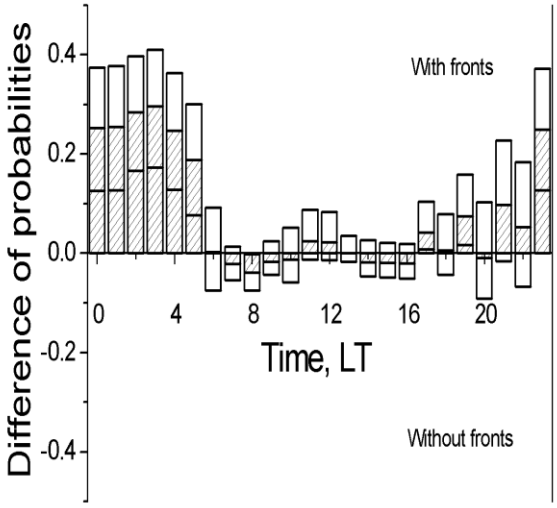
TOC > 180 D.U.

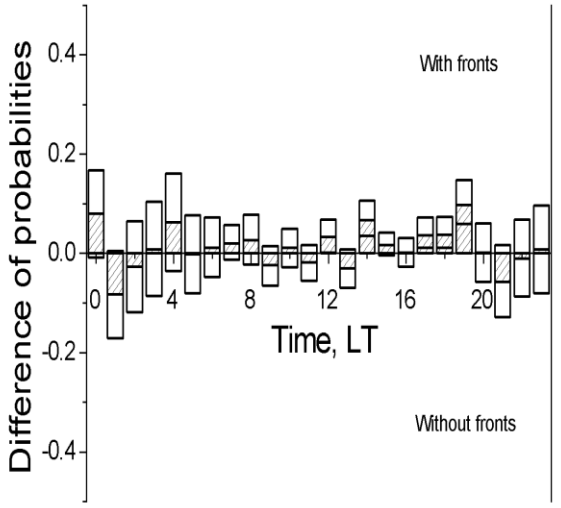




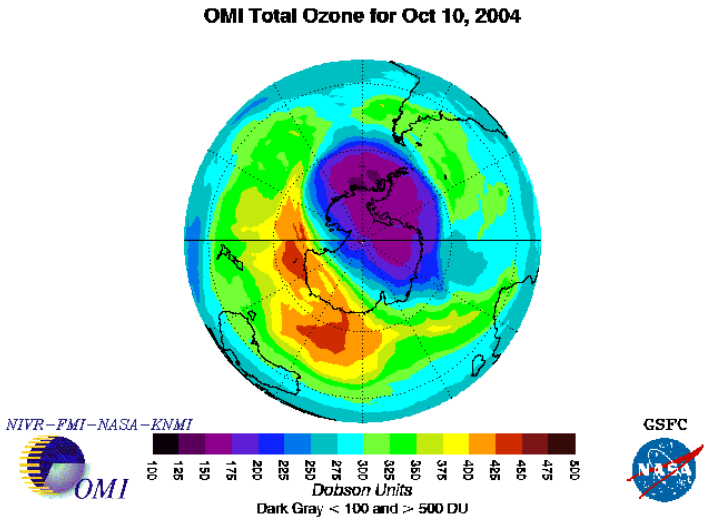


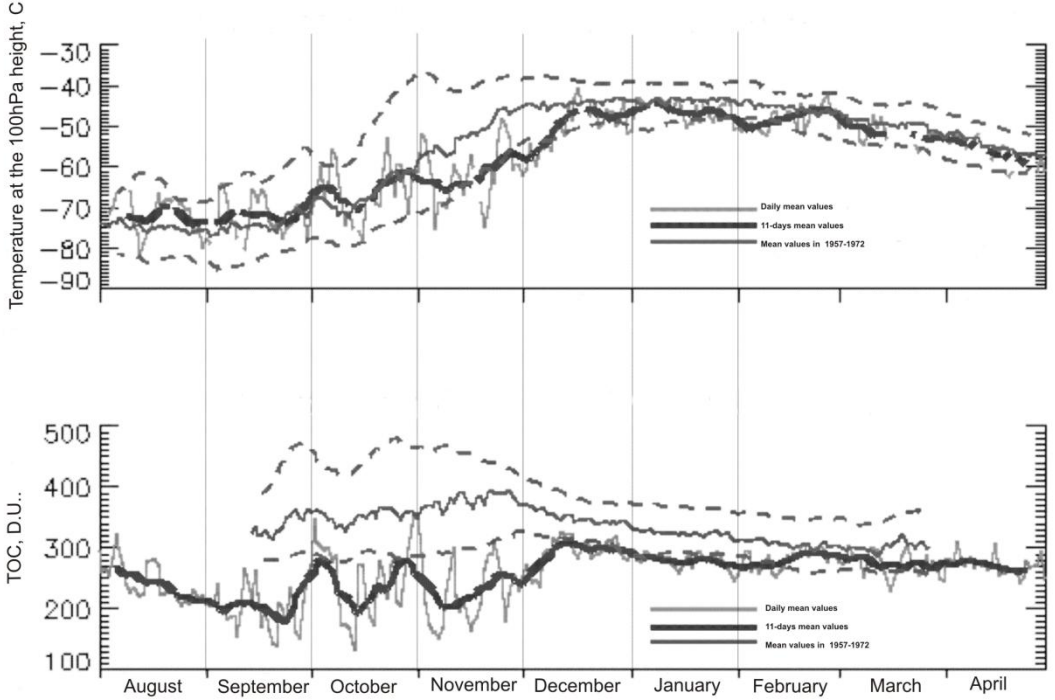


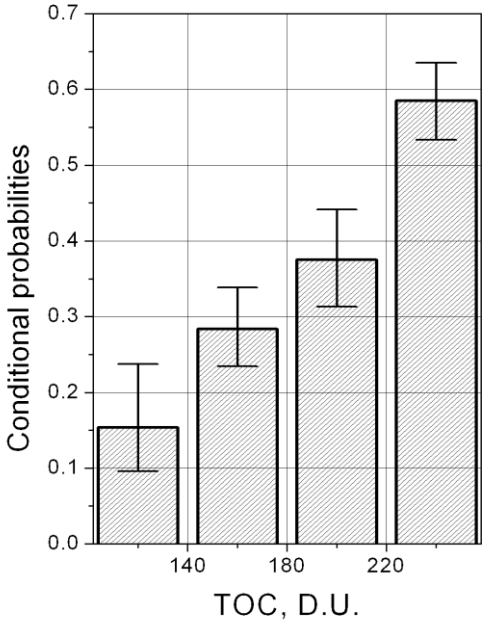


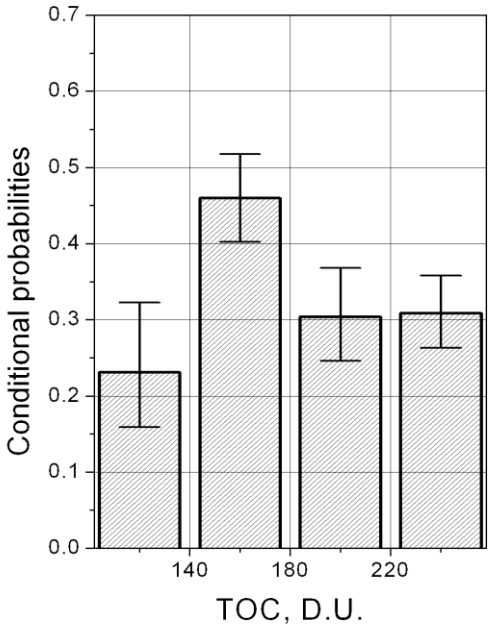


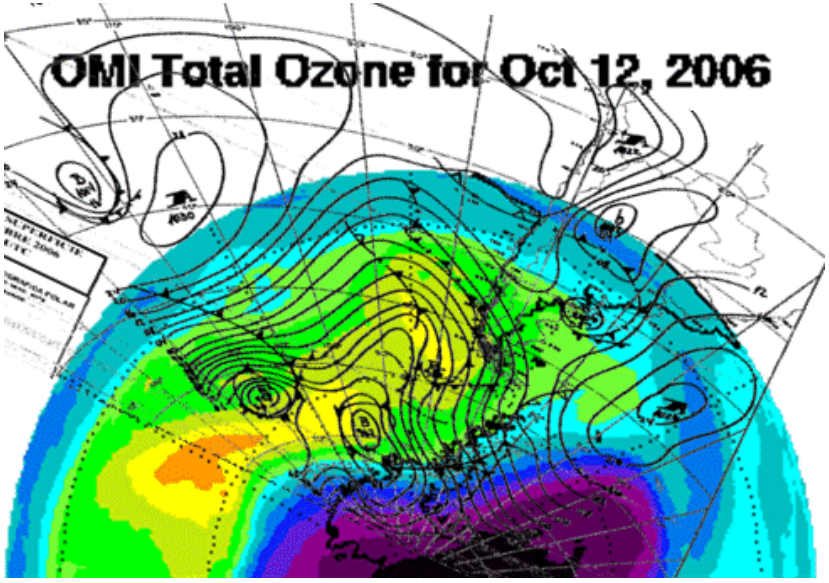
The role of ozone layer in the troposphere-to-ionosphere energy transfer









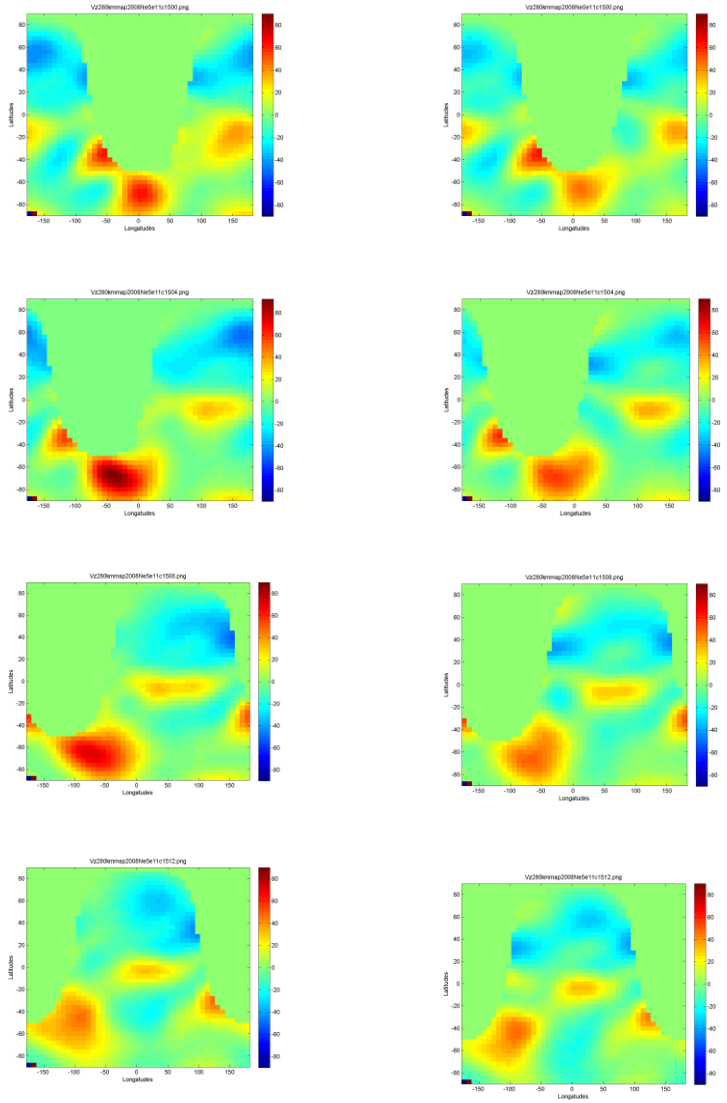


Modeling of efficiency of ion drag mechanism

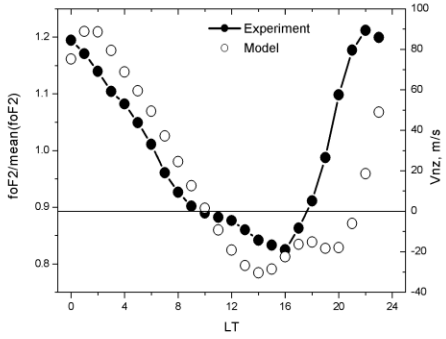
Modeling the global distribution of velocity of vertical transport of ionospheric plasma by thermospheric winds

$$V_z = V_{diff} + V_{drift} + V_{wind}$$

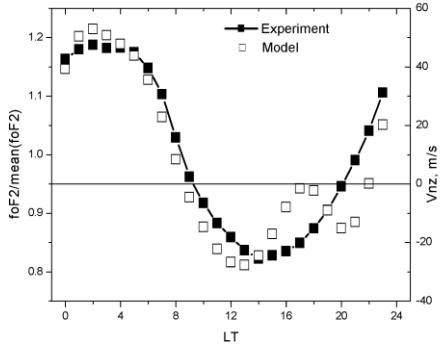
$$V_{wind} = V_{nx} \sin I \cos I \cos D - V_{ny} \sin I \cos I \sin D + V_{nz} \sin^2 I$$



Maps of allocation of vertical velocity of ionospheric plasma for January, 15 from 0 to 12 UT 4:00 (top to bottom) in the year of low (left) and high (right) solar activity

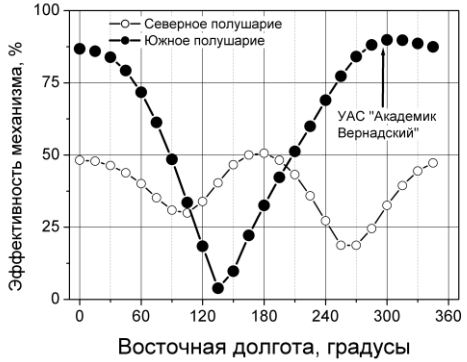


а)



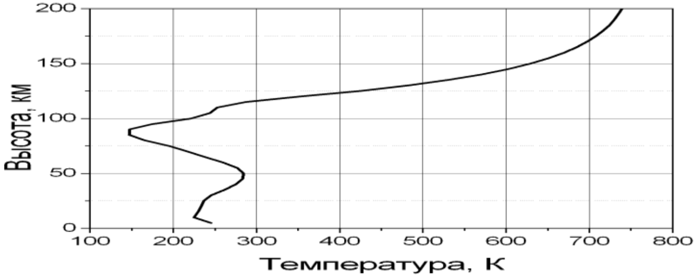
б)

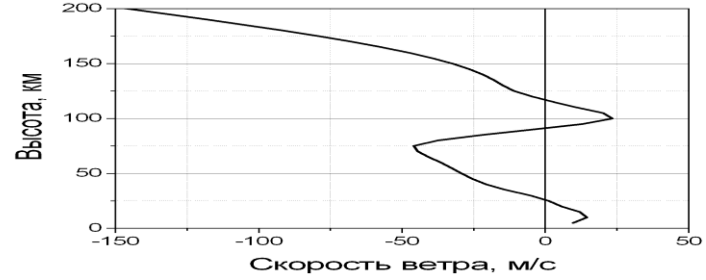
Daily variations of critical frequencies and ionospheric plasma vertical velocity in January
(a) for the year of low solar activity,
(b) for the year of high solar activity.

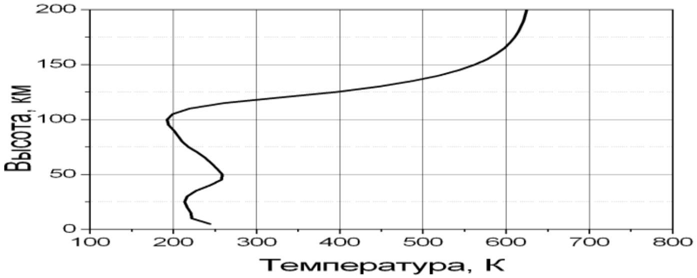


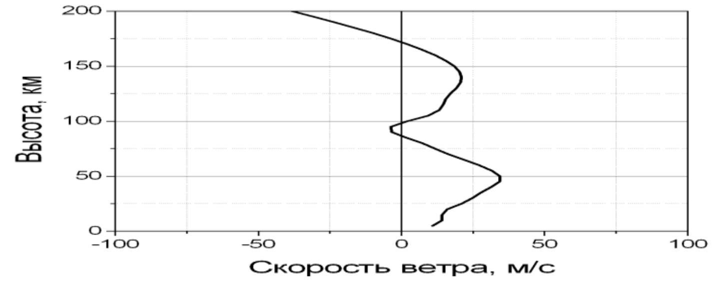
The longitude distribution of efficiency of ion drag mechanism in the Northern and Southern hemispheres along the 65 degrees of latitude

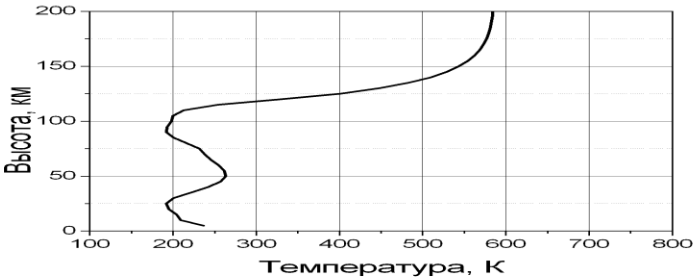
Modeling. Temperature and wind profiles
In frames of NMRLSISE-00 for 65S 65W

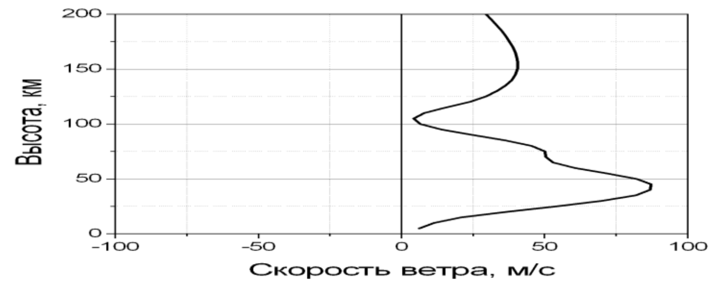


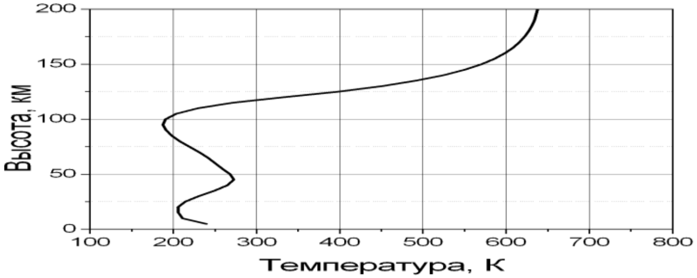


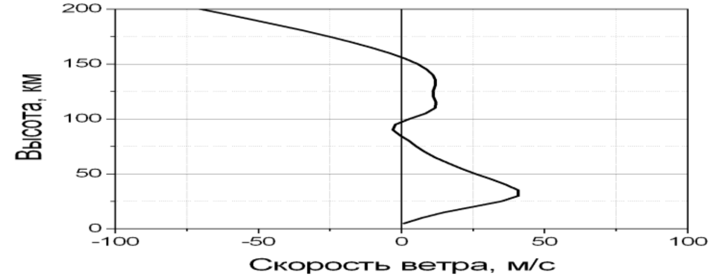




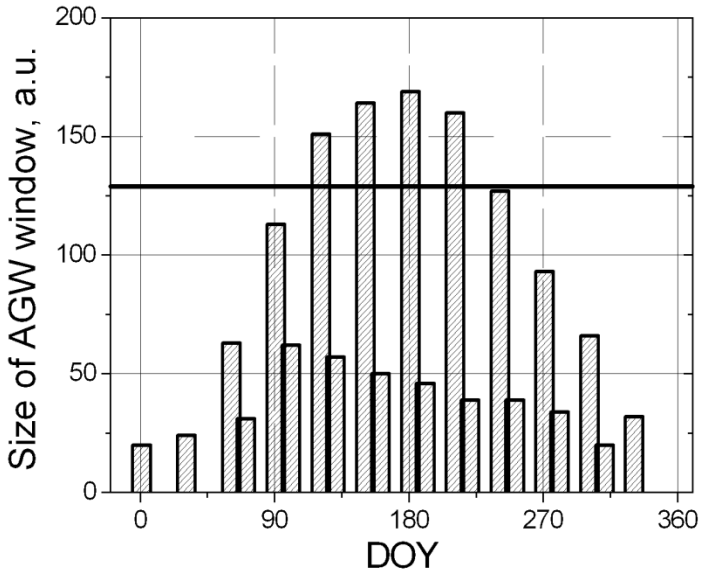


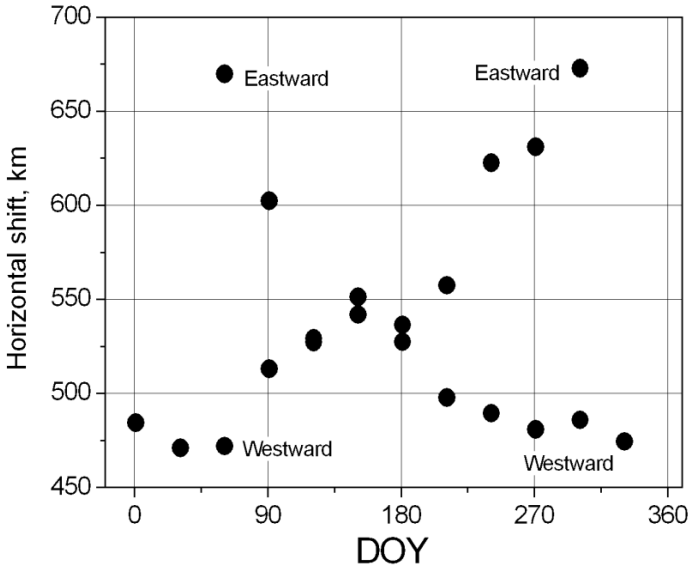


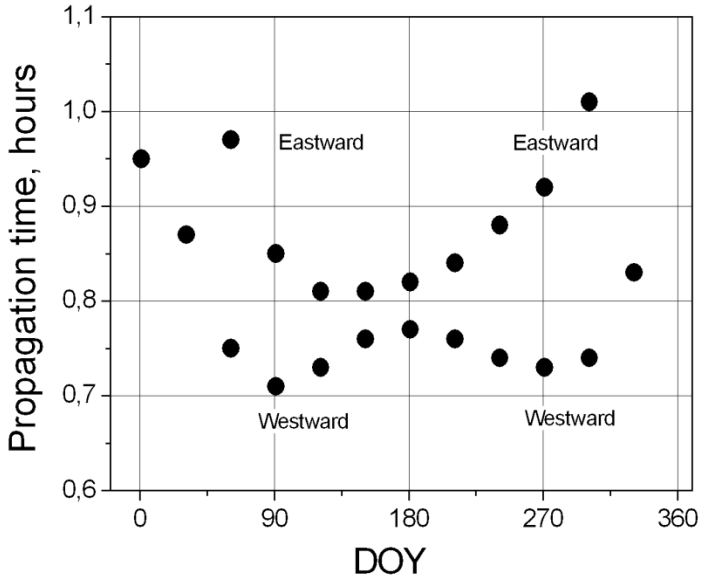


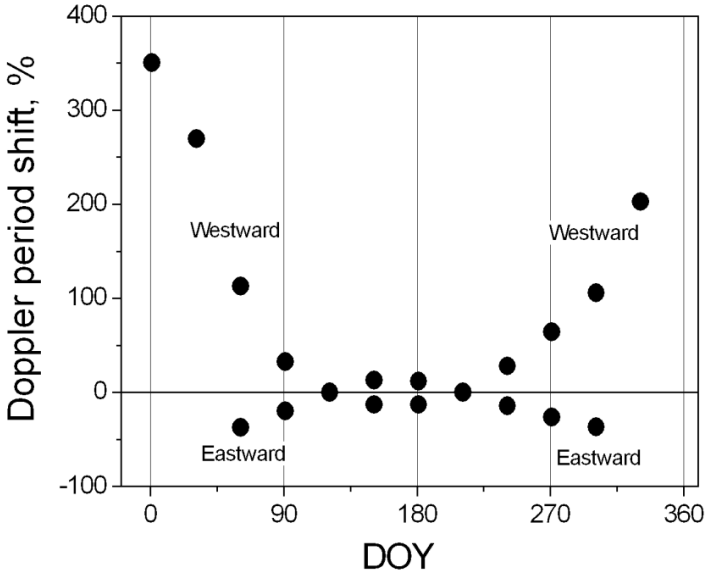


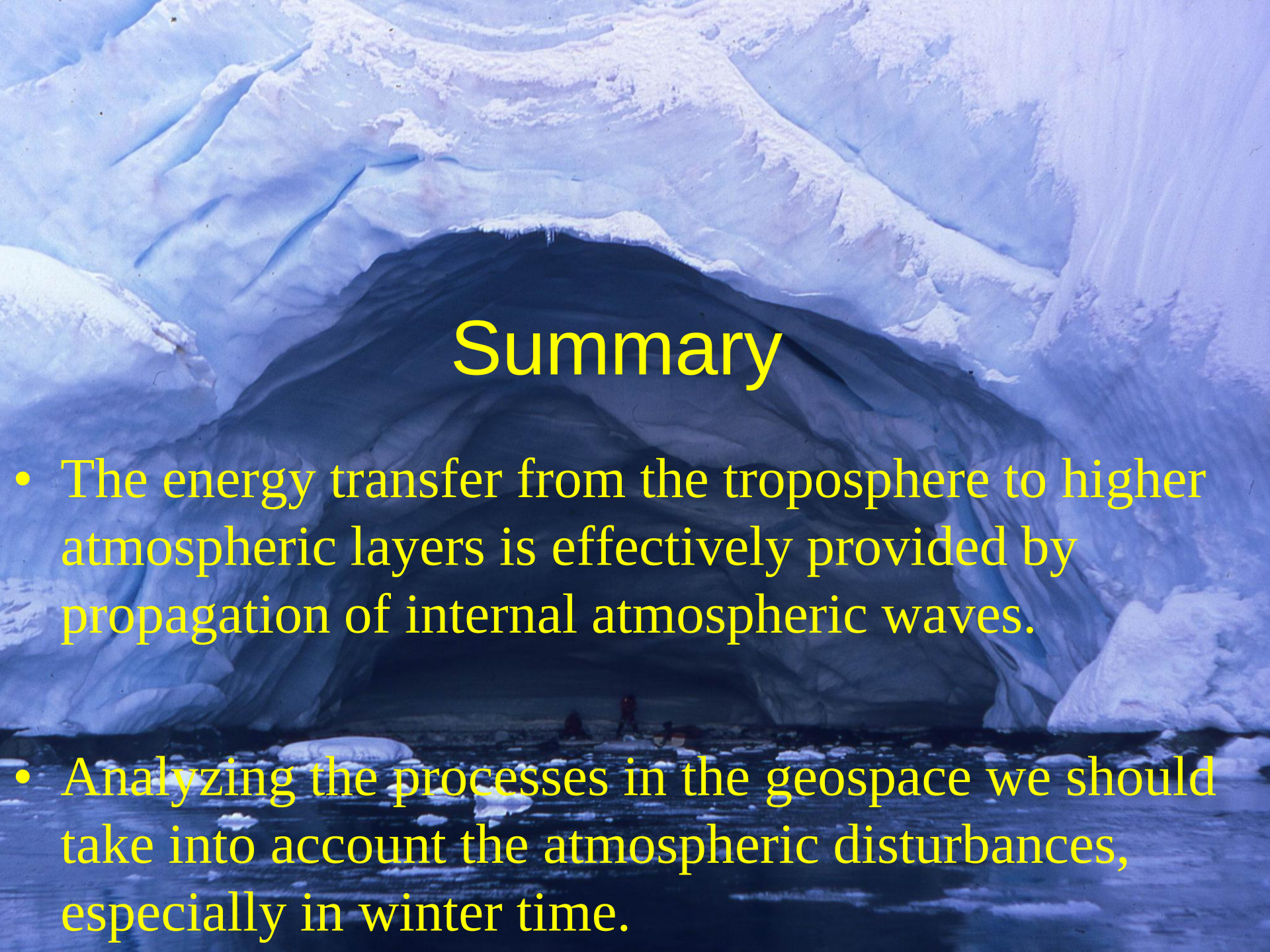
Modeling. Results for middle-scale AGW











Summary

- The energy transfer from the troposphere to higher atmospheric layers is effectively provided by propagation of internal atmospheric waves.

- Analyzing the processes in the geospace we should take into account the atmospheric disturbances, especially in winter time.


Thank you!