

The Russian State Hydrometeorological University
St.Petersburg



P-12. Long-period variations of the stationary planetary waves

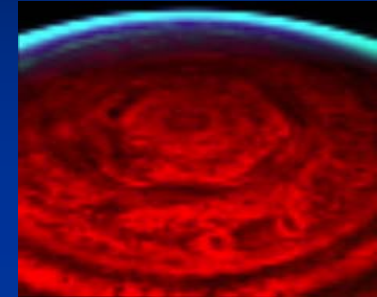
Kanukhina A.Y., Ulyanec E.K.,
Suvorova E.V., Savenkova E.N.,
Pogoreltsev A.I.

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What is the subject?

- stratospheric dynamics through stationary planetary waves variations during last 50 years

Example of Saturn's waves of ionized particles <http://photojournal.jpl.nasa.gov/catalog/PLA09186>



Why it is important?

- To understand impact of dynamical and photochemical processes on observed climatic changes of atmospheric temperature
- There is a growing evidence that additional extended-range tropospheric forecast skill may also come from slow variations of the circulation and planetary waves in the stratosphere

Data and models used:

- NCEP/NCAR re-analysis
- 3-d linearized model of PW

The main objectives:

- analysis of SPW of zonal wavenumber 1 and 2 from NCEP/NCAR data since 1959;
- interannual, interdecadal and long-term SPW variability analysis;
- numerical simulation of SPW propagation with linearized model and stratospheric background conditions that are characteristic for different decades, comparison of stratospheric reanalyses with numerical model results;
- analysis of middle and upper atmosphere variability due to SPW based on numerical results, and comparison with experimental results from literature.

Results:

- According to previous results we assumed that variability of the mean flow will cause the changes of the SPW propagation conditions.
- The simulation of the SPW1 performed with the linearized model supports this assumption and shows that during the last 40 years the amplitude of the SPW1 calculated in the stratosphere and mesosphere increased substantially.
- The analysis of the SPW amplitudes extracted from the geopotential height and zonal wind NCEP/NCAR data supports the results of simulation and shows that during the last years there exists an increase in the SPW1 activity in the lower stratosphere.
- These changes in the amplitudes are accompanied by increased interannual variability of the SPW1 also.
- Analysis of the SPW2 activity shows that changes of its amplitude have a different sign in the winter (northern) hemisphere and at low latitudes in the summer (southern) hemisphere.
- Value of the SPW2 variability differs latitudinally and can be explained by non-linear interference of the primary wave propagation from below and secondary SPW2.
- stratospheric dynamics becomes more stochastic