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Resonant Interaction between two planetary Waves with zonal Wave Number 2

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Planetary waves have significant influence on atmospheric circulation since they explain several dynamical phenomena such as stratospheric warmings. These are attributed to breaking planetary waves and often result in the fact that the Arctic vortex is less severe than the Antarctic one. Nevertheless, the generation of stratospheric warmings is not totally clarified. The most promising explanation is the interaction of planetary waves: in many cases the amplitude of the quasi-stationary planetary wave 1 builds up due to resonant wave-wave interaction, for example, until it transmits its moment and energy to the background wind field. The role of wave 2 is usually considered to be less important.

Based on ERA40-data (Jan. – Feb. 1990) we found evidence that a wave-wave interaction of planetary waves no. 2 was responsible for a minor stratospheric warming in February 1990. At 70˚N harmonic analysis was used to determine the four dominant wavelengths along the circle of latitude.

We saw a beating of the phase of the planetary wave no.2 and tentatively interpret our results in the following way: a travelling wave 2 interacts with the stationary one resulting in a quasi-stationary wave which shows a modulation similar to the frequency of the travelling one – the above mentioned beat can be observed. Due to this resonant interaction, the quasi-stationary one builds up until it breaks down resulting in a strong minor stratospheric warming. Additionally, energy seems to be transferred from wave 2 to wave 1.

The phenomenon of a beating phase can eventually be used as an indication for strato-

spheric warmings.