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Atmospheric Tides over the Pyrenees. Observational study and numerical simulation

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ABSTRACT

Atmospheric tides refer to the oscillations in the atmosphere whose periods are integral fractions of a day. In some magnitudes (e.g. temperature), these oscillations are quite evident but in others, such as the pressure in the midlatitudes, they are usually masked by the greater variations produced during the transient pass of synoptic weather systems. The main forcing agent for these oscillations, as opposed to ocean tides, is not the solar or lunar gravity pull, but the daily variations in solar insolation and the thermal effect derived from it. The main components of the solar atmospheric tides are the semidiurnal, with a 12-hour period, and the 24-hour period component or diurnal tide. The global scale tides are usually referred to as migrating tides, and are the result of a gravity wave which travels westerly with the apparent motion of the sun. Nevertheless, a significant part of the tide can be related to local characteristics, and this part is considered as the non-migrating component of the tide.

Barometric tides around the Pyrenees mountain range are analyzed by means of ground synoptic stations data recorded during one year, ground data from PYREX experiment and the CRA/LA VHF wind profiler installed in the North of the range. Tides are decomposed in their diurnal and semidiurnal components. Diurnal tides show a strong non migrating component and are very dependent on local conditions. Semidiurnal tides are more homogeneous and present a north-south asymmetry, also noted in the Alps. This cross-range asymmetry seems to be related to some interference effect caused by the mountain range in the migrating semidiurnal tide wave. The diurnal component asymmetry presents a very strong seasonal variation, so its cause must be probably related to thermal local conditions. A three month simulation carried out with NCAR's WRF limited area model reproduces this asymmetry and some of the features of the observed tides.