# Investigation of tidal variability with lidar and numerical simulation

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Systematic measurements of the middle-atmosphere temperature by a Rayleigh Lidar located at the Observatory of Haute Provence (44˚N) and at La Réunion Island (20.8˚S ) has led to a study the tidal effects in the 30- to 70-km height range. Good agreement is shown for diurnal and semidiurnal temperature variations calculated from lidar measurements in southern France and from data of the microwave limb sounder of the Upper Atmosphere Research Satellite (UARS). Tides induce temperature deviations observed in southern France to be as large as $\pm 3$ K, with a maximum at the stratopause. The amplitudes and phases of the semidiurnal variation change significantly with season and location.

Tides have a strong impact on long-term trends due to change of the time of measurements or satellite orbits. Accurate validations need to take into account the tidal issues. An analytic model of the diurnal component, based on sinusoidal functions, fits the data well, but is less successful for the semidiurnal component. The confidence in detecting bias in data comparisons is improved with time-of-day adjustments.

A 3-D chemistry-dynamics-transport model was used to explore the representation of the diurnal and semidiurnal tidal components between 10 and 80 km. Comparisons with the predictions from a global-scale wave model (GSWM) show that the model produces reasonably realistic simulations of the tide in the middle atmosphere, although strong differences do exist. Simulations to assess the temporal variability of the tide are reported. In particular, the sensitivity of the tidal amplitude to changes of the tidal forcing (ozone and water vapour distributions) and the effects of the structure of the background wind and temperature fields, is quantified. Our results suggest the need for updating the model with realistic background fields and revised tidal forcing in order to provide real-time estimates of the tide. Measurements and numerical simulations have been performed during the CAWSES campaign of September 2005.