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8.10 NONLINEAR INTERACTION BETWEEN THE DIURNAL AND SEMIDIURNAL TIDES: TERDIURNAL AND DIURNAL SECONDARY WAVES

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Many years of measurements obtained using French meteor radars at Garchy (latitude 47°N) and Montpazier (latitude 44°N) are used to show the existence of an 8-hour oscillation. Some examples of the structure of this wave are displayed and compared with measurements performed at Saskatoon (latitude 52°N) and Budrio (latitude 45°N). This wave can be interpreted as the solar-driven terdiurnal tide, or as the result of the nonlinear interaction between the diurnal and semidiurnal tides. Both hypotheses are tested with numerical models. Incidentally, the possible existence of a 24-hour wave resulting from this interaction is also studied.

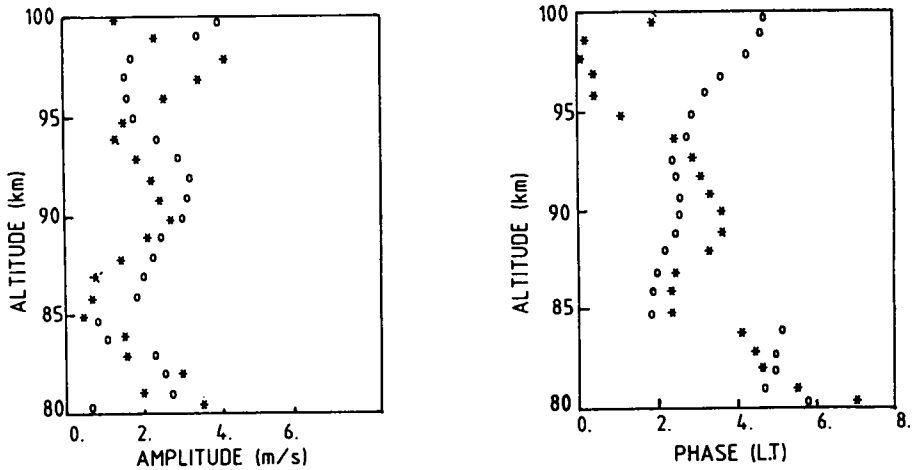

Figure 1. Amplitude and phase of terdiurnal tide (eastward wind), deduced from two simultaneous campaigns carried out at Garchy (47°N) and Montpazier (44°N) during the 8-20 July 1976 period. o - Garchy, * - Montpazier.

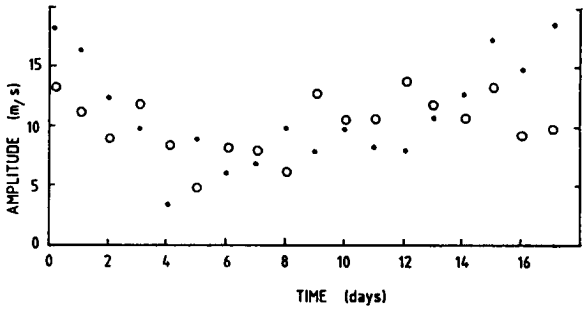

Figure 2. Short-time variation of the diurnal and terdiurnal tides for a single campaign. Garchy, 6 to 28 January 1976 period. Mean <90 - 95 km> eastward wind • - diurnal tide, o - terdiurnal tide.

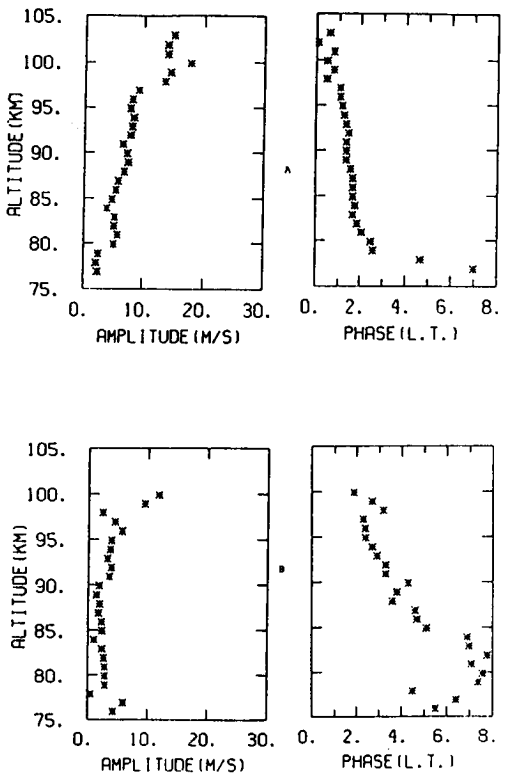

Figure 3. Terdiurnal monthly mean climatology for typical winter (a) and summer (b) months. Eastward wind at Garchy (47°N).

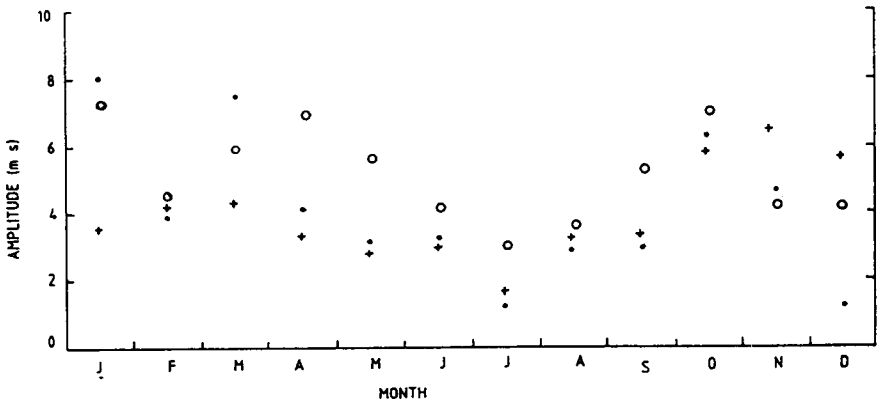

Figure 4a. Terdiurnal monthly mean climatology for all the months of the year and 94 km altitude: amplitude of the eastward wind at three different latitudes. • - Garchy (47°N), + - Montpazier (44°N), o - Saskatoon (52°N).

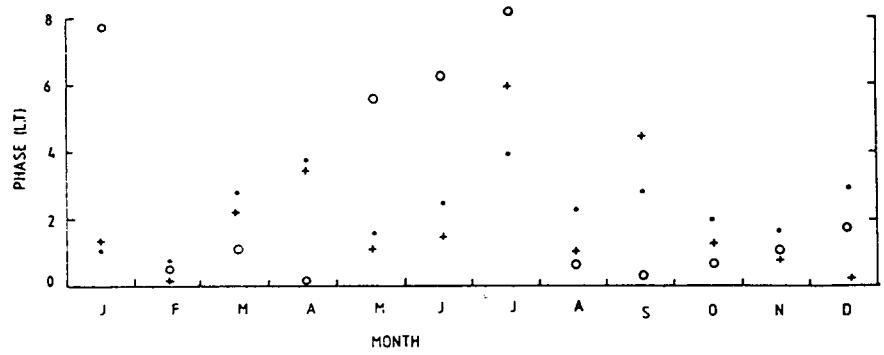

Figure 4b. The same as Figure 4a but for the phase. • - Garchy (47°N), + - Montpazier (44°N), o - Saskatoon (52°N).

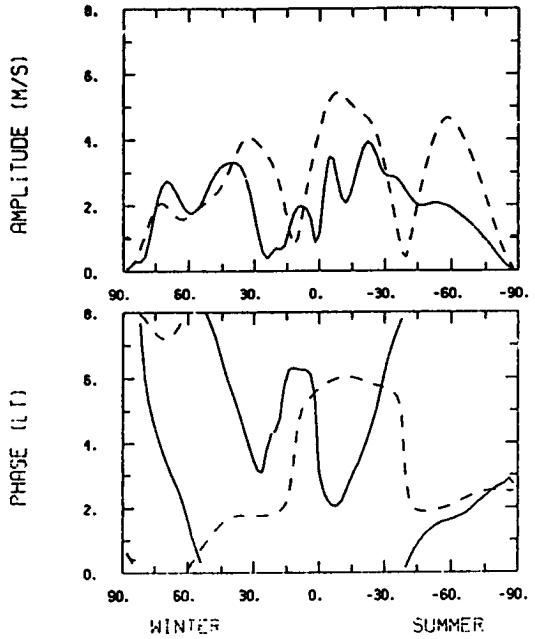

Figure 5. Latitudinal variation of the terdiurnal tide (eastward wind), for solstice conditions at 95 km altitude. The theoretical solar-driven and nonlinear waves are shown. The nonlinear wave is a secondary wave generated by the nonlinear interaction of the diurnal and semidiurnal tides. - - - - solar-driven wave, —— - nonlinear wave.

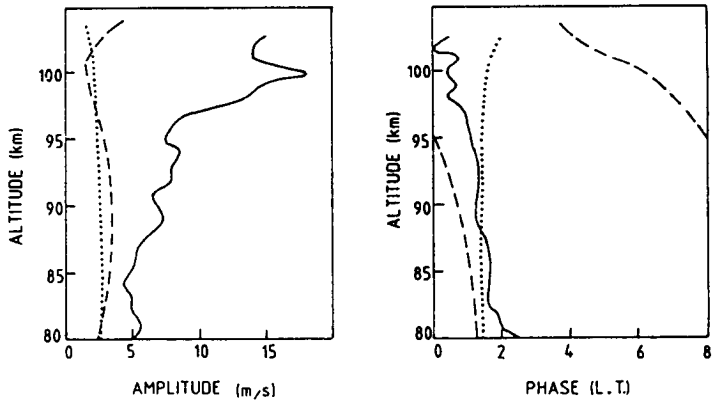

Figure 6. Eastward wind profile corresponding to the terdiurnal tide at 47° latitude in winter. Comparison of the data with the calculated solar-driven wave and with the superposition of the solar-driven and the nonlinear waves. —— - data, ... - solar-driven, - - - - solar-driven plus nonlinear.

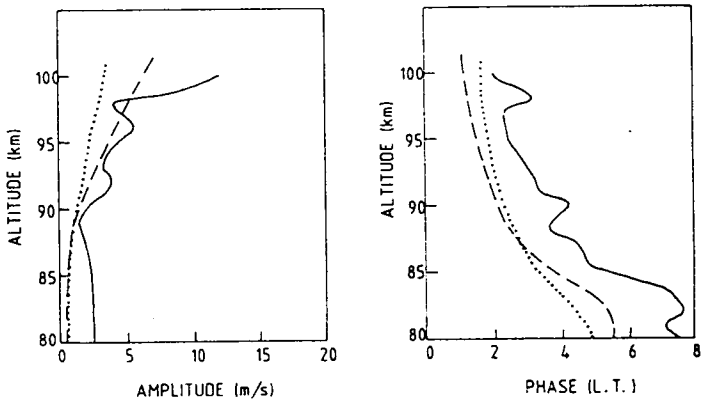

Figure 7. The same as in Figure 6 but in summer.

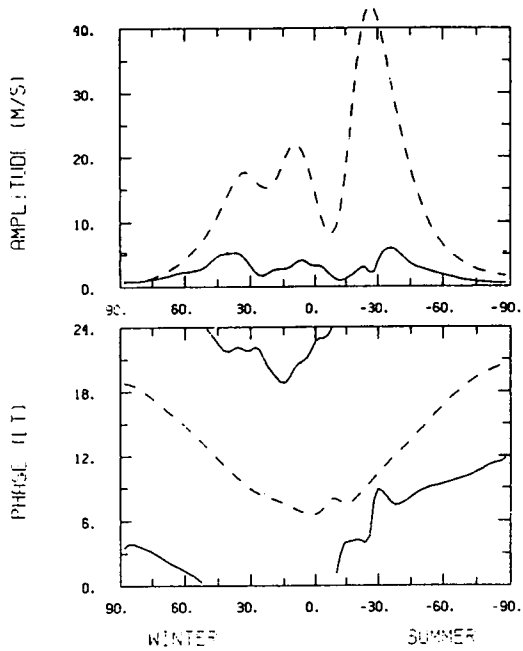

Figure 8. Latitudinal variation of the amplitude and phase of the diurnal nonlinear secondary wave for solstice conditions at 95 km altitude. The solar-driven diurnal tide is also shown. —— - nonlinear secondary diurnal tide, - - - - solar-driven diurnal tide.