



The wind regime of the mesosphere and lower thermosphere during the DYANA campaign—I. Prevailing winds

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Abstract—During the DYANA campaign, winds and tides at mesospheric and lower thermospheric altitudes were measured by 14 ground based experiments (MF radars, meteor radars and LF-drift systems). The experiments were located between 107°W and 102°E, mostly in northern mid-latitudes with well covered areas in Central and Eastern Europe. Emphasis is placed here upon the vertical profiles and height-time contours of the prevailing zonal and meridional winds with different resolution (15 d, 4 d). Generally, westerly winds are observed at heights below 95 km with a strong mesospheric variability and with longitudinal differences between the data of Central Europe, Eastern Europe, Asia and Canada. Planetary waves and a minor stratospheric warming in the first 10 days of February 1990 are the cause of this behaviour. In connection with the stratospheric warming, a wind reversal to summer east winds reaching from the upper stratosphere up to 95 km is observed. The close connection of the behaviour of the stratosphere with the observed longitudinal differences in the mesospheric response on the stratospheric warming and with the occurrence of wind oscillations (10–15 d) is discussed.

1. INTRODUCTION

During the DYANA campaign in the time period from 10 January 1990 through 16 March 1990, a large number of coordinated ground based, balloon and rocket measurements was carried out to study northern winter dynamics in the middle atmosphere up to heights of 100 km. The station network was extended to a large part of the northern hemisphere; most stations are in Europe, however. Continuous observations of the mesospheric and lower thermospheric wind field were carried out using 13 types of equipment (MF- and meteor-radars, LF drift systems) among which, seven systems allow the derivation of vertical profiles in the height range 60–105 km. These measurements, complemented by rocket data, allow the investigation of the wind variability on time scales from days to weeks, including their horizontal structure, as well as the investigation of strato-mesospheric coupling phenomena in connection with a minor

stratospheric warming in February 1990 and enhanced planetary wave activity in the stratosphere.

2. EXPERIMENTAL SET UP AND DATA ANALYSIS

The ground based measurements of winds in the mesosphere and lower thermosphere were carried out at 14 stations in a latitudinal belt between 70°N and 38°N at longitudes from 107°W through 102°E, with most of the experiments being located around 50°N between 2°E and 44°E. The experiments involve MF radar (3), meteor radar (9) and LF drift (2) facilities; besides the MF radars, one of the LF drift systems (Collm) and three meteor radars (Kazan, Bologna, Durham) use height ranging techniques. As the analysis of radar scatter from LF, MF and meteor systems to provide winds is well known (see e.g. MANSON *et al.*, 1990, 1991; SCHMINDER and KUERSCHNER, 1990; HOFFMANN *et al.*, 1990; CEVOLANI, 1989), only a brief