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Gravity-wave activity and its relation with prevailing winds during DYANA

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Abstract—The DYANA campaign in early 1990 gave a unique opportunity to study the gravity wave (GW) activity in the middle atmosphere in relation to the general circulation. Several instruments, including Rayleigh lidars, MF and meteor radars, OH and O_2 spectrometers and radio-wave absorption receivers provided data at various locations in Europe and Canada to study the GW activity during the campaign. These sets of data indicate that the GW activity is in general enhanced during periods of strong westerly prevailing winds or high planetary-wave activity in the middle atmosphere. When two sets of data are compared, they show a rather fast decorrelation as a function of altitude difference or horizontal distance. This study confirms that the level of GW activity in the middle atmosphere is very sensitive to filtering by the mean wind, but does not exclude its sensitivity to the sources of GW.

1. INTRODUCTION

The international campaign DYANA (*DY*namics *A*dapted *N*etwork for the *A*tmosphere), organised at the beginning of 1990 in various places on the globe, provided a unique opportunity to perform correlative studies of the dynamics of the middle atmosphere. One of the major scientific objectives of DYANA (OFFERMANN, 1994) was the study of the gravity wave (GW) activity and its relation with prevailing winds.

Several techniques of measurements at various locations have been used to follow GW activity during DYANA. These include Rayleigh lidar at Biscarrosse (44°N, 1°W), MF radar at Saskatoon (52°N, 107°W) and Juliusruh (55°N, 13°E), radio-wave absorption in Central Europe (50°N, 16°E), meteor radar at Kazan (56°N, 49°E), EISCAT radar at Tromsö (70°N, 19°E) and OH and O_2 spectrometers at Biscarrosse, El Arenosillo (37°N, 7°W) and Andoya (69°N, 16°E).

In Section 2 we briefly describe the measurements and present the results. In Section 3 we discuss the coherence between the various set of data and their relation with prevailing winds in the middle atmosphere.

2. EXPERIMENTAL TECHNIQUES AND RESULTS

Data compared in this study come from a wide range of techniques, locations and altitude ranges. In order to facilitate the comparison, each set of data will be presented in the same way and smoothed using the same filter. Due to the heterogeneity of these data, it is quite impossible to compare quantitatively the various sets of data. The measured parameters are different (temperature, horizontal wind, vertical wind, radio-wave absorption) and each technique smoothes the data in a different way, spatially and temporally. We concentrate in this paper on the temporal evolution of the GW energy during the campaign and its relation with the prevailing wind in the middle atmosphere. The latter is dominated in winter by the propagation of planetary waves with periods ranging from 10 days to one or two months (HAUCHECORNE *et al.*, 1987). It is then meaningful to filter the temporal