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N93-26480

STATUS OF THE OLYMPUS EXPERIMENT AT CRC

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ABSTRACT--The status of the Olympus Propagation Experiment of the Communications Research Centre in Ottawa, Canada, is briefly summarized.

1. INTRODUCTION

Path attenuation measurements at multiple frequencies correlated with concurrent dual-polarized radar data provide a unique method to investigate propagation effects. An experiment of this type is being implemented by the Communications Research Centre (CRC) on the grounds of the National Research Council of Canada in Ottawa. Beacon receivers monitor signals from the Olympus satellite at 12.5, 19.77, and 29.66 GHz at a path elevation angle of 14.2°. Sky noise radiometers operating near the same frequencies and pointed along the same path provide additional propagation information. A colocated dual-polarized 9.6-GHz radar probes the precipitation state on the path, permitting identification of precipitation regimes that cause the observed impairments.

The Olympus experiment configuration is displayed pictorially in Figure 1. Information on path propagation phenomena can be deduced by correlating the radar, beacon and sky noise data. Melting layer effects and propagation losses for higher time percentages are prime interests. Data collected by Diversitel Communications during equipment verification tests are presented below.

2. STATUS

Radiometric sky noise measurements at 12.0, 19.97, and 29.46 GHz (antenna diameters of 1.2 m, 0.61 m, and 0.46 m, respectively) were initiated in early February 1992. Attenuations for the first fade event, recorded on 16 February 1992, are plotted in Figure 2. Beacon measurements at 12.5 and 29.66 GHz (respective antenna diameters of 3.0 m and 2.4 m) were initiated in mid-March 1992. The 20-GHz receiver (2.4-m antenna diameter) is not yet available. The X-band radar, now in the calibration and commissioning phase, should be operational in the near future.

To illustrate the novel beacon measurement technique, a portion of an event recorded by the 30-GHz receiver on 7 April 1992 is shown in Figure 3. The two upper traces represent the components of the beacon copolar signal as detected by the receiver by rotating the antenna feed 45° from the incident linear polarization. This method provides a strong differential phase component (lower trace), even under clear-sky conditions. Differential attenuation (upper trace) and phase (lower trace) measured with the 12-GHz beacon receiver during a very-heavy wet snow event of 11 April 1992 are displayed in Figure 4. It is possible that some of the observed effects were caused by snow accumulating on the dish. The XPD derived from these data reached values as low as -10 dB. As evident from the figure, differential phase effects caused the depolarization.

3. CURRENT PROGNOSIS

ESA recently announced that North-South stationkeeping for Olympus has ceased, and it is planned to deorbit the spacecraft in about 12 months. Inclination is expected to increase by about 0.8° in that time. Errors in the beacon data caused by such large diurnal motions will be difficult to correct. CRC hopes to make complete measurements during the current rainy season, and continue data collection thereafter with the radiometers and radar to obtain meaningful attenuation statistics for small-margin applications.

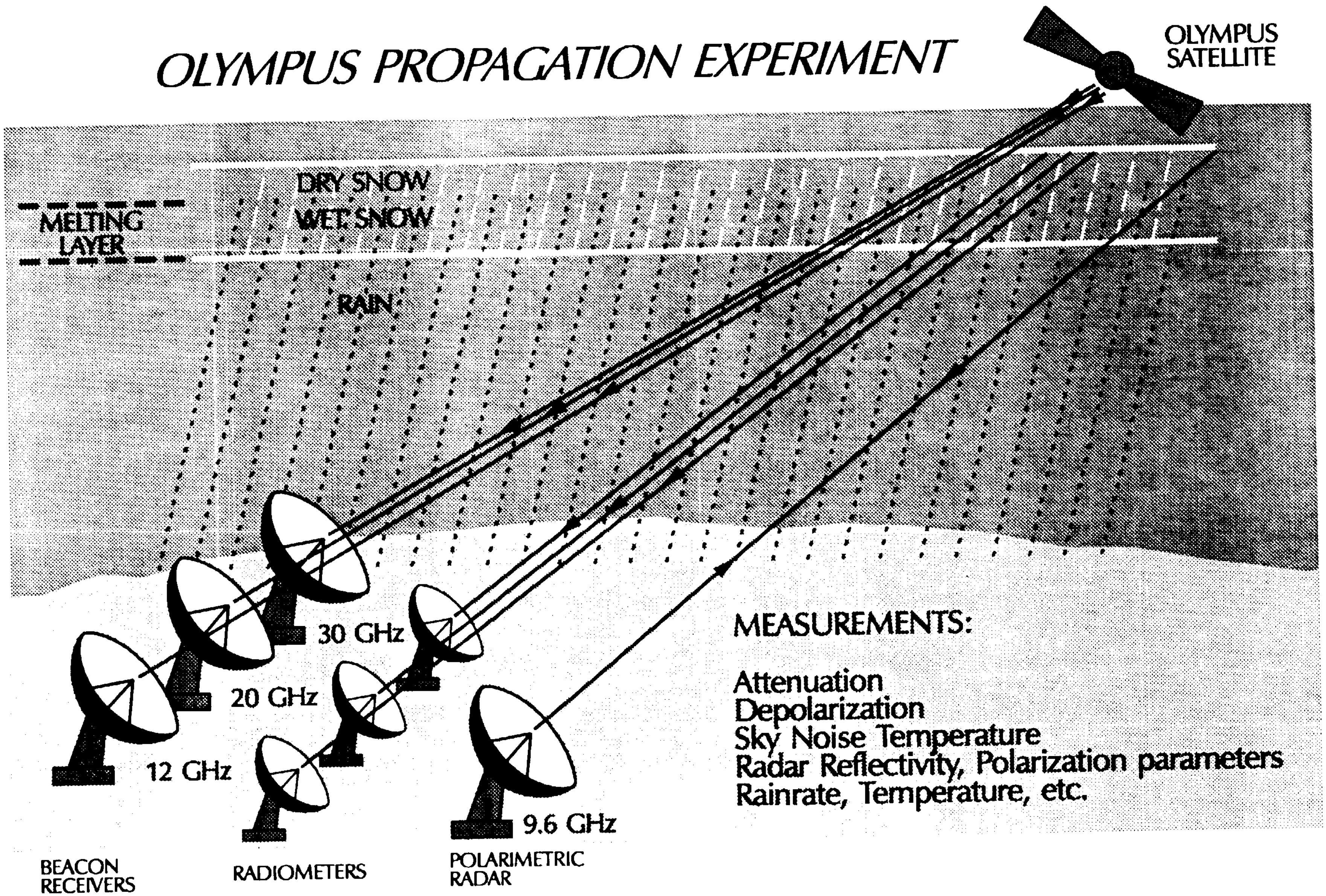

Figure 1. Configuration of CRC's Olympus Experiment at Ottawa.

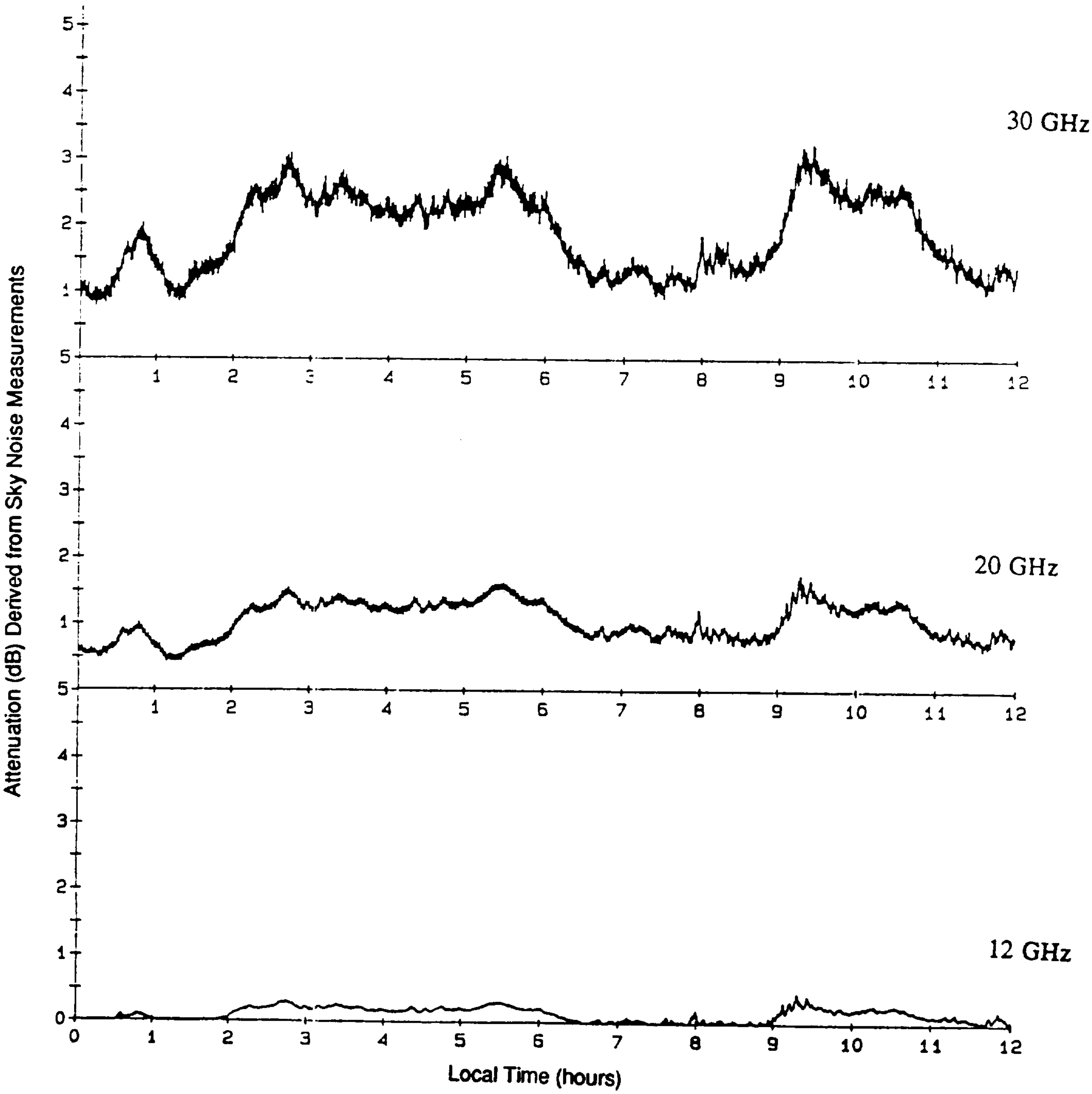

Figure 2. Radiometrically-Measured Path Attenuations for Event of 16 February 1992.

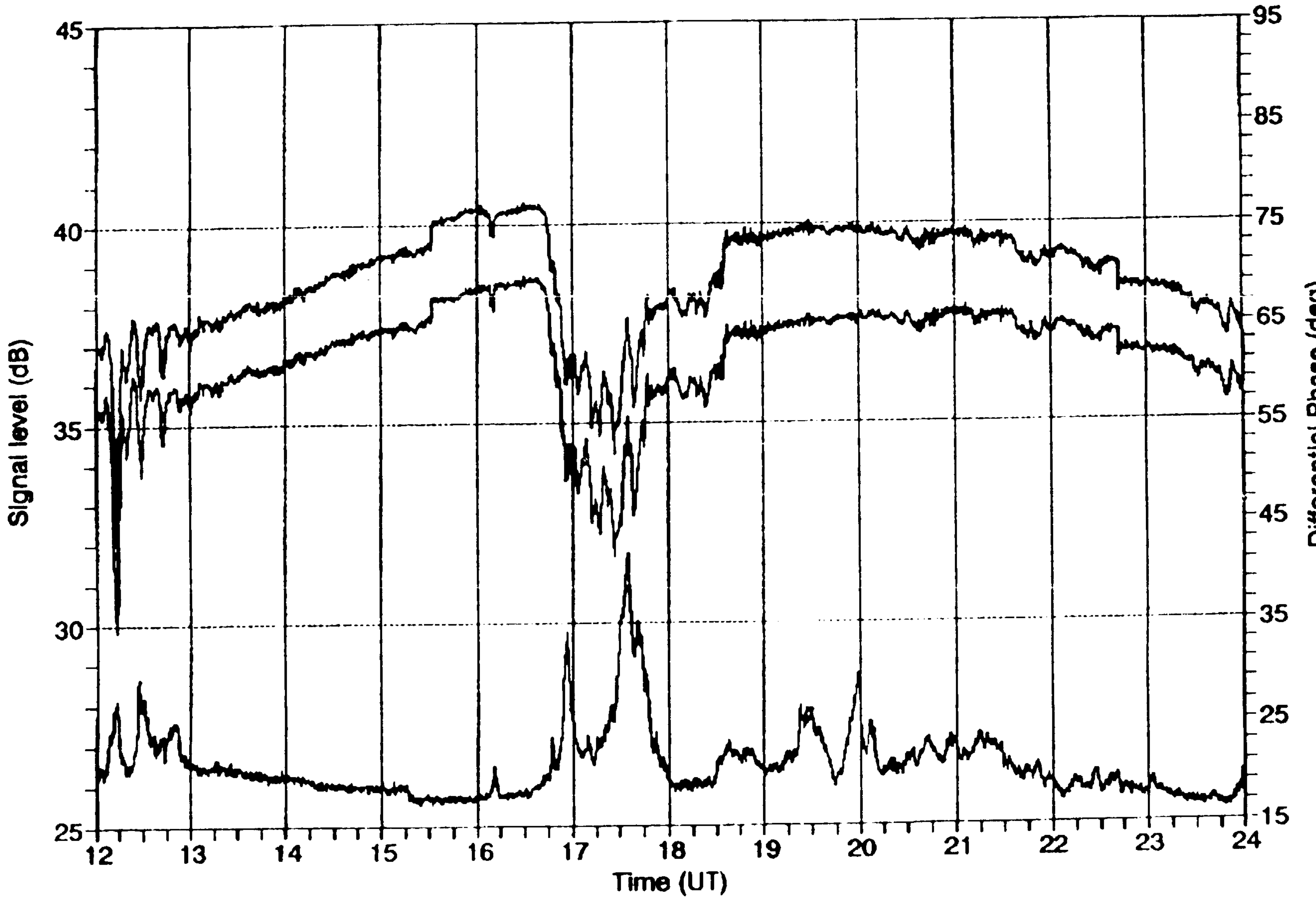

Figure 3. Two 30-GHz Copolar Component Signal Levels (upper traces) and Corresponding Differential Phase (lower trace) Measured on 7 April 1992 with Antenna Feed Oriented at 45° to Polarization Plane of Incident Wave.

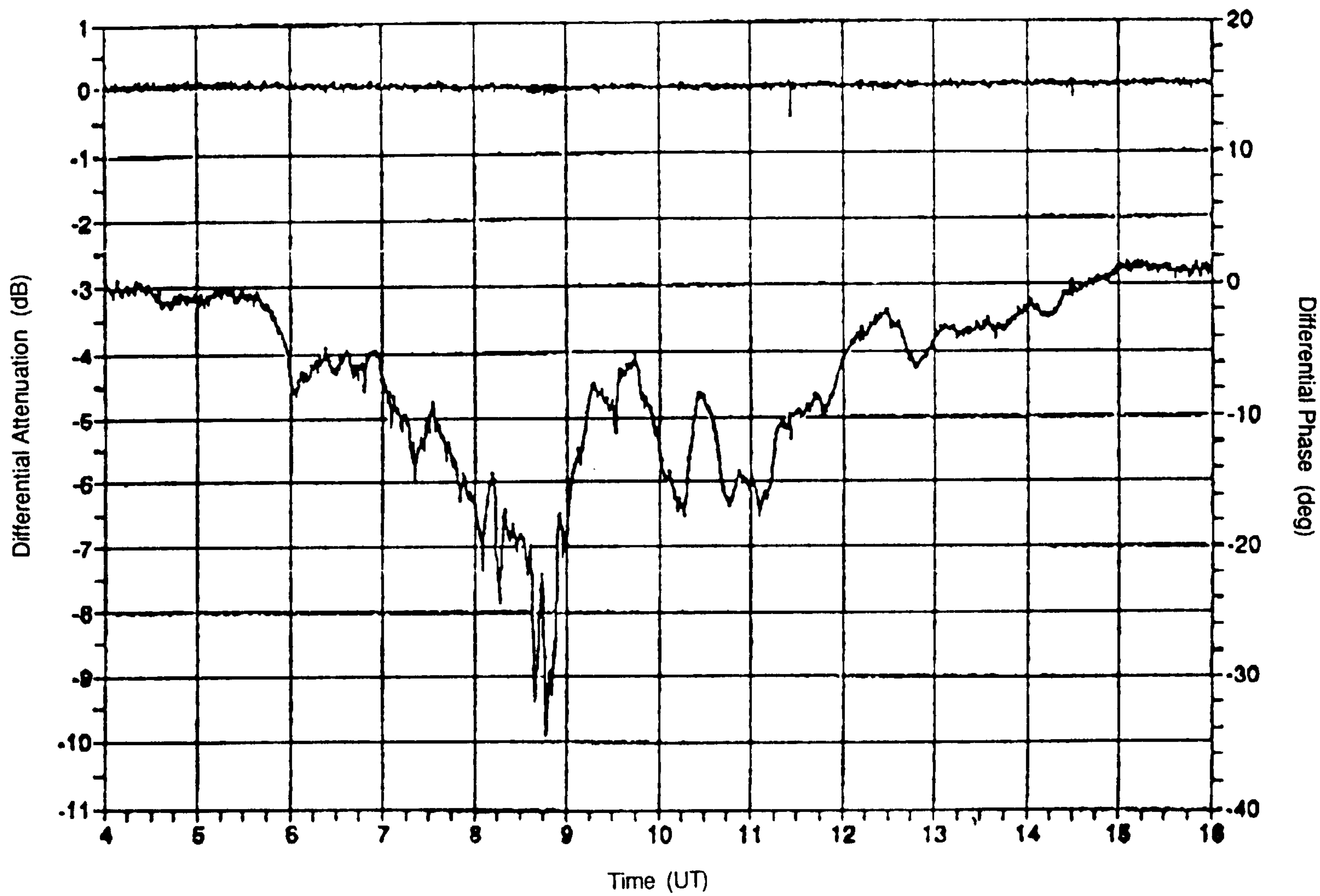

Figure 4. Differential Attenuation (upper trace) and Differential Phase (lower trace) Observed with 12.5-GHz Beacon Receiver During Heavy Wet Snowfall of 11 April 1992.