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Experimental investigation of high-altitude propagation of low frequency radio transmissions

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This paper presents an analysis of the low frequency radio emissions, recorded as additional background data during a corona-investigating high-altitude experiment employing a stratospheric flight train. The analyzed recording covers the altitudes between 4875 m and 20326 m, showing the existence and variations of the longwave signals of 139 kHz (DCF39 impulse-packaged FSK teleswitch, transmitter Burg) and 147.3 kHz (DDH 47, Deutscher Wetterdienst, RTTY, transmitter Pinneberg) within the chosen receiver bandwidth (AM-A3E, with the electric field strength sensitivity in the order of single μV/m). The signal data have been approximated by parts (as presented in Fig. 1) and finally by two sets of continuous functions (for the total and envelope values), used to extrapolate the signal's behavior on higher altitudes, ranging to the middle of the Earth's stratosphere. The analysis showed that the change of the signals' strength is mainly related to the increasing spatial distance to the transmitting antennas, with less potential influence of the movement through antenna's radiation pattern. The experiment showed that the longwave transmissions are clearly received on altitudes greatly exceeding their ordinary service altitudes, which enables them to be used in high-altitude aviation, near-space and space science/applications.

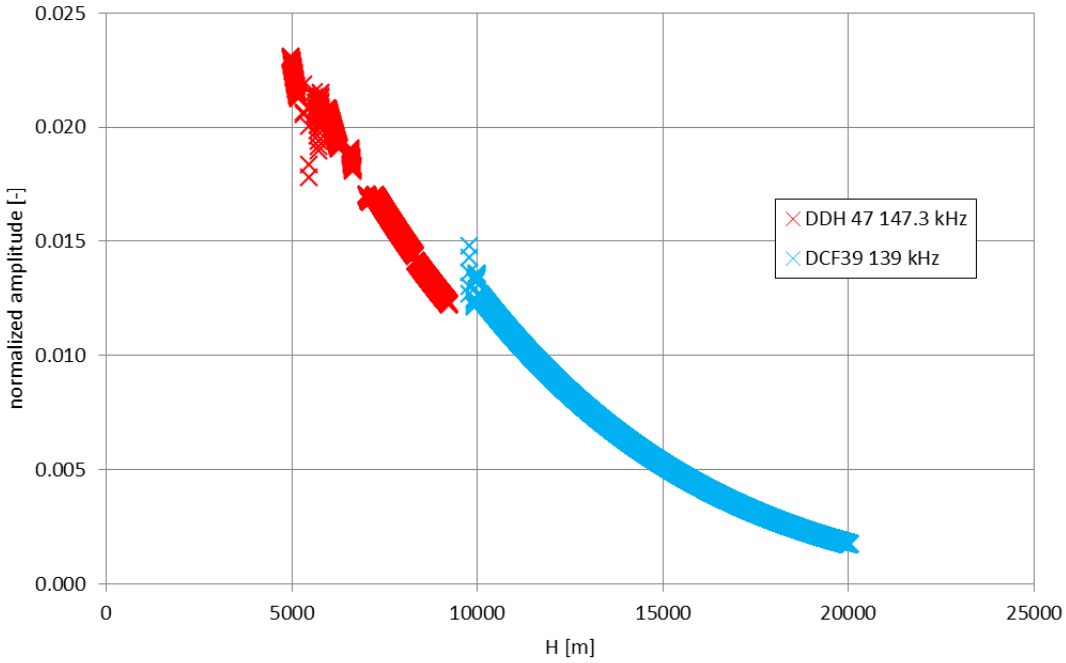

Figure 1. The recorded signal's normalized amplitude data, as approximated in parts for the ascending phase of the stratospheric flight train.