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2. DYNAMICS OF THE MIDDLE ATMOSPHERE IN WINTER (DYNAMICS)

2.1 INTERRELATION BETWEEN THE DIFFERENT VARIATIONS OF TURBULENT DIFFUSION AND IONOSPHERIC ABSORPTION ORIGINATING IN THE MIDDLE ATMOSPHERE

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The turbulent diffusion coefficient has been computed from the parameters of sporadic E layers using the wind shear theory of midlatitude sporadic E and models of the ionosphere as well as that of the neutral upper atmosphere. The turbulent diffusion coefficient obtained for the period of circulation disturbances associated with stratospheric warmings and for the intervals of the winter anomaly indicate changes similar to the ionospheric absorption of radio waves, in the former case decreased, in the latter case increased values. This may hit at the role of turbulent transport in the formation of these anomalies. On the basis of these findings, a seasonal variation of the turbulent diffusion coefficient having minimum in summer and an increase of this parameter with increasing geomagnetic activity are anticipated.

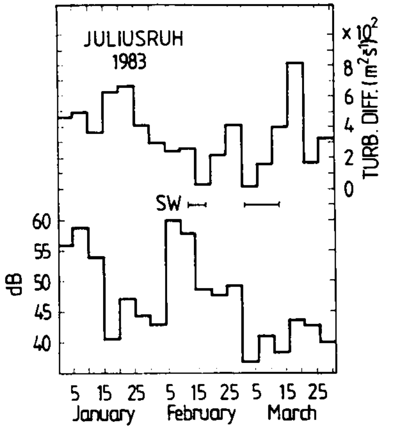

Figure 1. Daytime values of the turbulent diffusion coefficient determined by means of sporadic E parameters in the height range 100–135 km and noon values of the ionospheric absorption measured by the A1 method in Juliusruh (54°38'N; 13°23'E) in the first months of 1983. For the reduction of the scattering 5 day averages are shown. Both parameters indicate decreased values related to stratospheric warmings (SW). As the turbulent diffusion coefficient is proportional to the momentum deposition, the decrease of the turbulent diffusion coefficient might indicate reduced mean zonal momentum deposition in the mesosphere/lower thermosphere connected with stratospheric warmings (decrease of the eastward mean wind). (Another explanation can be the conditions that the turbulent diffusion coefficient indicates turbulence due to shear instability. Its decrease is connected with the increase of the vertical wavelength of gravity waves and these waves saturate at higher altitudes.)

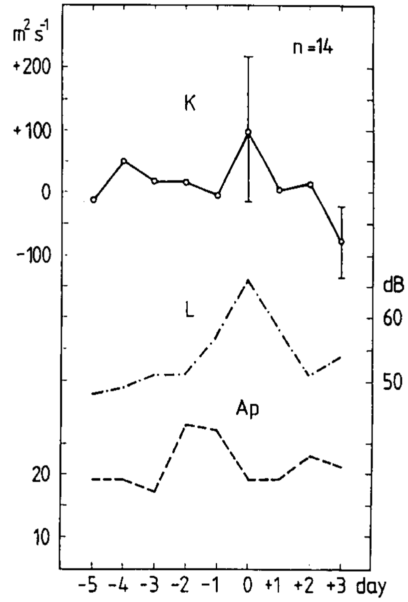

Figure 2. Departures of the daytime turbulent diffusion coefficient K, determined by means of sporadic E parameters, from the monthly hourly mean in the height range 100–115 km before and after days of excessive ionospheric absorption L, measured by the A1 at noon in Juliusruh (54°38'N; 13°23'E) in the winters 1980-81, 1981-82, and 1982-83, as well as the variation of the geomagnetic activity index Ap. Both K and L indicate increased values during these events. Considering that the turbulent diffusion coefficient is related to the momentum deposition in a simple way, the increase of the turbulent diffusion coefficient might be an indication of the increased mean zonal momentum deposition in the mesosphere/lower thermosphere related to winter anomaly events (increase of the eastward mean wind.)

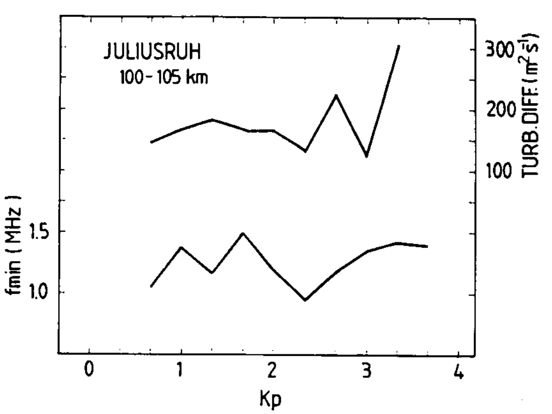

Figure 3. Daytime values of the turbulent diffusion coefficient determined by means of sporadic E parameters in the height range 100–105 km and the ionospheric absorption at noon characterized by f_{min} in Juliusruh (54°38'N; 13°23'E) as a function of the geomagnetic activity. Both parameters indicate increased values at small Kp values, which can be connected with the storm after-effect, and rising values toward increasing Kp. Considering the turbulent diffusion coefficient as an indicator of the momentum deposition, the increase of it might be due to the increased mean zonal momentum deposition in the mesosphere/lower thermosphere connected with the geomagnetic activity (increase of the westward mean wind in summer.)