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WINTER ANOMALY 1982/83 IN COMPARISON WITH EARLIER WINTERS (1960-82)

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The winter anomaly in the winter of 1982/83 is compared with the winter anomalies of earlier winters (1960-82) from the point of view of amplitude and timing of the winter anomaly, and geomagnetic and dynamic activity influences. Some evidence of a negative influence of sudden stratospheric warmings on the winter anomaly is given.

Ionospheric absorption of radio waves has been measured continuously since 1960 at the Panska Ves Observatory (Czechoslovakia) by the A3 method. The measurements have been performed on four A3 paths situated in Central Europe (see Table 1).

Figure 1 shows the year-to-year variability of the magnitude of the normal (background) winter anomaly (L_w/L_s - winter/summer ratio of absorption) over the period 1960-83. The L_w/L_s ratio is calculated as the ratio of the absorption in the month of maximum winter anomaly to the mean absorption for the summers (June, July) before and after the winter in question. The 1539 kHz data are computed from values measured at $\chi = 75°$, other data are mid-day (noon ± 2.5h) mean values derived from monthly half-hour median values of absorption reduced to the January solar zenith angle.

The winter anomaly phenomenon occurs every year (Figure 1), but its magnitude displays a pronounced year-to-year variability. The magnitude of the winter anomaly in the last winter (1982/83) appears to be very low and is expected to remain low even after the expected increase of L_w/L_s when including the forthcoming summer 1983 values.

Figure 2 shows the development of radio-wave absorption at 6090 kHz and 1539 kHz, measured at Panska Ves at $\chi = 75°$, and the development of geomagnetic activity in the winter of 1982/83. Unfortunately, the 6090 kHz data were less reliable during this winter due to technical problems. Geomagnetic activity was very high this winter, the highest being observed in February. The monthly medians of absorption (short bold horizontal lines in Figure 2) display a maximum in February as a response to the highest geomagnetic activity. The winter anomaly maximum in February is rather exceptional. It has only been observed in 3 winters of the 23 winters studied, always in relation to high magnetic activity. In spite of high magnetic activity, the main period of the stratospheric warming related reversal of the prevailing zonal wind observed in Central Europe (Collm Observatory - SCHMINDER, 1983) is reflected well in the 1539 kHz absorption in the form of a deep decrease of absorption, as expected.

Summarizing, it can be said that the winter 1982/83 is not suitable for studying a "pure meteorological" winter anomaly because of very high magnetic activity, but it supports my recent conclusion (e.g. LASTOVICKA, 1983) about the negative influence of stratospheric warmings and associated reversals in zonal winds in the upper mesopause region on radio-wave absorption.

There is further evidence of the negative influence of stratospheric warmings on absorption. In winters with major stratospheric warmings (Table 2), the winter anomaly maximum has been observed in a month other than the stratospheric warming maximum. There is only one significant exception -- the most untypical winter of 1979/80 -- when both maxima were observed in February due to

Table 1.

TRANSMITTER	f(MHz)	f_{eq}(MHz)	REFLECTION POINT ψ(N)	λ(E)	PERIOD OF RELIABLE WORK
Kiel	2.775	1.0	52°27'	12°27'	1960-1973
Norddeich	2.614	0.8	52°08'	11°00'	1960-1973
uxemburg	6.090	2.1	50°04'	10°18'	since 1971
eutschlandfunk	1.539	0.65	50°16'	11°47'	since 1978

Table 2. Winter anomaly maxima in winters with major stratospheric warmings. Dates of stratwarm maxima after FINGER et al. (1979), LABITZKE et al. (1981) and LABITZKE (1981). x - specific distribution of magnetic and stratospheric activity.

WINTER	STRATWARM MAXIMUM	2775 kHz MAXIMUM	2614 kHz MAXIMUM	6090 kHz MAXIMUM	1539 kHz MAXIMUM
62/63	27 Jan	Dec	Dec	-	-
65/66	31 Jan	Dec	Dec	-	-
67/68	1 Jan	Dec	Dec-Jan	-	-
69/70	2 Jan	Dec	Jan	-	-
70/71	7 Jan	Dec	Dec	-	-
72/73	6 Feb	Jan	Dec	Jan	-
73/74	3 Mar	-	-	Jan-Dec	-
74/75	2 Mar	-	-	Jan	-
76/77	4 Jan	-	-	Dec	-
78/79	25 Feb	-	-	Jan	Jan-Dec
79/80	29 Feb	-	-	Feb^{x}	Feb^{x}
80/81	6 Feb	-	-	Jan	Jan

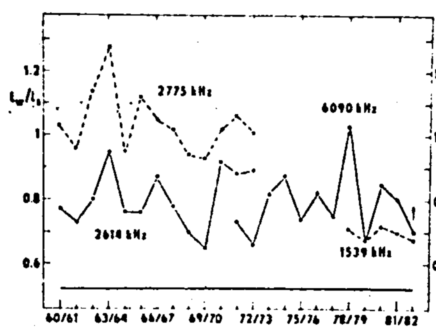

Figure 1. Long-term variability of the magnitude of winter anomaly, 1960-83. L_w/L_s, winter/summer ratio of absorption, reduced to the same level of the "no-anomaly" absorption ratio (horizontal line at the bottom). Vertical arrow, the 1982/83 value is expected to increase a ltle after including the summer 1983 values.

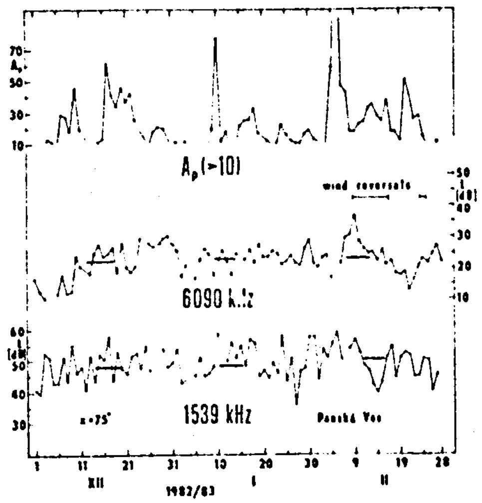

Figure 2. Development of radio-wave absorption at $\chi = 75^\circ$ and of geomagnetic activity (only $A_p > 10$ is shown) in the winter of 1982/83. The periods of stratwarm-associated reversals of the prevailing zonal wind in the upper mesopause region (observations at Collm - SCHMINDER, 1983) are shown, too.

specific distribution of geomagnetic activity and minor stratwarms during this winter. The "mutual incompatibility" of the winter anomaly and major stratospheric warming maxima is still more important for winters with the major stratwarm maximum in January. The winter anomaly maximum in winters without a major stratwarm (10 winters) has been observed in January, while in winters with the major stratwarm maximum in January, the winter anomaly maximum has been observed in December (Table 2). Consequently, the occurrence of a major stratospheric warming appears to be followed by a decrease, not an increase, of absorption (i.e. of winter anomaly). This agrees with LASTOVICKA and TRISKA (1982) and LASTOVICKA (1983).

In conclusion it can be said that major stratospheric warmings and related changes in the prevailing zonal wind in the upper mesopause region decrease the magnitude of radio wave absorption and winter anomaly. The winter of 1982/83 supports this conclusion, even if this winter is not suitable for studying a "pure meteorological" winter anomaly due to the very high geomagnetic activity in this winter.

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