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7.6 LARGE-SCALE DYNAMICS OF THE STRATOSPHERE AND MESOSPHERE DURING THE MAP/WINE CAMPAIGN WINTER 1983/84 IN COMPARISON WITH OTHER WINTERS

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For the MAP/WINE winter temperature and wind measurements of rockets were combined with SSU radiances (Stratospheric Sounder Unit onboard the NOAA satellites) and stratopause heights from the Solar Mesosphere Explorer (SME) to get a retrieved data set including all available information. By means of this data set a hemispheric geopotential height, temperature and geostrophic wind fields eddy transports for wave mean flow interaction and potential vorticity for the interpretation of nonlinear wave breaking could be computed. Wave reflection at critical lines was investigated with respect to stratospheric warmings. The meridional gradient of the potential vorticity and focusing of wave activity is compared with derived data from satellite observations during other winters.

Dynamical Features Shown by the MAP/WINE Data Set Important for Future Studies

- Are the often observed strong minor warmings in the mesosphere the start of sinking motion for photochemically relevant species?

- Is the folded stratopause observed during minor warmings in the stratosphere a mixing layer for potential vorticity and tracers?

- Is the destruction of the mesospheric jet a necessary condition for a major warming in the middle stratosphere, when the downward transported polar minor species will be mixed horizontally into lower latitudes?

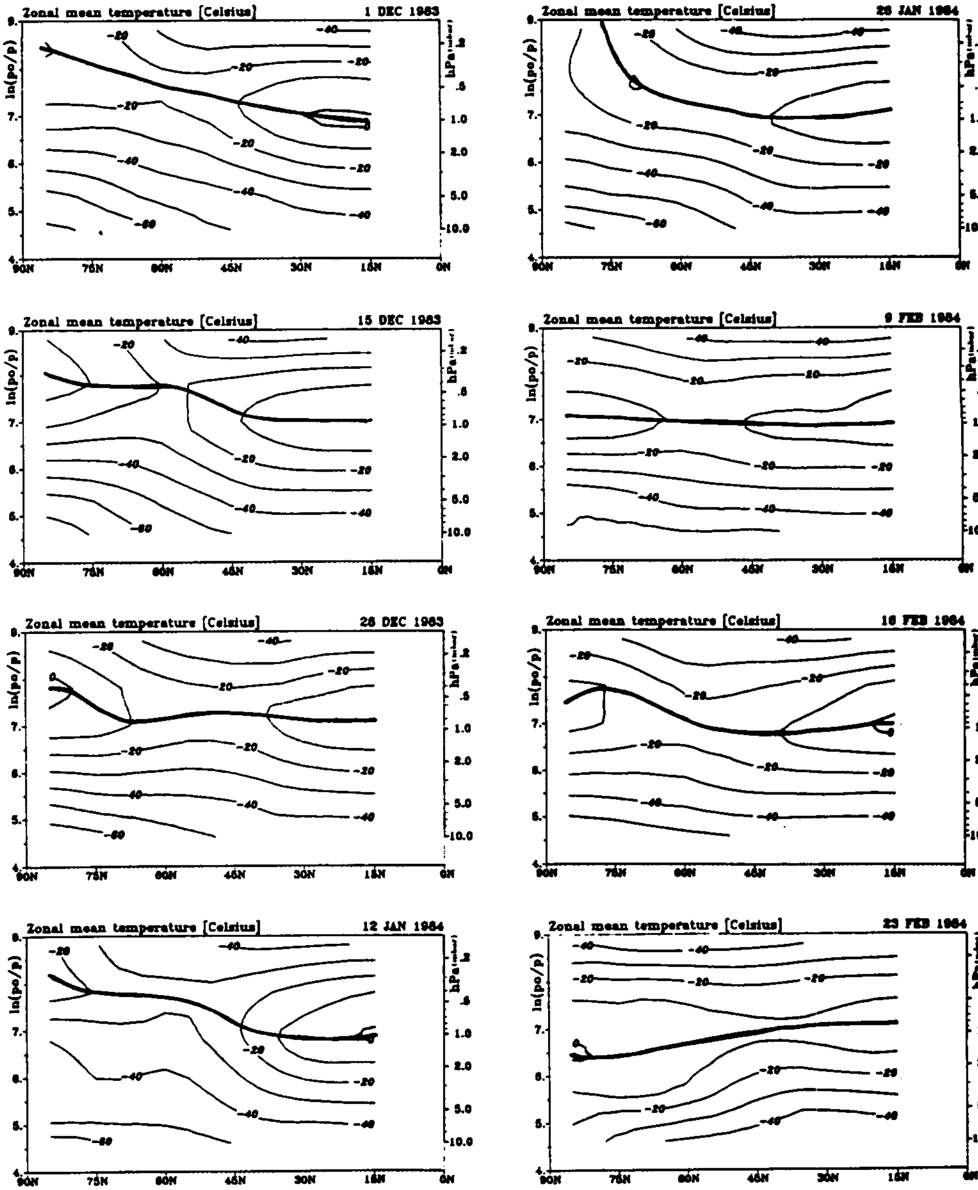
Zonal mean temperature [Celsius] 1 DEC 1983
Zonal mean temperature [Celsius] 28 JAN 1984
Zonal mean temperature [Celsius] 15 DEC 1983
Zonal mean temperature [Celsius] 9 FEB 1984
Zonal mean temperature [Celsius] 28 DEC 1983
Zonal mean temperature [Celsius] 16 FEB 1984
Zonal mean temperature [Celsius] 12 JAN 1984
Zonal mean temperature [Celsius] 23 FEB 1984
ln(po/p)
hPa
90N
75N
60N
45N
30N
15N
0N

Figure 1.

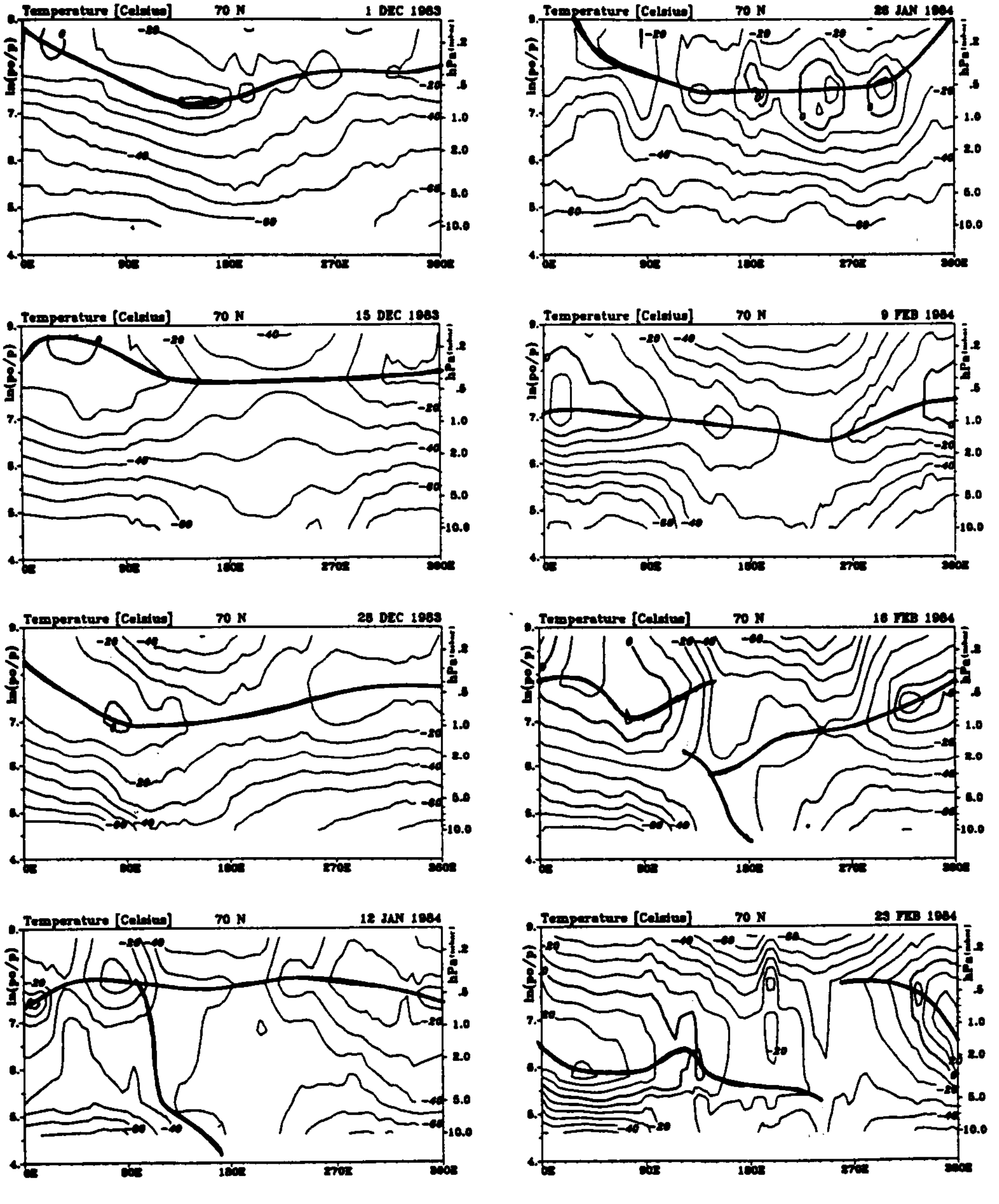
Temperature [Celsius] 70 N 1 DEC 1983
Temperature [Celsius] 70 N 28 JAN 1984
Temperature [Celsius] 70 N 15 DEC 1983
Temperature [Celsius] 70 N 9 FEB 1984
Temperature [Celsius] 70 N 28 DEC 1983
Temperature [Celsius] 70 N 16 FEB 1984
Temperature [Celsius] 70 N 12 JAN 1984
Temperature [Celsius] 70 N 23 FEB 1984
ln(po/p)
hPa
0E
90E
180E
270E
360E

Figure 2.

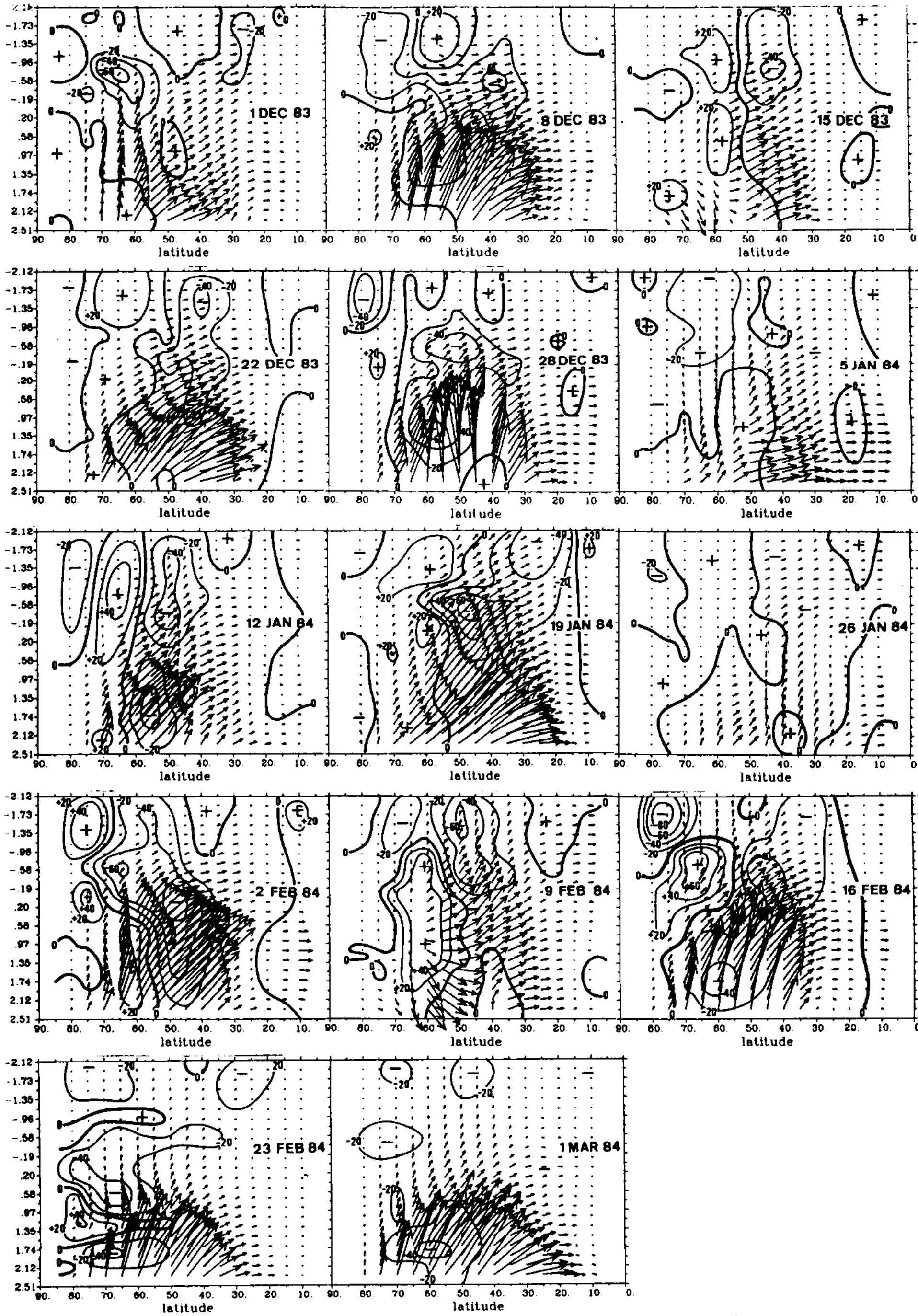

Figure 3. Eliassen-Palm-vector and its divergence (ms^{-1}/day).

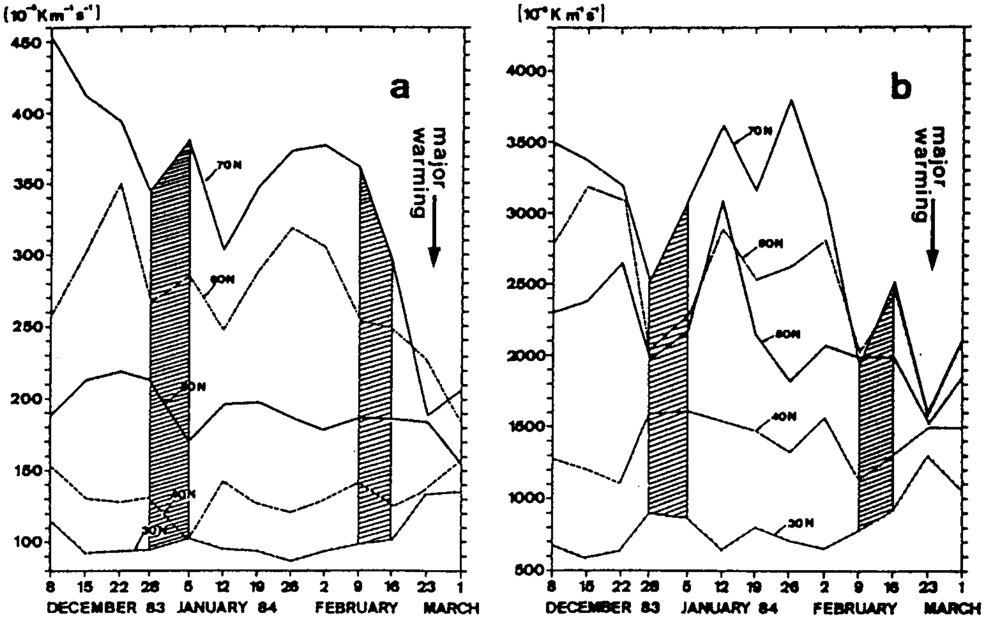

Figure 4. Zonal mean of Ertel's potential vorticity for winter 1983/84 from 30°N to 70°N. (a) at 1200 K isentropic level ~ 39 km. (b) at 220 K isentropic level ~ 54 km (minor warmings are shown as hatched areas).

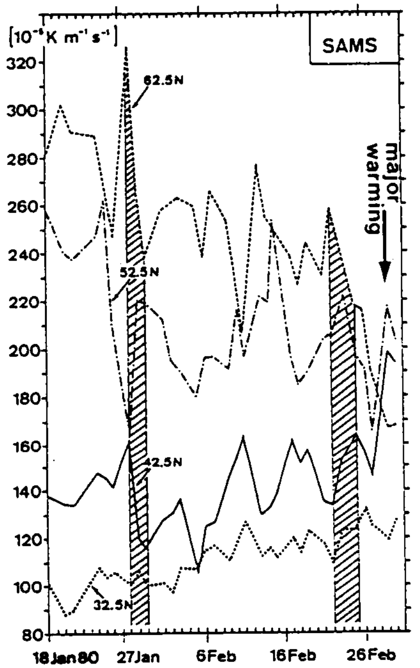

Figure 5. Zonal mean of Ertel's potential vorticity for winter 1979/80 from 32.5°N to 62.5°N at 1200 K isentropic level ~ 39 km (minor warmings are shown as hatched areas).

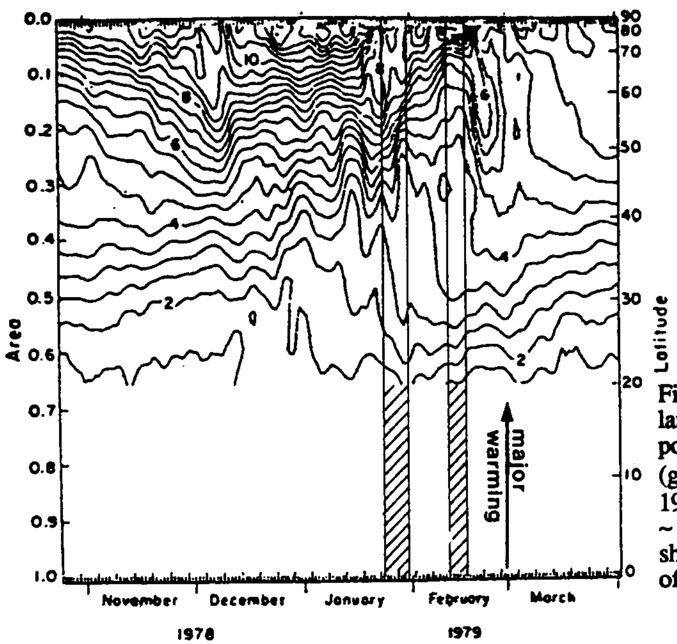

Figure 6. From Butchert et al. [1986] latitude-time sections of zonal mean potential vorticity contours ($gH_0p_0^{-1}10^{-4}$K m^{-1}s^{-1}) for winter 1978/79 at 850 K isentropic level ~ 29 km (minor warmings are shown as hatched areas) by author of this paper.