

## ***Interactive comment on “Enhancements of gravity wave amplitudes at midlatitudes during sudden stratospheric warmings in 2008” by T. Flury et al.***

**Anonymous Referee #3**

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The paper presents an analysis of gravity waves in radiosondes launched from Payerne, a station in Switzerland - hence in a region of strong topography. The main point is that enhanced gravity waves are found during some of the sudden stratospheric warmings (SSW) of the period studied. The study has a potential to be of interest, yet a number of issues are inappropriately discussed or left open, and there are significant confusions in the analysis, in particular concerning the frequencies of the gravity waves studied. The paper can not be accepted for publication unless a very major revision of the analysis and discussion is carried out.

Major points: 1- one of the major problems in the analysis comes from the confusion regarding the frequencies of the gravity waves. The authors choose to analyze the radiosoundings as time series. Hence, a fluctuation occurring over, say 3,25km is as-

C13269

sociated with a period of  $3250/6,5 = 500$ s. It is not relevant to compare this period with the Brunt Vaisala period, because the radiosonde is not advected as a Lagrangian tracer. For waves that are stationary to the ground (mountain waves, in a first approximation), and for waves that are low-frequency (inertia-gravity waves generated by jets and fronts for example), the wave signal will not change very much over the time taken for the balloons to go through one wave period, and hence this time is, to leading order, the vertical wavelength divided by the ascent rate. Yet the authors repeatedly compare their periods with the Brunt Vaisala period (e.g. p6, line -9; caption of Figure 7).

This confusion is already present in the title, which is unjustified in emphasizing 'short period gravity waves'.

2- the second major problem with the analysis is that the authors do not discuss or interpret sufficiently well their findings: they have a limited number of cases ('about 109 profiles' (why 'about?'), p4, par 2, line 2); two minor SSW, one major SSW: enhancement of GW only during the minor SSWs, why?), and find some enhancement in GWs when the vortex edge comes over Switzerland. Is the enhancement due to the fact a- that the radiosondes sample a different region of the flow (the vortex edge) relative to the region they usually sample, b- that there is enhanced generation of GWs during a SSW? With only the radiosondes (i.e. sampling at one location), they do not have the means to conclude on this issue. But it needs to be more explicitly spelled out, and there is possibility to address it at least partially (for a certain part of the GW spectrum) using satellite measurements (which are mentioned, but used in only a very limited manner).

Minor points

p4. end of par 2: after keeping only radiosoundings with data from 13 to 32 km, how many profiles are left?

p4-5. the temperature profiles only are analyzed. Yet it is mentioned on page 4 that the sonde carries a GPS receiver, precise enough to determine altitude. Hence an

C13270

estimation of the winds are available. Why is this not used in the analysis?

p4-5. The issue of using the measurements of radiosondes as time series or approximate them as vertical profiles has been discussed by

Guest, F. M., M. J. Reeder, C. J. Marks, and D. J. Karoly, Inertia-gravity waves observed in the lower stratosphere over Macquarie Island, *J. Atmos. Sci.*, 57, 737-752, 2000.

The radiosoundings used there were analyzed more fully than the present ones.

p7. Equation (3) This is not Ertel's potential vorticity, which involves the scalar product of two vectors. This is only the leading order approximation valid for large-scale atmospheric flows with motions essentially parallel to isobaric surfaces.

p9, section 3.3 What is special about the altitude range 25-30km? Why should it be that there is a wave enhancement only in that altitude range?

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Interactive comment on *Atmos. Chem. Phys. Discuss.*, 10, 29971, 2010.