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Atmospheric Measurement Techniques Discussions

Interactive comment on "Modeling the ascent of sounding balloons: derivation of the vertical air motion" *by* A. Gallice et al.

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Radiosonde data are likely the most widely used meteorological data for both operational and research meteorology, but the main measured parameters used are horizontal winds, temperatures, and humidity, however data on the rise rate of the balloon is also available. Fluctuations in the rise rate can be used to derive information on gravity waves, but if one determines the mean rate of rise and subtracts that portion of the rise rate due to buoyancy, in principle the vertical velocity can be obtained. The purpose of this paper is to improve the methodology to derive vertical velocity from radiosonde rise rate data. One improvement over previous attempts at doing this are consideration of the temperature changes of the gas inside the balloon by its expansion and heat

exchange with the ambient air. Another improvement is to empirically derive the drag on the balloon from observed balloon rise rates rather than by using drag coefficients on idealized balloon shapes (e. g., a sphere) when in reality the balloon shape is both more complex and a payload is suspended from the balloon.

The authors do a very nice job at implementing these improvements, although one can argue that they don't consider the drag arising from the rise rate fluctuations as well as the mean rise rate. Also, likely there are turbulent layers arising through gravity wave breaking that imply fluctuations in the turbulence contributions to the drag.

The authors have a short section on derivation of gravity wave information from rise rate fluctuations, although this is not the principal topic of this paper. This includes some discussion on whether it is better to use temperature fluctuations to derive gravity wave vertical velocities rather than the rise rate fluctuations. There has been some recent work on this subject that sheds some light on this paper's discussion of this topic. In particular, Lane et al. (2003) used the fact that gravity wave vertical velocity fluctuations are more sensitive to higher frequency gravity waves than are the horizontal velocities and temperatures to investigate gravity waves launched from convection in the tropics. This was followed up by Geller and Gong (2010), who further investigated the differing response of radiosonde measured variables to different gravity wave frequencies, and by Gong and Geller (2010), who used the fact that radiosonde rise rate fluctuations respond more to the high frequency waves generated by active moist convection to derive information on convectively generated gravity waves in both the tropics and the extratropics. These later works help to resolve some of these issues introduced in the present paper's discussion on this general topic.

A motivation for this paper is to improve the modeled balloon rise rate for campaigns that use the "match technique" in which attempts are made to sample the same air parcels some at different times by balloon launches meant to sample the evolution with time of fixed air parcels (e. g., Rex et al., 1999). It will be interesting to see what improvements will result from the improvements in modeling radiosonde rise rates given in this paper by Gallice and colleagues.

References

Geller, M. A., and J. Gong (2010), Gravity wave kinetic, potential and vertical fluctuation energies as indicators of different frequency gravity waves, J. Geophys. Res., 115, D11111, doi:10.1029/2009JD012266.

Gong, J., and M. A. Geller (2010), Vertical fluctuation energy in United States high vertical resolution radiosonde data as an indicator of convective gravity wave sources, J. Geophys. Res., 115, D11110, doi:10.1029/2009JD012265.

Lane, T. P., M. J. Reeder, and F. M. Guest (2003), Convectively generated gravity waves observed from radiosonde data taken during MCTEX, Q. J. R. Meteorol. Soc., 129, 1731–1740, doi:10.1256/qj.02.196.

Rex, M., P. Von Der Gathen, G. Braathen, N. Harris, E. Reimer, A. Beck. R. Alfier, R. Krüger-Carstensen, M. Chipperfield, H. De Backer, D. Balis, F. O'Connor, H. Dier, D. Dorokhov, H. Fast, A. Gamma, M. Gil, E. Kyrö, Z. Litynska, I. S. Mikkelsen, M. Molyneux, G. Murphy, S. J. Reid, M. Rummukainen, and C. Zerefos (1999), Chemical ozone loss in the arctic winter 1994/95 as determined by the match technique, J. Atmos. Chem., 32, 35-59.

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