

Interactive comment on “Spatial structures in the heat budget of the Antarctic Atmospheric Boundary Layer” by W. J. van de Berg et al.

Anonymous Referee #1

Received and published: 19 September 2007

General comments

The authors of this paper use diagnostics from a high-resolution atmospheric model to study the spatial distribution of sources and sinks of heat in the atmospheric boundary layer over Antarctica. Their approach is rigorous and soundly-based. The results of this study help us to understand the spatial pattern of near-surface temperature and inversion strength across Antarctica and may also lead to an understanding of why surface temperatures in East and West Antarctica respond differently to changed atmospheric circulation (Thompson and Solomon, *Science*, 2002; Marshall, *Int. J. Climatol.*, 2007). I recommend publication of this paper in *The Cryosphere* once the authors have attended to the points listed below.

Specific comments

1.) The heat budget equation as presented (equation 1) applies to a single level in the atmosphere. However, what is often presented in the paper (e.g. in figure 6) appears to be the contributions to the temperature tendency averaged over the depth of the ABL. Since the ABL height is not constant, but varies spatially, additional terms involving the spatial derivatives of ABL height appear in the tendency equation. This is alluded to in the text but I think it would be clearer if the vertically-integrated form of the tendency equation were presented. 2.) The rescaling used for ABL depth (section 3.3) seems rather arbitrary and it is not clear what physically motivates this choice. If the focus of interest is the surface inversion layer, why not use the surface inversion depth?

Technical comments

1.) p273, l10-11: "The wind field in a steady-state ABL must be divergent". Not necessarily. Thermal balance could be achieved by horizontal advection.

2.) p274, l1: Something missing between "Fig. 2" and "presented"? "and"?

3.) p274, l17: "gas", not "gasses".

4.) p274, l23: "taken", not "token".

5.) p276, eqn. 1: Why is there no latent heat flux term?

6.) p282, l4: "...the free...".

7.) p282, l10: "indicates", or "implies", not "implicate".

Interactive comment on The Cryosphere Discuss., 1, 271, 2007.