Comments on "Similarity Theory for the Planetary Boundary Layer of Time-Dependent Height"

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Zilitinkevich and Deardorff (1974) are to be commended for resolving some of the controversial aspects of the similarity theory for the planetary boundary layer (PBL). Their proposed amendment of the traditional theory (Zilitinkevich *et al.*, 1967) is based on the observation that the PBL height in reality is determined by many factors not considered in the ideal theory, and that it may not bear any unique relation-

ship with the dynamic height scale u_*/f and the stability parameter μ. Therefore it is appropriate to consider h as an independent length scale (see also Deardorff, 1972). But it does not necessarily follow that u_*/f is irrelevant and should be dropped altogether from similarity considerations, as the authors have done. A more complete and proper dimensional analysis would give fh/u_* as an additional similarity parameter. Whether it is significant or not can only be established on the basis of more sophisticated theoretical models of the PBL or systematic and careful observations from different homogeneous sites.

Using a second-order closure model for the unstable PBL we have recently shown (see Wyngaard *et al.*, 1974; Arya and Wyngaard, 1975) that the surface cross-isobar angle and the related similarity functions (F_v and a defined by the authors, for example) are more sensitive to fh/u_* than to the stability parameter h/L. The parameter fh/u_* was kept essentially fixed in earlier models including Deardorff's (1972). In the real atmosphere it may easily vary over more than a decade at any location with strong diurnal variations in h and u_*. The observed increase in the mean α_0 toward the equator (see Brummer *et al.*, 1974) can easily be explained in terms of the decrease in the mean fh/u_* (Arya and Wyngaard, 1975). This parameter is likely to be more important in stably stratified conditions, and there is no compelling reason that it should have a constant value for the transitional neutral conditions.

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