THE COMBINED USE OF THREE DIFFERENT APPROACHES TO OBTAIN THE BEST ESTIMATE OF MESO-β SURFACE WINDS OVER COMPLEX TERRAIN

(*Research Note*)

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Abstract. Three approaches for estimating meso-β ($\Delta x = 5$–10 km) surface winds over complex terrain are applied to obtain best estimates of typical summertime surface flow in Israel, based on a detailed 3-D model, a one-level sigma model and a dense network of surface wind observations. A scheme for combining the three approaches is outlined and illustrated through two examples showing how the approaches complement each other. It is suggested that such a man-machine combination is best for estimation of surface winds over complex terrain.

1. Introduction

One of the major problems in boundary-layer meteorology is the diagnosis/nowcasting of mesoscale surface winds over highly complex terrain. Knowledge of the detailed surface mesoscale flow has become necessary for various applications like the dispersion of air pollutants, harnessing of wind energy, and locating wildland fires, as well as research of mesoscale circulations over complex terrain. This note will focus on the meso-β scale with a typical grid distance of 5 to 10 km. On even smaller scales, where a sufficiently dense network of observations is generally not available, non-hydrostatic models may become necessary, see, e.g., Gross (1987).

In general, attempts at diagnosing surface mesoscale wind fields can be grouped into three primary classes. One is by the use of all available surface observations to do some kind of objective or subjective analyses, e.g., Doron (1979) and Skibin and Hod (1978) in Israel. The existence of a dense network of surface stations is necessary in this case, and sometimes automatic remotely-connected stations are designed for particular purposes. This approach is in general very expensive and is very limited over highly complex terrain, where large terrain variability prevents most stations from being representative even of their relatively close surroundings. For a discussion, see Goodin *et al.* (1979).

A second approach applies detailed three-dimensional numerical models, which solve the full primitive equation set, given the initial and boundary

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