IDEALIZED BAROCLINIC WAVE SIMULATION WITH MM5 AND ITS APPLICATIONS

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MM5 has been increasingly popular among mesoscale research community. However, most of the past research with MM5 are case studies initialized the model with "real" observational / gridded-analysis data. Applications of MM5 in idealized studies have been relatively rare because there are no "standard" preprocessors to easily generate idealized initial/boundary conditions on a case-dependent basis. To our best knowledge, MM5 has never been used in studying idealized baroclinic waves in the literature. Here we proposed a relatively easy procedure to initialize MM5 with idealized 2-D unstable baroclinic jet; some of the preliminary results from the study of mesoscale predictability and gravity wave generation will be presented at the workshop.

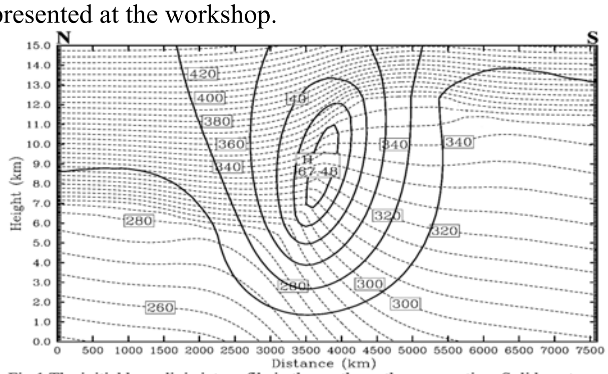

Fig.1 The initial baroclinic jet profile in the north-south cross section. Solid contours denote wind speed (D=10m/s) and dashed contours denote potential temperature (D=5K).

We first employ potential vorticity (PV) inversion technique (Davis and Emanuel 1991) to create a balanced 2-D baroclinic jet (Hoskins and West 1979) [Fig. 1, as used in Whitaker and Davis (1994)]. By modifying the existing program to initialize MM5 with single sounding as used by Rotunno and Ferretti (2001), we treat the 2-D fields from the aforementioned 2-D baroclinic jet as multiple soundings and then interpolate them onto 3-D mm5 grid. Fixed lateral boundary conditions have been applied in all directions. By making the model domain in the zonal direction sufficiently large and inserting a temperature perturbation close to the inflow boundary, we have successfully reproduced the life cycles of baroclinic waves (Fig. 2).

Because of the nesting capability and a wide range of physics options in the model, the idealized baroclinic wave simulation with MM5 has the advantage of studying various processes such as gravity wave generation by baroclinic jet (Zhang et al. 2001a) and the influence of moisture on the predictability of large scales (Zhang et al. 2001b,c), as will be presented at the workshop.

Reference

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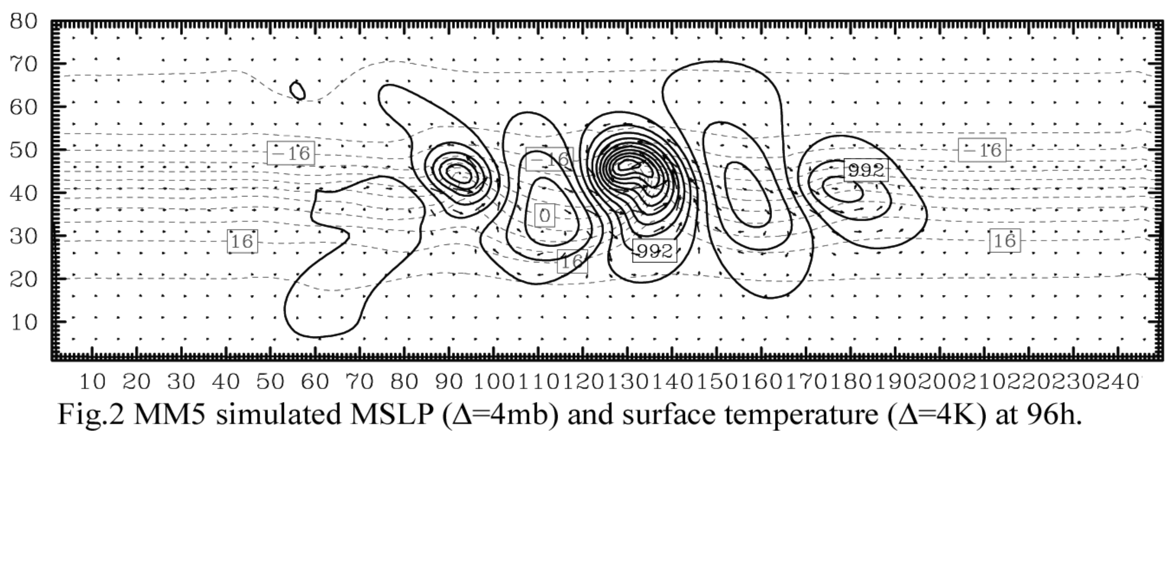

Fig.2 MM5 simulated MSLP (Δ=4mb) and surface temperature (Δ=4K) at 96h.