Progress Report for Modeling Bay/Sea Breeze

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Submitted to TNRCC August 31, 2001

Our initial assessment was that 42 sigma levels would be necessary for accurate simulation of the bay/sea breeze. We tested the model configurations using the output files from the real-time TexAQS 2000 runs from last year. The data that was archived from last year during the study period is MM5 output, and the program sequence to run the model using this information is as follows: the MM5 output is unpacked from tape, and run through INTERPB which converts the sigma levels into pressure levels; next, when REGRID_DOMAIN_I is created, this information is run through INTERPF, which converts the data back to sigma levels, and the number of sigma levels is adjusted from 30 to 42; finally, when the sigma level output is created, it is then used to run MM5.

The use of MM5 output as input to MM5 introduces slight smoothing of the initial fields, but this does not affect the subsequent simulation beyond the first few minutes.

For testing, data was acquired for August 30, 2000, and the information was extracted to be used in the model to run a 48 hours forecast. The previously outlined procedure for running the model was used. We found that, for this test case, the model simulation was blowing up and not running to completion. This problem was ultimately cured by a slight redistribution of the model sigma levels near the lower and upper boundaries after performing this alteration, and in the process increasing the number of sigma levels to 43, and the model ran to completion.

Following this forecast run the number of sigma levels was fine-tuned to enable better resolution of the upper and lower boundaries. After several trial runs using various sigma levels and resolution, the final levels that are used for the model run are as follows:

> 1.000, 0.990, 0.980, 0.970, 0.960, 0.950, 0.940, 0.930, 0.920, 0.910, 0.895, 0.880,
> 0.865, 0.850, 0.825, 0.800, 0.775, 0.750, 0.720, 0.690, 0.660, 0.630, 0.600, 0.570,
> 0.540, 0.510, 0.745, 0.440, 0.405, 0.370, 0.330, 0.290, 0.250, 0.210, 0.175, 0.145,
> 0.115, 0.090, 0.065, 0.045, 0.025, 0.010, 0.000.

These sigma levels, now 42 half-sigma levels, allow for good upper and lower resolution, and the model does not crash.

The model results at 30 and 43 level resolutions were compared for the August 30-31 case. We found that the sea breeze location was unaffected by the increase in vertical resolution. The intensity of the sea breeze front was increased somewhat by the increase in vertical levels. Small differences in the offshore wind fields were also found, but the differences were difficult to quantify without adequate data. The 43-level run better resolved the vertical variations of wind at night observed in the profiler data. An objective assessment of this accuracy was not conducted, pending suitable strict quality control of the profiler data.

In summary, because the differences are small, we expect that any further increases in the number of vertical levels would have little if any impact on the sea breeze structure. We suggest that further testing be performed with an idealized two-dimensional model to isolate the effect of vertical resolution on sea breeze simulations.