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HIGH WINDS AND HIGH RESOLUTION AT THE MET OFFICE

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1. INTRODUCTION

The Met Office uses a single model code for its operational NWP and climate modelling, the Unified Model (UM), (Cullen, 1993). Several configurations are run routinely; global model at various resolutions and limited-area models for different regions. A major change to the Met Office models has been undergoing trials since 2001 and is due for implementation during the first half of 2002.

2. THE NEW MODEL CONFIGURATION

2.1 *New Dynamical core*

The current dynamics scheme, a split-explicit scheme consisting of a forward-backward scheme for the adjustment steps and a Heun scheme for advection, is now nearing the end of its life span. A new dynamical core has been developed, with the aim of improving both the accuracy and stability of the numerics (Cullen et al, 1997).

The main features of the scheme are:

- Two time level semi-implicit Semi-Lagrangian scheme
- Non-hydrostatic model with height as the vertical co-ordinate.
- Charney-Philips grid staggering in the vertical, i.e. potential temperature is on the same levels as the vertical velocity including top and bottom boundaries where vertical velocity is zero.
- C grid staggering in the horizontal, i.e. u-component is east-west staggered from temperatures and v-component north-south staggered.

2.2 *Parametrizations*

These are detailed in the previous paper (13.1, Greed et al.) in this volume.

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2.3 ***Physics Coupling***

This is detailed in the previous paper (13.1, Greed et al.) in this volume.

3. LIMITED AREA MODEL (LAM) TESTS

The same underlying computer code is used for limited area runs as for the global model but a number of the code options in the dynamics and parameters inside the physics parameterizations are changed to give more realistic local values. The model is run with a one-way coupling. In the test runs the initial conditions for a limited area run are created by reconfiguring from a global model analysis and the lateral boundary conditions (LBC's) are created during the global forecast run for the same start time. However, in operations we run a continuous data assimilation cycle so that only the LBC's are provided by the global model. We have the option of running test cases with any number of 3 hour data assimilation cycles to begin with.

Currently a number of different regions have limited area forecasts run operationally. The main one of these is the "mesoscale model" which is run for an area which covers the United Kingdom and areas around it.

The "mesoscale model" is currently run with a horizontal resolution of approximately 12km. As with the global forecast model parallel trials have been conducted to make sure that the new version of the model does not produce degraded forecasts. Although some cases have shown a slight degredation in the forecast it has been accepted that the new model is acceptable for operational use.

With the new model being non-hydrostatic it has the capability to run acceptably at much higher resolution (of the order of 1km). Results from a stand-alone version of the model showed that we could get good results at 1km resolution (Malcolm et al, 2001).

The aim of the proposed study is to show that we can run at these higher resolutions with the new model inside the unified model system.

4. UPDATING OF LBC's

The updating of LBC's for the new scheme is significantly different from the split explicit where merging of data in an internal boundary (rim) zone is applied (Davies,1976) with blending weights from unity (global LBC's) to zero (LAM data).

In the Semi-Lagrangian predictor step any departure points outside of the LAM region are calculated from data supplied by the global model in an external halo region surrounding the LAM domain. Currently we use the same code as that of the global model but the data available in the (external) halo region is only accurate for Courant numbers up to unity if we wish to calculate LAM values at the first interior point. To get round this we can set more than one blending weight in the rim zone equal to unity; in effect discarding any LAM calculated values where the boundary weight is unity. We are generalizing the code to reduce the number of redundant calculations.

In the corrector (solver) step we apply the lateral boundary condition at the edge of the LAM domain. As above, setting a wider rim of unit weights effectively discards calculations. In MPP code this does not really matter as saving calculations on the edge processors may lead to load imbalance.

5. HIGH WINDS CASE STUDY

On the 25th February 2002 a small but intense low pressure system crossed the centre of the United Kingdom. This resulted in wind gusts of more than 80mph (35m/s) in some areas. The parallel trial mesoscale model driven by the new operational (N216 = 432x325) global model did not produce a good forecast of this.

The idea of this study was to run with the new global forecast model at 3 different resolutions, N144 (288x217), N216 and N324 (648x487) and use these to produce lateral boundary conditions and initial conditions for mesoscale runs at resolutions of 12km, 4km and if possible 1km. Also tested are high resolution limited area runs driven by LBC'S and initial conditions from lower resolution limited area runs.

Results will be presented at the conference.

6. CONCLUSIONS

The new model is expected to go operational on June 18th 2002. A major benefit of the new model, for future developments, is that it is non-hydrostatic. This yields the ability to run the code at high resolutions. Initial 4km and 2km tests are promising.

7. REFERENCES

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