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Towards Data Assimilation for High Resolution Nested Models

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Abstract

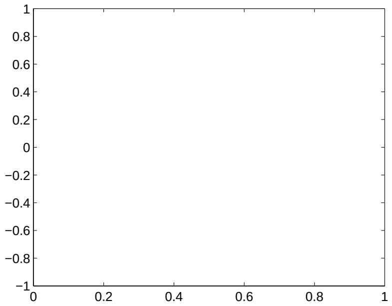
Accurate prediction of convective storms is important because these storms

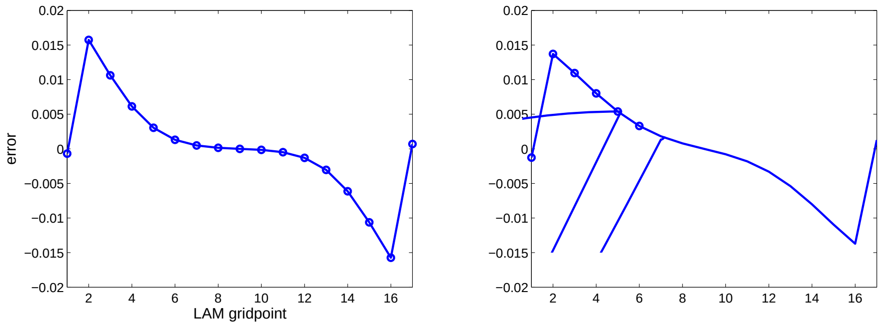
Met Office High Resolution Trial Model has a horizontal domain of 300km$\times$300km and 76 vertical levels [6].

In order to generate a weather forecast with a limited area model (LAM) we need initial conditions and lateral boundary conditions (LBCs). To generate initial conditions that accurately describe the observed reality we combine a previous model forecast (background) with observations. The tool that allows us to do this is data assimilation and the initial conditions are known as the ‘analysis’. The LAM also needs LBCs because the grid is nested within a larger grid and has ‘edges’. This is not necessary for the global model because the grid stretches over the whole globe.

the global model values at $b1$ and $b2$. In order to relax the solution on the interior of the limited area domain to the values prescribed at the boundaries there is a buffer zone implemented at the boundaries covering bz LAM gridpoints. A Davies Relaxation scheme [5] is used in the buffer zone. We use Davies Relaxation because this is what is used operationally. Since our discretisation is explicit it can be shown algebraically that the Davies Relaxation is equivalent to the interpolation

$$\mathbf{u}^{new}$$


1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1
0
0.2
0.4
0.6
0.8
1



0.02
0.015
0.01
0.005
0
−0.005
−0.01
−0.015
−0.02
error
2
4
6
8
10
12
14
16
LAM gridpoint

(a)

is that the LAM takes boundary conditions from a coarser resolution global model. Figure 2(a) shows the error at $t = 0.25$ and Figure 2(b) shows the error at $t = 0.50$.

As can be seen in Figure 2(a), at time $t = 0.25$ there are small discrepancies between the two models at the boundary. The error is at a maximum at the second gridpoint in; this is the edge of the buffer zone. The error then decreases as we move inwards through the domain to become zero at several of the central gridpoints. This pattern is repeated at time $t = 0.5$ in Figure 2(b), although there are some differences worth noting. The magnitude of the maximum error is smaller at time $t = 0.5$. However the number of gridpoints with zero error is fewer, with only the very central gridpoints having no error at all. This is because the errors at the

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