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Raising the Roof: Vertical Coupling in an Extended Unified Model

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Forecasting weather in the lower thermosphere (85 - 120) is of particular interest due to its impact on spacecraft, as well as GPS and radio communications. To this end, we aim to extend the current 80km upper boundary on the Met Office's Unified Model (UM) to a height of around 120km. Thus, we shall raise the roof on current numerical weather prediction and help to allow the forecasting of space weather in the lower thermosphere. This region, however, has proven to cause particular difficulties for the UM. These problems range from the model crashing at start up to successful runs being completed, but with the output containing anomalies in wind speed and temperature compared to data.

Several possible causes have been proposed which could be responsible for the observed anomalies, one of which is the parametrisation of Gravity Waves (GWs) within the model. Thus, in order to better understand this problem, we use a toy model in order to experiment with different model setups. During this experimentation, we aim to narrow down the possible causes of instability and determine if indeed the problem is caused by a particular GW parametrisation or if there are other factors also contributing to the observed inaccuracies. We also perform preliminary extended UM simulations to assess the model anomalies directly. With these model runs we aim to obtain more information on the exact causes of error in the full UM, with particular focus on the impact of the GW scheme with a 120km upper boundary. Once we have satisfactorily identified and corrected the causes of anomaly in the UM, we shall validate the improved model against GW radar data obtained by Nick Mitchell at the University of Bath.