Abstract

Improving Quantitative Precipitation Forecasting (QPF) of small-scale convective systems is a major challenge in Numerical Weather Prediction (NWP). These systems are the main cause of extreme rainfall within the UK, and can create widespread damage to local communities through generating hazards such as flash floods and landslides.

Two approaches are used to improve forecast accuracy; increasing model resolution so that small-scale features are resolved, and running ensembles, where a probabilistic outcome can be given and extreme events are more likely to be forecast. Each of these developments involve increased computer power and more time to process. Therefore, running a limited number of members of most value within a high-resolution model, such as the 1.5 km 'convective-scale' NWP model developed by the Met Office is a positive solution.

The purpose of this report is to analyse the events that occurred in Boscastle on 16th August 2004, which lead to an intense rainfall event, generating flash floods. Using this event, the effects of perturbations on rainfall output within a high-resolution model are examined. Two strategies are considered: model physics perturbations and potential temperature perturbations.

The model runs fall short of diagnosing the intense precipitation, however using the Fractions Skill Score as a measure of skill, they capture the spatial accuracy of the small-scale rain effectively. This skill score is used to determine a length scale at which the model output is useful, and also to assess the difference in precipitation pattern between selected model runs.

This report proposes a generic method for choosing ensembles that diverge most from a control forecast. My results produce promising results, therefore it is suggested that this method is applied over many more cases with a wider selection of model perturbations, with the aim of diagnosing the most useful 5-6 members to use in a convective-scale ensemble.

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List of Abbreviations

CAPE	Convective Available Potential Energy
CCN	Cloud Condensation Nuclei
CIN	Convective Inhibition
ECMWF	European Centre for Medium-range Weather Forecasting
EPS	Ensemble Prediction System
FSS	Fractions Skill Score
GANDOLF	Generating Advanced Nowcasts for Deployment in Operational Land-Based Flood forecasts
IWP	Ice Water Path
JCMM	Joint Centre for Mesoscale Meteorology
LBCs	Lateral Boundary Conditions
LWP	Liquid Water Path
MetUM	Met Office Unified Model
MOGREPS	Met Office Global and Regional Ensemble Prediction System
MOSES	Met Office Surface Exchange Scheme
NAE	North Atlantic and European
NWP	Numerical Weather Prediction
PDM	Probability Distributed Model
QPF	Quantitative Precipitation Forecasting
STEPS	Short Term Ensemble Prediction System
TEPS	Targeted Ensemble Prediction System
TWP	Total Water Path
UKV	UK Variable model