Dynamical Downscaling of Extra-Tropical Cyclone Precipitation

Adrian Champion, Kevin Hodges

ESSC, University of Reading

NATURAL ENVIRONMENT RESEARCH COUNCIL

Storm risk mitigation

University of BRISTOL

University of Reading

National Oceanography Centre
NATURAL ENVIRONMENT RESEARCH COUNCIL

Met Office

KING'S College LONDON

DEMON – Developing Enhanced impact MOdels for integration with Next generation NWP and climate outputs

NATURAL ENVIRONMENT RESEARCH COUNCIL

Storm
risk mitigation

The consortium

University of BRISTOL

Paul Bates, Jim Freer, Gustavo De Almeida, Maxime Souvignet

- Inundation modelling, Hydrological modelling, Uncertainty cascades

University of Reading

Sarah Dance, David Mason, Kevin Hodges, Javier Garcia-Pintado, Adrian Champion

- Data assimilation, Remote sensing, High resolution NWP modelling experiments

National Oceanography Centre
NATURAL ENVIRONMENT RESEARCH COUNCIL

Kevin Horsburgh, John Maskell

- Head of National Tidal and Sea Level Facility
- Expert knowledge of surge model uncertainties
- Fully dynamically coupled extreme storm surge and fluvial modelling

Met Office

Brian Golding

- Head of Forecasting
- Expert knowledge of NWP and climate model uncertainties
- Access to data from experimental high resolution meteorological runs

KING'S College LONDON

Hannah Cloke

- Utilizing ensemble prediction systems in model cascades
- Uncertainty propagation

NATURAL ENVIRONMENT RESEARCH COUNCIL

Storm risk mitigation

Objectives

a. What storm impact model features are the most sensitive to projections of future changes in storms?

b. How can probabilistic future climate and NWP model output best be used for meaningful predictions of storm?

c. How can storm impact models be improved with next generation NWP and climate models?

NATURAL ENVIRONMENT RESEARCH COUNCIL

Storm risk mitigation

Technical scope of work

WP1: Characterizing errors in NWP and climate models WP2: Developing tools to cascade uncertainty through multi-model chains	Analysis will show what storm impact model features are most sensitive to projections of future changes in storms	Meets Deliverable 3a. Key innovation: benchmarking NWP-to-climate model outputs for impact forecasting
WP3: Improving impact model predictions by assimilation of remote sensing and ground data WP4: Understanding the interaction of storm surge and fluvial flooding using fully coupled dynamic models	Will show how probabilistic climate, NWP and surge model output can best be used for meaningful predictions of storm impact	Meets Deliverable 3b. Key innovation: tools to assimilate RS data sequences in flood forecasts
WP5: Developing high spatial resolution impact models WP6: Rigorous evaluation of prediction enhancement using benchmark test cases	Optimises storm impact models for use with next generation NWP and climate models	Meets Deliverable 3c. Key innovation: physically correct impact models at the scale of critical infrastructure

NATURAL ENVIRONMENT RESEARCH COUNCIL

Storm risk mitigation

Aims/Objectives

- Develop high temporal and spatial resolution precipitation datasets for use in hydrological models.
- Validation of precipitation datasets.
- Investigate the uncertainties in the downscaled precipitation.

NATURAL ENVIRONMENT RESEARCH COUNCIL

Storm risk mitigation

Downscaled Precipitation

- June and July 2007
  - ECMWF Operational Analysis
  - 12km, 4km and 1.5km resolutions
  - 12, 24, 36 and 48 hour lead times
- 20th and 21st century cyclones
  - ECHAM5 T213 Global Climate Model Data
  - 12km and 4km resolutions
  - 12, 24, 36 and 48 hour lead times

NATURAL ENVIRONMENT RESEARCH COUNCIL

Storm risk mitigation

Observational Datasets

- MIDAS Raingauge Data
  - Creating a UK wide gridded hourly dataset

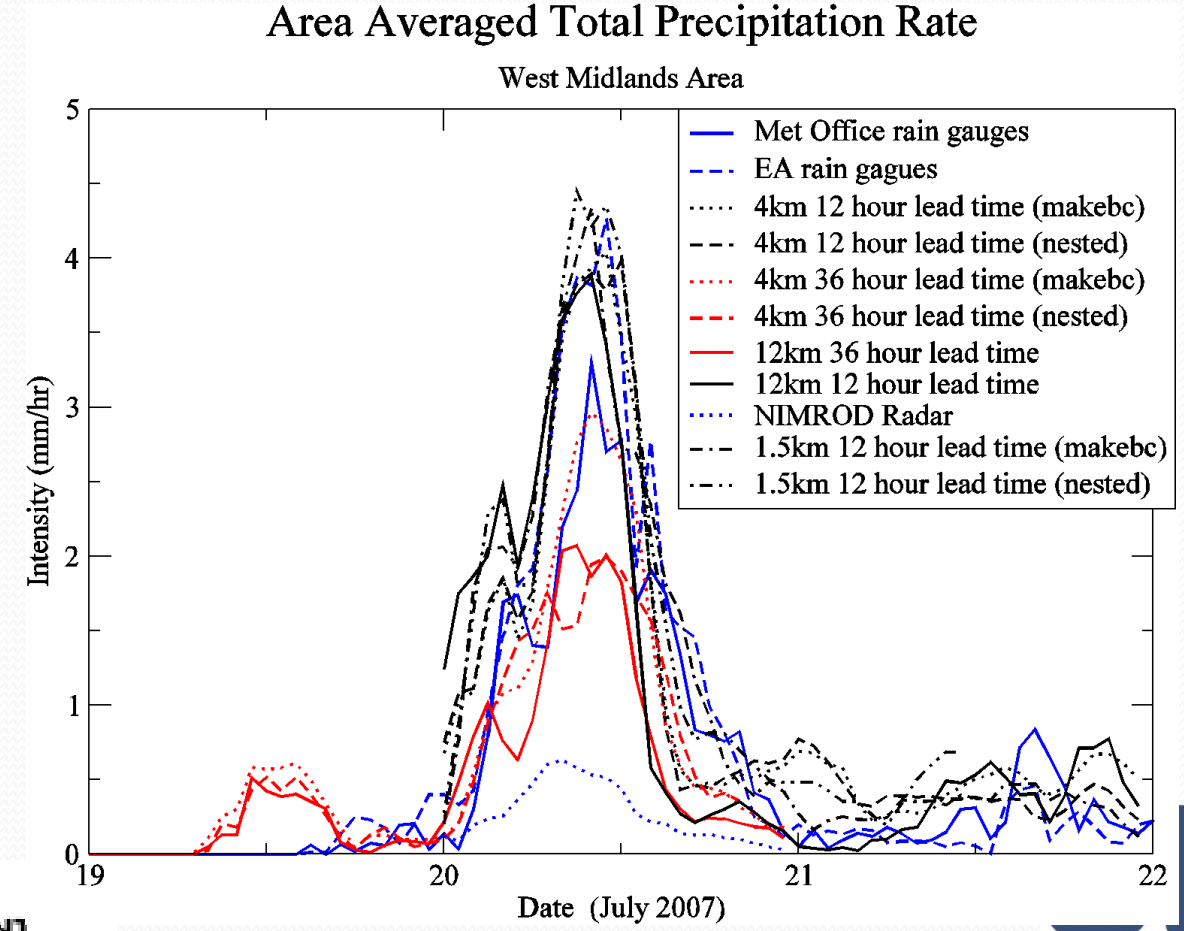
- Environment Agency Data
  - Hourly data available (non-gridded) for 3 regions around Tewkesbury for 15th -> 30th July 2007

- Radar Data
  - Creating an accessible dataset

NATURAL ENVIRONMENT RESEARCH COUNCIL

Storm risk mitigation

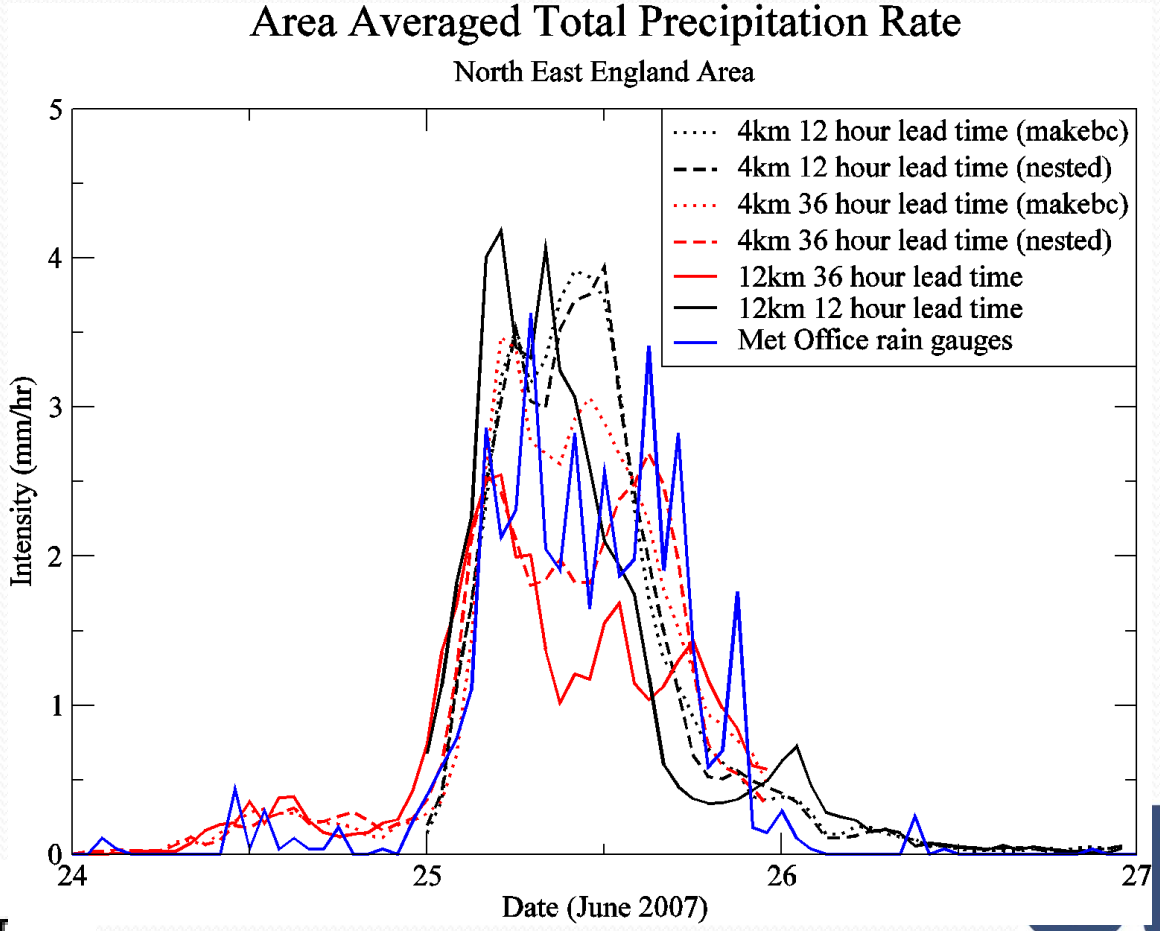
July 2007



NATURAL ENVIRONMENT RESEARCH COUNCIL

storm risk mitigation

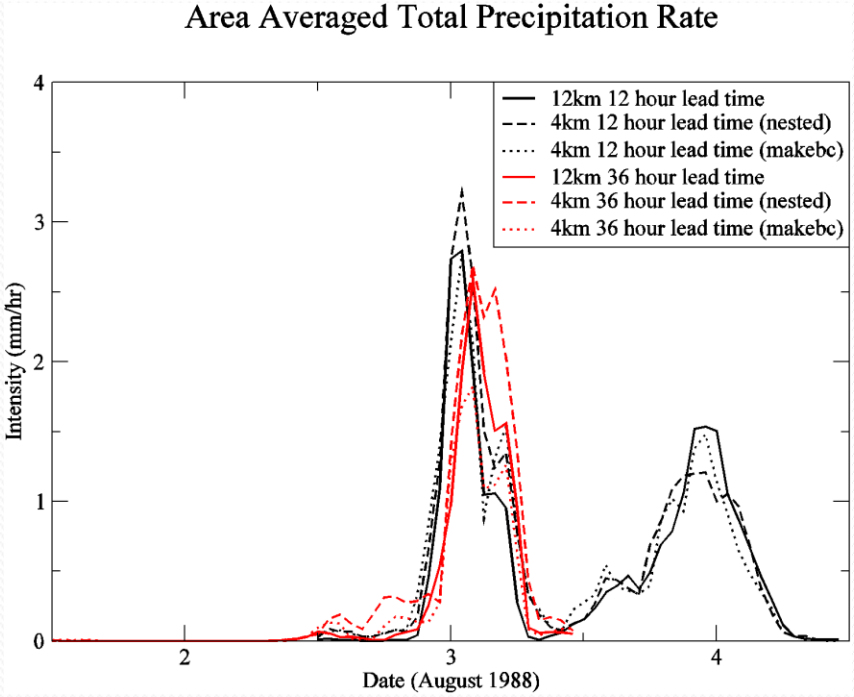
June 2007

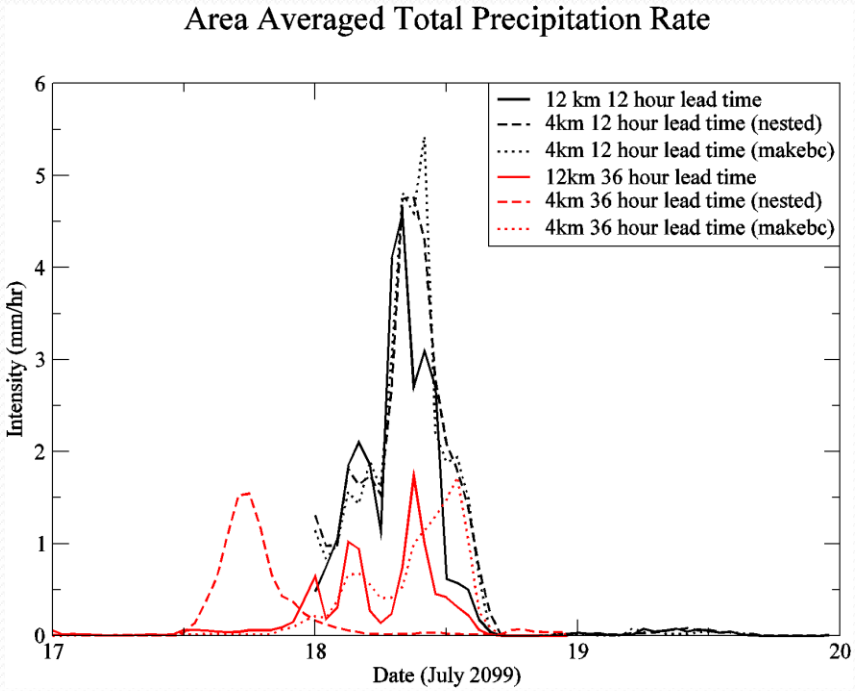


NATURAL ENVIRONMENT RESEARCH COUNCIL

storm risk mitigation

GCM Downscaling





NATURAL ENVIRONMENT RESEARCH COUNCIL

Storm risk mitigation

Future Work

- Using ECMWF Ensemble System to drive LAM
  - June and July 2007 events
  - 12km, 4km and 1.5km
- Expand sample size of GCM events
- Use WRF as nested model
  - Compare to UM results
- Interaction with CONVEX?

NATURAL ENVIRONMENT RESEARCH COUNCIL

Storm risk mitigation