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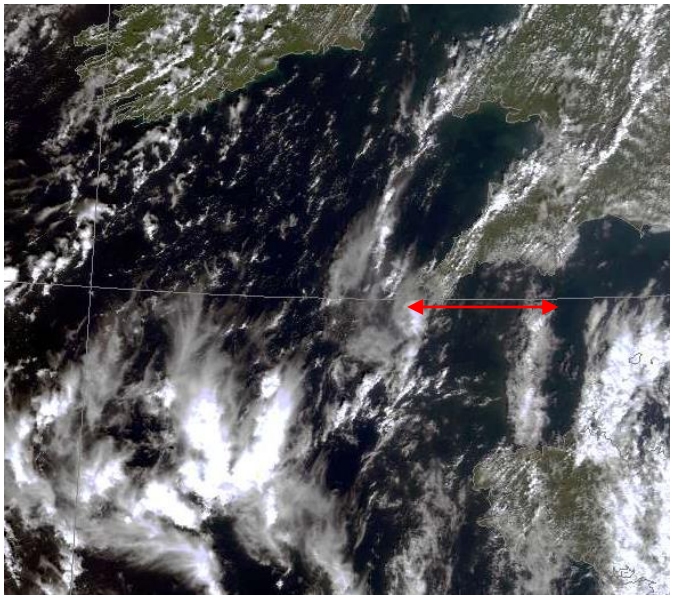
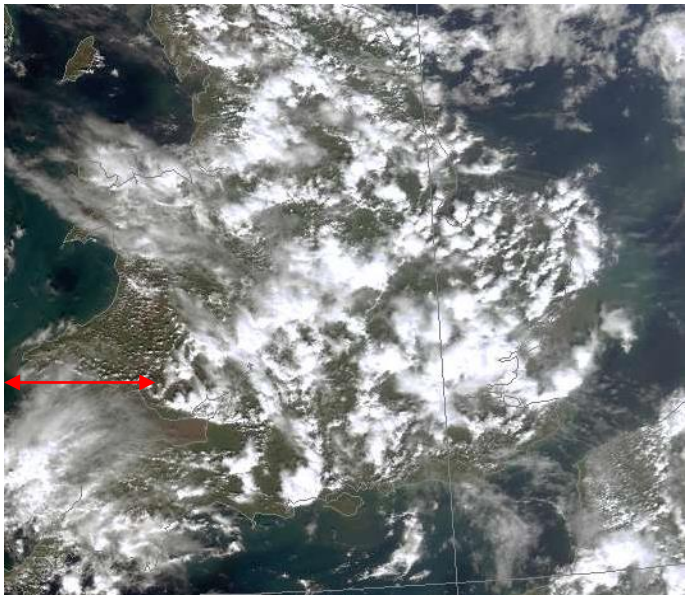
Characterising Convective Regimes over the British Isles





scale:

~100 km

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Prof. G. Craig (LMU)

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Motivation

- Convection-permitting ensembles lead to improved forecasts

- Are high-resolution ensembles better in all situations?

OR

- Does increasing the members of a low resolution ensemble have more benefits for flash flood forecasting?

Quantitatively distinguishing between convective regimes

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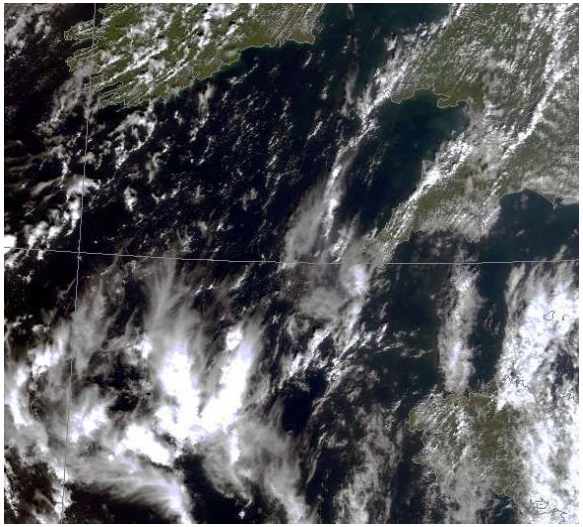
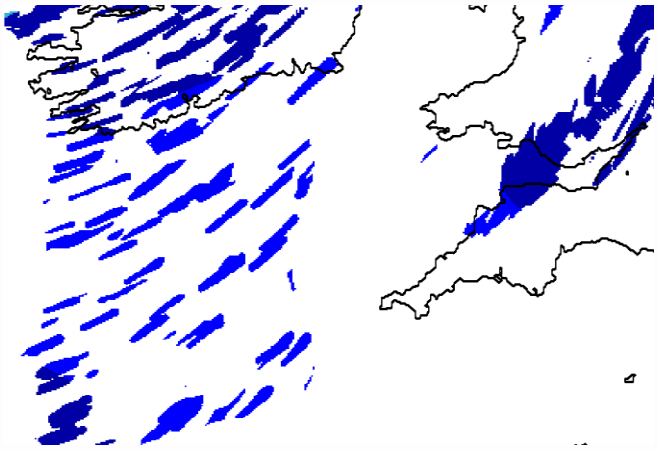
- Convective adjustment timescale, τ_c (Done et al., 2006)
- Time it takes the atmosphere to adjust back to a neutral profile
- Ratio of CAPE to rate of release of CAPE

$$\tau_c \sim \frac{CAPE}{|(d(CAPE)/dt)_{CS}|} = \frac{1}{2}\frac{c_p}{L_v}\frac{\rho_0 T_0}{g}\frac{CAPE}{P_{rate}}$$

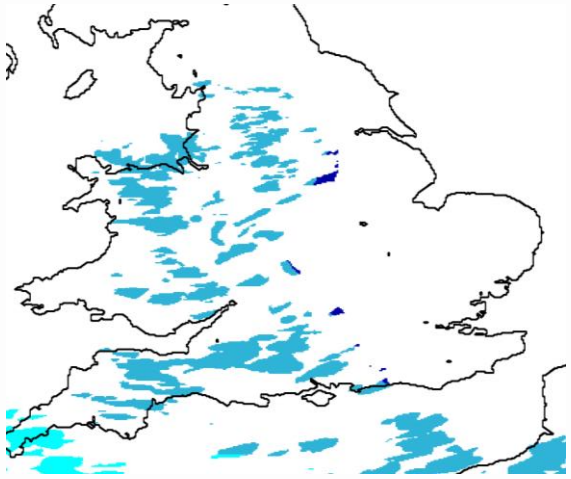
- $\tau_c > 3$ hrs → non-equilibrium convection
- $\tau_c < 3$ hrs → convective quasi-equilibrium

Regime separation





Non-equilibrium convection



Convective quasi-equilibrium

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Aims of the PhD

1. Characterise convection regimes over the UK through the use of a convective timescale (Done et al., 2006)

2. Determine whether a predicted convective timescale can distinguish between qualitatively different convective-scale error growth

3. Determine the trade offs between a low-resolution ensemble with more members to a high resolution ensemble based on the convective regimes

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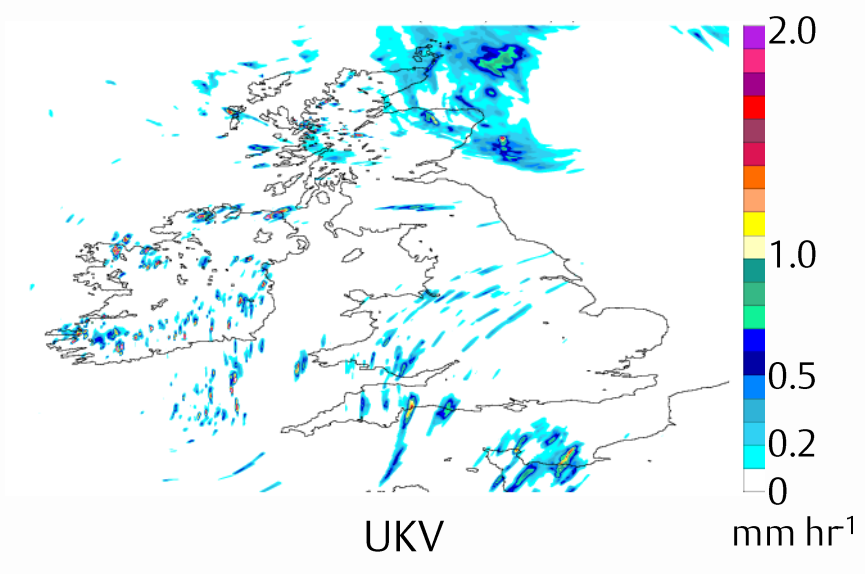
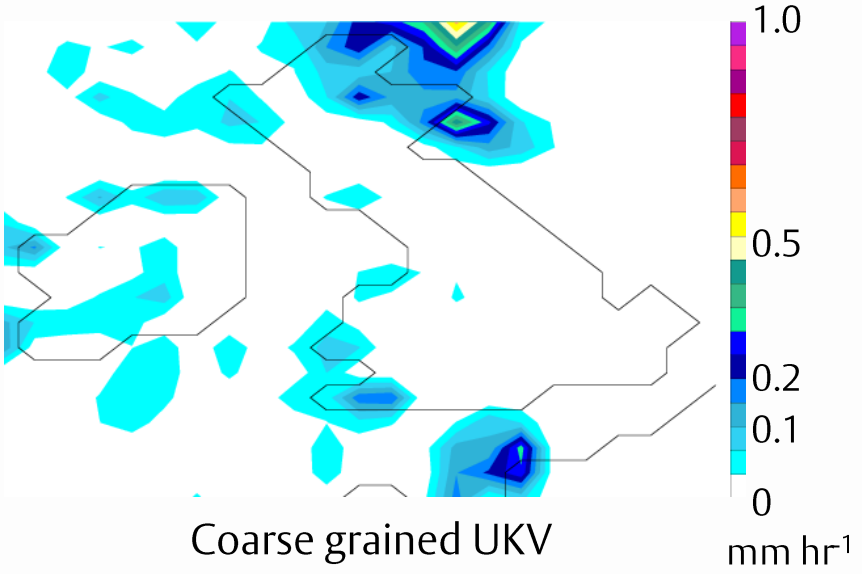
Aims of the PhD

1. Characterise convection regimes over the UK through the use of a convective timescale (Done et al., 2006)

Calculation of the timescale



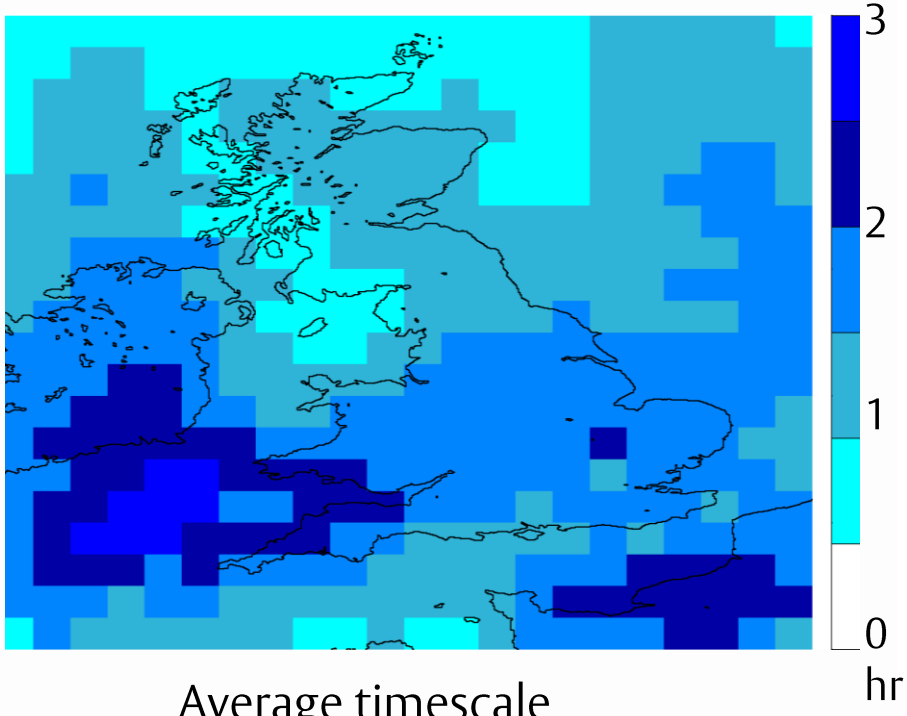
UKV



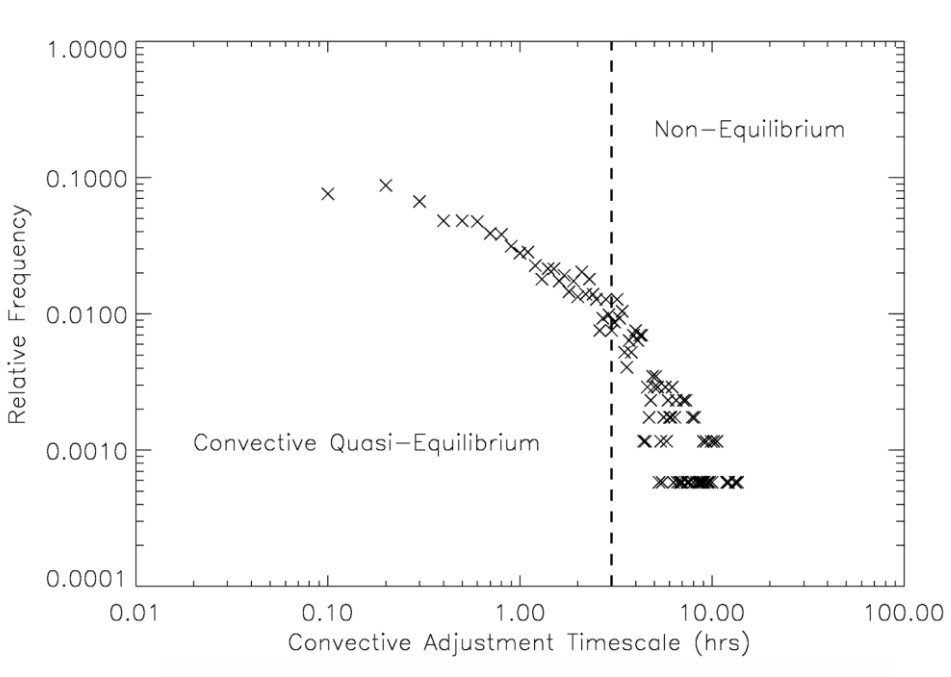
Coarse grained UKV

- Coarse-grained UKV (United Kingdom Variable resolution) data to 60 km
- Gaussian kernel, half-width 60 km
- Rainfall threshold 0.2 mm hr^{-1}
- Three summer climatology for the UK (2012-2014)

Frequency of the convective regimes across the UK



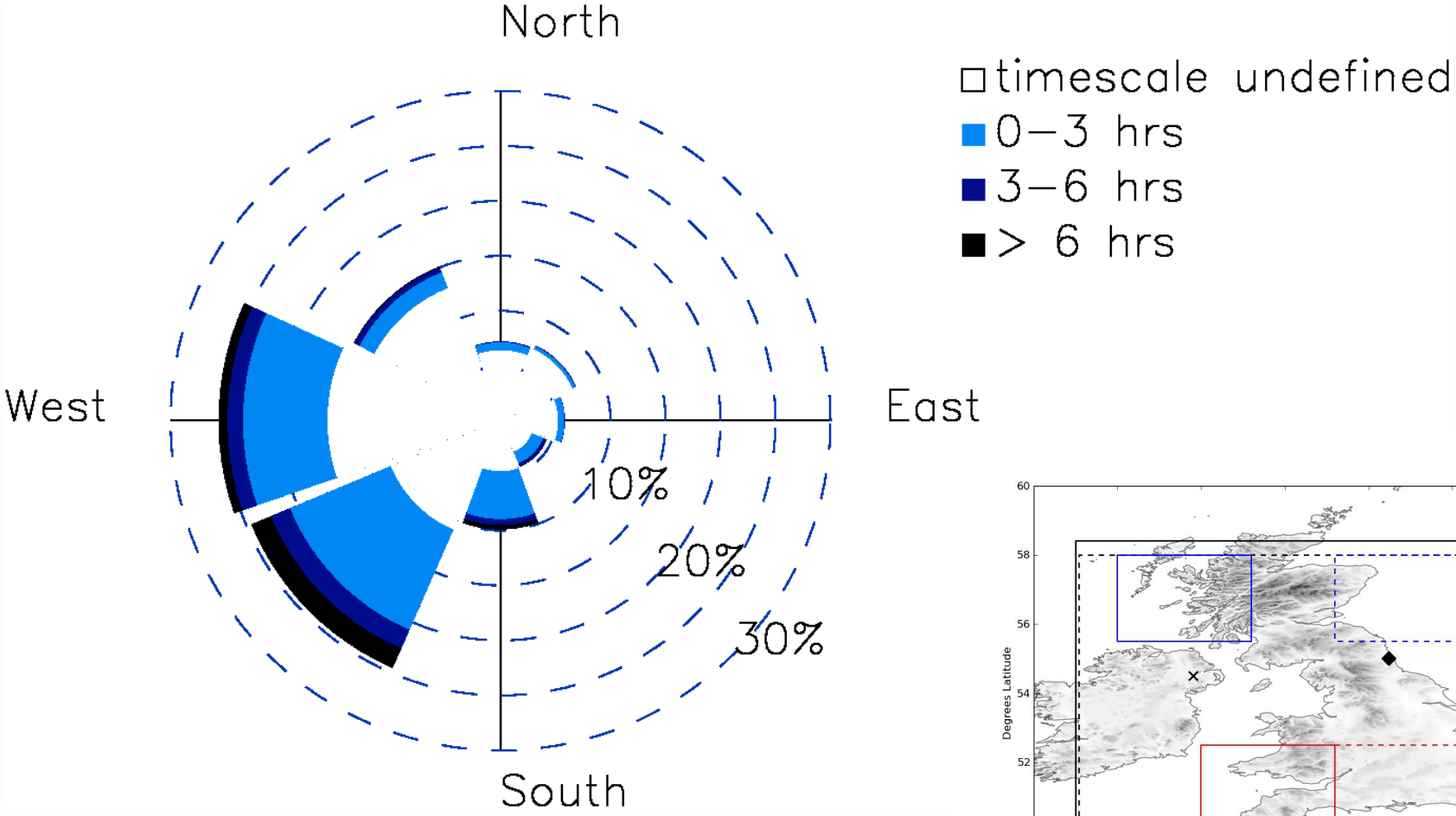
Average timescale



Frequency distribution of regimes

- 85% of UK convection is in convective quasi-equilibrium
- Meridional gradient
- Timescale decreases west to east

Synoptic-scale wind and the convective adjustment timescale



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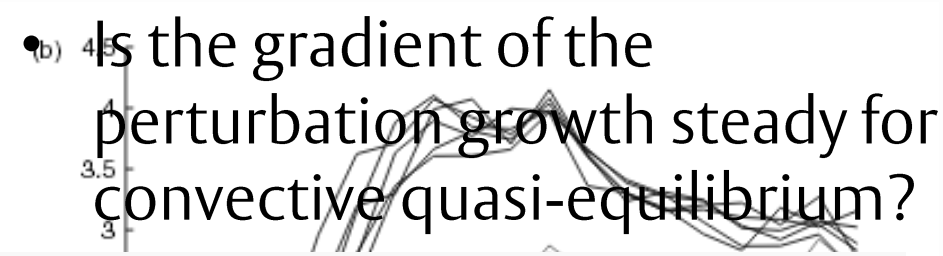
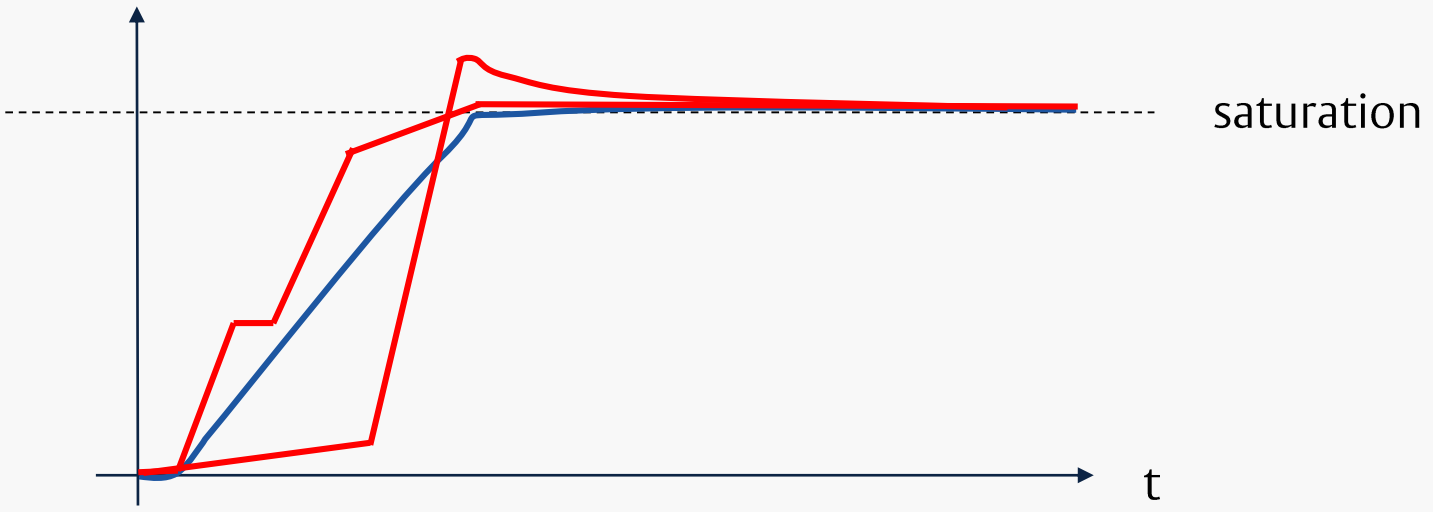
Summary

- Convective Adjustment Timescale can be used to distinguish between convective regimes
- 85% of convection in the UK is in convective quasi-equilibrium
- Convection advected downstream of regions of large orographic gradients or the continent are often not in equilibrium

Future Work

- Is perturbation growth more rapid for non-equilibrium convection?
- Is the gradient of the perturbation growth steady for convective quasi-equilibrium?





Non-equilibrium
Convective quasi-equilibrium

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Initial Condition Strategy