Convection Working Group

Potential projects for discussion during Convection breakout sessions.

Overarching aim: To better understand the deficiencies in the representation of convection in km and sub-km scale models in order to find ways to tackle the underlying causes of the various biases observed.

Overarching Projects

The following projects are centred around a specific methodology or dataset. It is anticipated that the generality of these projects will allow multiple biases to be addressed.

1) Comparison of models with observations of cloud, vertical velocity and other quantities of fundamental importance.		
Rationale		An understanding of the differences between observed convection and its representation in the models will be relevant to a number of biases.
Biases		- Rainfall amount - Rainfall timing - Blobbiness
Datasets	Obs	- Darwin CPOL dataset - DYMECS/TRICs - Others?
	Models	- Cases studies, Long free runs
Activities		- Trajectory analysis of initial precipitating updrafts - Analysis of cell statistics, structure, using cloud/updraft data. - Comparisons of measurements of turbulence with model - Analysis of role of driving model

2) Analysis of pre-convective environment compared to subsequent issues with convection		
Rationale		An understanding of the representation of the pre-convective environment in the model may highlight reasons for issues with the timing of initiation.
Biases		- Initiation
Datasets	Obs	- Radiosondes - Aircraft
	Models	- UKCP18 - Africa climate runs (CP4) - HWT
Activities		- Comparisons of model profiles with observations - Automated stratification by weather type in order to pick out pre-convective environment - Analysis of role of driving model - Comparisons of regional models with driving (global) model

3) Idealised/semi-idealised modelling		
Rationale		Provide a clean test environment to understand reasons for model behaviour.
Biases		- Rainfall amount - Rainfall timing - Blobbiness
Datasets	Obs	- Profiles for initialisation
	Models	- Case study runs - LES
Activities		- Investigate how convection is handled if profiles evolve correctly and impact of different errors in profiles - Comparison of different models (UM, WRF, LES) - Investigate different resolutions – convergence problem - Blobbiness? - Understanding effects of stochastic perturbations

Specific Projects

The following projects are centred around a specific bias or aspect of the model. These will take a more targeted approach to understand why the models have trouble representing certain features.

1) Analysis of representation of elevated convection		
Rationale		Operational meteorologists consistently identify the inability of MetUM to forecasts elevated convection as a priority for model development. To move forward, the reasons why elevated convection is not well-forecast must be understood.
Datasets	Obs	- Profiles for initialisation - Radar - PECAN
	Models	- Case study runs - LES/idealised
Activities		- Process studies of cases in order to understand causes of issues - Ensemble studies to understand predictability - Idealised modelling to investigate response to profiles primed(?) for elevated convection - Increased theoretical understanding e.g. importance of waves and bores – can these be sufficiently represented by the model?

2) Analysis of representation of squall lines		
Rationale		MetUM is unable to form squall lines as often as observed, in particular over the western Maritime Continent. To move forward, reasons for missed triggering and poor organisation must be understood.
Datasets	Obs	- Radar - Satellite
	Models	- Case study runs - LES/idealised
Activities		- Ensemble studies to understand why/why not a squall is triggered - Comparison of squall processes in model to theory

3) Analysis of effect of representation of soil moisture on initiation of convection		
Rationale		Soil moisture boundaries are important in the triggering of storms. In regions where soil moisture data is poor, it is important to understand the sensitivity of MetUM to soil moisture initial conditions.
Datasets	Obs	- Satellite
	Models	- Multi-forecast runs
Activities		- Carry out sensitivity studies to understand effect of soil moisture on convection