Geophysical Research Abstracts,
Vol. 11, EGU2009-6360, 2009
EGU General Assembly 2009

A quantitative local scale validation of climate model output against observational data based on physical relations

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Extreme precipitation is a major natural hazards. To assess its potentially devastating impact on flooding, acgriculture, infrastructure and society, information with a high resolution is necessary. This becomes crucial when studying future changes of extreme precipitation where one relies on model projections exclusively. Atmosphere ocean general circulation models (AOGCMs) provide reasonable accuracy on continental scales, regional climate models (RCMs) on scales of the order of 100km. On gridscales, i.e. typically 25km-50km, even RCM output might be considerably biased.

We developed a technique that allows for a regionally resolved quantitative validation of RCM output based on physically relevant relationships and demonstrate this approach in a UK case study. To this end, we developed a statistical model that uses large scale atmospheric circulation indices to predict local scale extreme precipitation. We fitted this model to observed data from 689 rain gauges across the United Kingdom, and to the corresponding output of the HadRM3 model. We then used the statistical model fitted to the dynamical model, and observed atmospheric circulation indices to predict the observed extreme precipitation, aggregated to grid scales. This technique allows for a regionally resolved quantitative validation of HadRM3 extreme precipitation on a physical level.