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An analysis of the Northern Hemisphere severe convective environment in the ERA-Interim re-analysis and CMIP5 models

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Severe storms can cause loss of life and costly damage to property and infrastructure. To investigate this problem, convective available potential energy (CAPE) and convective inhibition (CIN) are calculated for the Northern Hemisphere for spring, summer and autumn from the ECMWF Interim re-analysis for the period 1979-2012 and for a number of CMIP5 models for 2006-2100. These are currently the largest scale storms analysis from these datasets.

In the re-analysis, it is shown that CAPE peaks over warm, moist regions (e.g. Red Sea, Persian Gulf and Gulf of Mexico) and CIN peaks over similarly defined locations (e.g. Red Sea, Arabian Sea and Mediterranean). Over land, CAPE peaks in Western Africa (MAM), around the Himalayas and over island groups (e.g. Caribbean, Philippines) and CIN peaks over Western Africa and the USA. In terms of trends over the 34-year period, Europe shows the highest positive trend in CAPE, although this is superimposed on the lowest overall values. North Africa exhibits negative trends in CAPE and SSE probability and positive trends in CIN, which are all consistent with a decreasing likelihood of severe storm development.

In the CMIP5 models, there is much variability between models but there are some consistent results, such as a multi-model doubling of European CAPE under RCP85