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Surface forcing and response in a 20th and 21st century AOGCM simulation

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A simple methodology is applied to a transient integration of the UKMO-HadGEM1 fully coupled AOGCM in order to separate forcing dependent changes from climate response (defined as changes that scale with global-mean surface-air-temperature change) in simulated 20th century and future (under the IPCC A1B emissions scenario) global-mean surface energy and precipitation trends. Forcings include short timescale responses that occur directly due to the forcing agent. Results reveal that surface forcing is largely dominated by positive down sensible and latent heat forcings, which oppose an increasingly negative surface radiative forcing. Changes to the surface SW radiation budget are dominated by surface SW forcings, which are strongly negative due to aerosol direct and indirect effects, rather than response. The non-radiative forcings are the result of rapid surface and tropospheric adjustments and impact 20th century, as well as future, evaporation and precipitation trends. For example as a response to global warming global precipitation rate should have increased by $\sim$ 8 % by the end of the 21st century under the A1B scenario. However the realized precipitation increase is only $\sim$ 2.5 % because climate forcing agents directly suppress precipitation.