EMS Annual Meeting Abstracts,
Vol. 6, EMS2009-464, 2009
9th EMS / 9th ECAM

9th EMS Annual Meeting
9th European Conference on Applications of Meteorology
High resolution meteorology
- applications and services

Forced and internal 20th century climate variability

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Climate has undergone major change during the 20th century, much of which can be attributed to external (natural and anthropogenic) forcing. Variations internal to the climate system also contribute to observed fluctuations, particularly at regional, but also at a global scale. Climate model simulations provide one means to separate internal and externally forced climate variations. However, this method may not be completely un-biased, as the models have been developed with knowledge of the observed 20th century climate. Here a simple statistical model, which assumes the externally forced climate variations are to first order described by a time-invariant pattern and proportional to the logarithm of the atmospheric CO2 concentration, is optimally fit to observed surface temperature. Using the CMIP3 20th century model simulations, the method is shown to be highly effective. Observed forced and internal climate variations estimated using this method largely agree with those obtained using from the CMIP3 models. However, important differences are seen during the most recent period, with the statistical estimating indicating a stronger component of internal climate variability, which has contributed to global warming. Sensitivity of the method and other implications will be discussed.