Abstract

Observed and modelled near-surface and, in particular, upper-air temperature datasets for the latter part of the 20th Century are considered in an attempt to yield the most likely explanation of recent climate changes. This is achieved through a suite of increasingly complex detection and attribution approaches culminating in a consideration of the spatio-temporal evolution of a range of tropospheric temperature parameters. In this latter study, a first attempt is made to advance towards making meaningful assessments of model adequacy. For all approaches employed, the most likely explanation of the observed trends arises through a consideration of anthropogenic forcings, although there is additional evidence for a volcanic effect. In all cases numerous sensitivity studies are undertaken in an attempt to ensure against making ambiguous conclusions. Taken together along with the consistency of results herein with those of previously published studies, this leads to increased confidence in the presence of a demonstrable anthropogenic influence on recent climate. Furthermore, the analysis here is unable to definitively prove that the two models considered are inadequate explanations of the observations during the period considered. However, caution is advised against making more meaningful statements until the degree of adequacy can be explicitly quantified.

Results detailed in this thesis are critically dependent upon the veracity of the observed and modelled fields. Analysis of the results implies that corrections made to the observed upper-air temperature dataset employed here are sub-optimal in considering solely temporal consistency aspects. In restricting corrections to a temporal aspect alone, it is likely that some of the corrections move the dataset away from the principal spatio-temporal modes of atmospheric variability. Additionally, strong evidence was found for gross residual errors, which were removed prior to the detection and attribution analyses. Scope remains for development of more optimally derived observed upper air temperature products.