CONSTRAINING UNCERTAINTIES IN CLIMATE MODELS AND IN ANTHROPOGENIC AEROSOL FORCINGS USING CLIMATE CHANGE DETECTION TECHNIQUES

C. E. Forest (1), M. R. Allen (2), **P. H. Stone** (1) and A. P. Sokolov (1)
(1) Joint Program on the Science and Policy of Global Change, Massachusetts Institute of Technology, (2) Rutherford Appleton Laboratory and University of Oxford.

Projections of climate change in response to increases in greenhouse gas and aerosol concentrations in the atmosphere have a wide range of uncertainty. Major reasons for this are differences in the sensitivities of atmosphere-ocean general circulation models (AOGCMs) to external radiative forcing and in AOGCMs' rates of heat uptake by the deep ocean; and uncertainty in the strength of aerosol forcing. We calculate constraints on these factors by comparing radiosonde-based observations of temperature trends in the free troposphere and lower stratosphere during the period 1961–95 with corresponding simulations with a 2D zonal-mean statistical dynamical climate model in which the sensitivity and deep-ocean heat uptake, as well as the aerosol forcing, can be varied. The comparisons are based on optimal fingerprinting techniques, with the estimates of natural variability being taken from a long control run of the HadCM2 AOGCM. These comparisons allow us to make objective estimates of the joint uncertainties in the parameters varied. For example, if one accepts the aerosol forcing and rate of deep-ocean heat uptake assumed by the IPCC in its 1995 projections, then there is about a 20% chance that the climate sensitivity lies outside the 1.5–4.5-degree range adopted by the IPCC.