GREENHOUSE CLIMATE CHANGE FINGERPRINT DETECTION

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1. INTRODUCTION

This paper provides a brief discussion of methods for detecting climate change associated with an enhanced greenhouse effect and presents an example of the fingerprint detection technique. Much of this discussion is taken from Section 8 *"Detection of the Greenhouse Effect in the Observations"* of the recent review on climate change by the Intergovernmental Panel on Climate Change [1] and from notes prepared by Professor Tom Wigley, Climate Research Unit, University of East Anglia for that Section.

There has been some controversy over the issue of greenhouse climate change detection. In some cases, detection has been considered to be the demonstration of a significant observed climate change consistent with model predictions of the enhanced greenhouse effect. In practice, detection also requires that the observed changes are in accord with detailed model predictions and not due to other causes. Thus, we must be able to attribute all or part of the observed climate change to the enhanced greenhouse effect alone (IPCC [1]).

Over the last hundred years, there has been a significant global-mean surface warming of about 0.5°C (Fig. 1, [1, 2]). At the same time, greenhouse gas concentrations in the atmosphere have increased substantially, with about 30% increase in CO_2 concentration. The long-term global warming is qualitatively consistent with an enhanced greenhouse effect. However, there are marked global temperature fluctuations on decadal time scales shown in Fig. 1 which are an indication of natural climate variability on these scales. Very little is known about climate variability on century