

Influence of Volcanism on Long Records of Northern Hemispheric Temperature

Gabriele Hegerl, Department of Earth and Ocean Sciences, Duke University, Durham, NC 27708, USA, Ph: 919 684 6167, fax: 919 684 5833, hegerl@duke.edu

Long temperature records provide a unique opportunity to separate the climate impact of external forcings such as volcanism, changes in solar radiation, and anthropogenic changes in the composition of the atmosphere, since particularly anthropogenic and solar forcing have long timescales. Several reconstructions of annual Northern Hemispheric temperature (Mann et al., 1999; updated reconstruction Crowley and Lowery, 2000) and Northern Hemispheric growing season temperature (Briffa et al., 2000) are applied. The technique is based on (standard and optimal) multiple regression of temperature records on energy balance model simulations (Crowley 2000, updated) of the influence of volcanism, solar radiation and anthropogenic changes on Northern Hemispheric temperature. Results indicate that the signature of volcanism can be clearly and highly significantly detected in all reconstructions during the pre-instrumental period both if considered alone and in conjunction with solar and anthropogenic signals. Results support the idea that clusters of volcanism can cause long-term variations of climate, such as a pronounced cooling in the early 19th century. Volcanism also appears to have contributed to the anomalously cool conditions in the 17th century.

The results of simulations with a broad range of climate sensitivities and ocean heat uptake can also be used to demonstrate which climate sensitivity and ocean heat uptake yield simulations that are consistent with the paleo records. However, results are sensitive to which reconstruction of NH temperature is used. The possible origin of these differences is discussed.