

Impacts of Tropical Volcanic Eruptions on Pacific Climate Variability: Statistical Detection in Proxy Climate Data

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Tropical volcanic activity might be expected to impact climatic variables not only through changes in irradiance but by inducing changes in circulation via modulation of tropical sea surface temperatures. An index of tropical volcanic activity since 1500 has been constructed using the Dust Vale Index (e.g., H. H. Lamb, 1970; Trans. Roy. Soc., 266, 425-533), with some attempt to remove artificial trends. A variety of proxy climate records from around the Pacific are used to characterize climate and circulation variability. These include indices of temperature and rainfall from tree ring reconstructions (Alaska, Patagonia, Tasmania, Southwest US), sea surface temperature and precipitation from coral $\delta^{18}\text{O}$ (Secas Is. and New Caledonia), F. Biondi's reconstruction of the Pacific Decadal Oscillation, and Quelccaya ice cap $\delta^{18}\text{O}$. The volcanic and proxy records are linked by a combined EOF - extended SVD approach and significance is tested with Monte Carlo simulations using autoregressive models. The results show statistically significant patterns of response that project onto known modes of low frequency climate variability seen in observations and long simulations with coupled models.