Geophysical Research Abstracts
Vol. 18, EGU2016-16157-1, 2016
EGU General Assembly 2016

Risk assessment of the impact of future volcanic eruptions on direct normal irradiance

Kristian Pagh Nielsen (1), Philippe Blanc (2), and Frank Vignola (3)

(1) Danish Meteorological Institute, Department of Research and Development, Copenhagen Ø, Denmark (kpn@dmi.dk), (2) MINES ParisTech, Centre Observation, Impacts, Energy, F-06904 Sophia Antipolis Cedex, France, (3) Solar Radiation Monitoring Laboratory, University of Oregon, Eugene, OR 97403-1274, USA

Stratospheric sulfate aerosols from Plinian volcanic eruptions affect the solar surface irradiance forcing by scattering the solar radiation as it passes through the Earth atmosphere. Since these aerosols have high single scattering albedos they mostly affect direct normal irradiances (DNI). The effect on global horizontal irradiance (GHI) is less because some of the scattered irradiance reaches the surface as diffuse horizontal irradiance (DHI) and adds to the GHI. DNI is the essential input to concentrating solar thermal electric power (CSP/STE) and concentrated photovoltaic (CPV) plants. Therefore, an assessment of the future potential variability in the DNI resource caused by Plinian volcanic eruptions is desirable. Based on investigations of the El Chichón and Pinatubo eruptions, the microphysical, and thereby optical, properties of the stratospheric sulfate aerosols are well known. Given these, radiative transfer computations of the DNI resource can be made. The DNI resource includes forward scattered irradiance within the acceptance angle of a given CSP/STE or CPV plant. The rarity of Plinian eruptions poses a challenge for assessing the statistical risk of future eruptions and its potential of risk in the electricity production. Here we present and discuss methods to account for these potential volcanic eruptions for technical and economical studies including scenarios with very high probability of exceedance (e.g. P99 scenarios) for risk assessment of DNI-based solar power projects.