AOGS 2005

Cosmic Rays, Solar-Terrestrial and Geophysical Databases: A Look at the Past 500 years

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Recent studies of the solar-terrestrial environment for the past 500 years have necessitated the use of a variety of historical databases: nitrates in ice cores, radionuclides, knowledge of large volcanic eruptions, sunspot numbers, mid-latitude aurora geomagnetic records and climatic data. The impulsive nitrate increases in polar ice cores have been identified as proxies of large solar proton fluence events. The volcanic record provides time markers for the ice core. The records of major geomagnetic storms and mid-latitude aurora have been used for additional identification. While the geomagnetic and aurora databases and geomagnetic field models provide correlative information for these studies over the past 500 years, the nitrate measurements may be the prime, and in many cases only, identification of major solar proton fluence events that occurred prior to ~1500. Another factor that must be considered in studies of the past is the evolution of the geomagnetic field resulting in non-homogenous changes in the galactic cosmic radiation flux over the earth as a function of time. With the implication that cosmic radiation may have an effect on climate, the geomagnetic field/galactic cosmic radiation flux changes should be considered in the study of the possibility that cosmic radiation may contribute to low cloud cover and hence climate. Examples of how these various databases are being used in the study of solar-terrestrial and geophysical phenomena over the past 500 years will be presented.

Keywords: Cosmic Radiation, Solar-Terrestrial Environment, Solar Proton Events, Aurora, Geomagnetic Field, Climate Change