Project Details

ROSES ID: NRA-00-OSS-01
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Project Title:
Can we Determine Long-term Solar Irradiance Variability from Terrestrial Geomagnetic and Cosmogenic Proxy Records?

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Summary:
The overall goal of the proposed research is an investigation of physical relationships between the Sun's irradiance and plasma energy outputs that influence historical proxies of solar activity recorded at or near the Earth. Explicitly, the relationships sought are those between the closed magnetic flux regions on the Sun that produce irradiance variations and the open flux regions that control the solar wind which modulates terrestrial geomagnetic and cosmogenic indices of historical solar activity. Empirical associations between electromagnetic and plasma outputs from the Sun are evident in contemporary data, as are their mutual connections to the Sun's magnetic activity cycle. Since the observational record of solar irradiance exists for only two cycles, terrestrial proxies are essential to infer historical irradiance variations that may contribute long-term climate change. The present lack of understanding of the physical relationships between solar irradiance and terrestrial proxies impedes the reliable attribution of natural versus anthropogenic causes, and motivates the proposed work.
We propose to analyze and model space- and ground-based contemporary observations to establish the physical connections of radiant and solar wind processes with photospheric magnetic fields. We then will simulate the variability of open and closed magnetic flux caused by meridional flows, diffusion and rotation, and investigate how well these simulations can account for the observed radiative and plasma parameters, and the terrestrial proxies that they influence. Relevant space-based observations include solar irradiance and wind, and the interplanetary magnetic field. Ground-based observations include solar magnetic fields, sunspots and plages, and neutron fluxes generated by cosmic rays and geomagnetic indices. Perturbing the various transport, diffusion and rotation parameters in a manner consistent with speculated changes in the solar dynamo will them permit us to assess various scenarios for the impact of reduce solar magnetic flux, such as in the Maunder Minimum, simultaneously on solar irradiance, solar wind, interplanetary magnetic fields and the terrestrial pro

Publication References:

Summary: no summary

Reference: Fröhlich, C.; Lean, J.; (2002), Solar irradiance variability and climate, Astronomische Nachrichten, vol. 323, no. 3, p. 203-212, doi: 10.1002/1521-3994(200208)323:3/4<203::AID-ASNA203>3.0.CO;2-L

Summary: no summary

Reference: Fröhlich, Claus; Lean, Judith; (2004), Solar radiative output and its variability: evidence and mechanisms, The Astronomy and Astrophysics Review, Volume 12, Issue 4, pp.273-320, doi: 10.1007/s00159-004-0024-1