

The Sun and its magnetic activity

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The magnetic activity and variability of the Sun is the origin of the various effects in the space environment as well as in the magnetosphere and atmosphere of the Earth that will be discussed during this meeting. These effects range from particle and electromagnetic radiation over induced electrical fields and currents to variations of the galactic cosmic ray flux caused by the varying heliospheric magnetic field. The variability of the solar magnetic field encompasses all temporal and spatial scales which are accessible to observation. Convection and magnetic flux interact on timescales of minutes (granulation) to days (supergranulation) while the evolution of active regions and the global transport of magnetic flux on the solar surface takes place on timescales ranging from days to years. The solar cycle and its long-term modulation vary on scales of decades to centuries. Of particular significance in this connection is the recent discovery that both the open flux (interplanetary flux) and the total magnetic flux on the solar surface have doubled in the last century. The lecture will give an overview of the various manifestations of solar magnetic activity and sketch the underlying physical processes. This includes the cyclic generation of magnetic flux by a hydromagnetic dynamo process in the solar interior, its rise through the convection zone and emergence in the solar atmosphere, as well as its key role for the rich variety of phenomena of solar magnetic activity.