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Constructing a stress index for the saturnian magnetosphere

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When a magnetosphere is stressed, the magnetic field lines can be stretched or compressed. Near the magnetic equator, close to the planet, this is expressed as a weakening or strengthening of the field strength. Since these changes from the "ground" state are related to stresses elsewhere in the magnetosphere, they act as a monitor of the system's time-varying perturbations. At Earth, the Dst index is produced using the observed field strength changes at the planet's surface. At Jupiter, an index was created using the Galileo magnetometer data from the inner magnetosphere. Here we present a stress index for the saturnian magnetosphere using Cassini magnetometer measurements from the equatorial inner magnetosphere. In this index, we find that there are two kinds of perturbations present. There are small deviations from the ground state consistent, both in duration and magnitude, with expected solar wind variations. There are also long-term variations in the index that appear to be due to endogenic sources, possibly the variation in the rate of mass addition from Enceladus. When the stress index reaches an extreme negative or positive value, the behavior of other phenomena is also unusual, confirming the utility of the index as an indicator of magnetospheric stress.