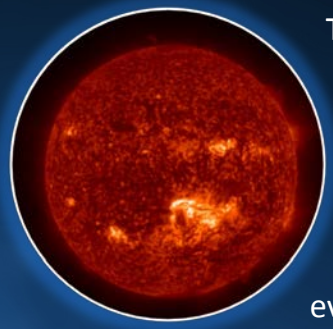
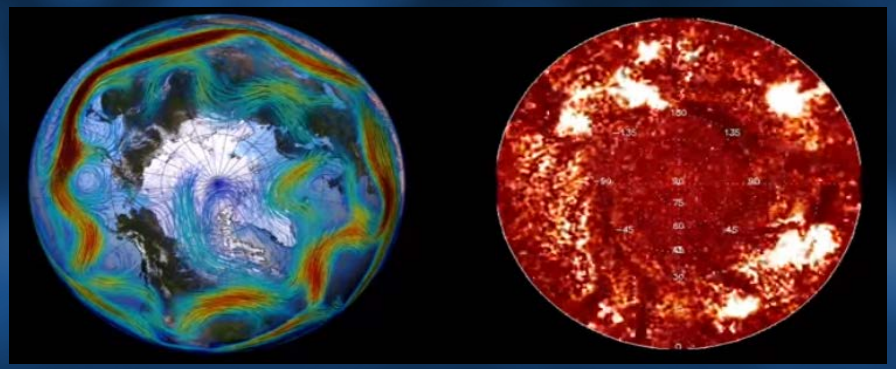
Solar Waves Stream in New Insight: Predicting Space Weather at the Surface

New research using data from the NASA Heliophysics STEREO A, B and SDO missions has revealed information about the sun that could help us predict space weather events impacting our planet from the place in which they originate: the solar corona.



The solar environment is a chaotic place, simmering with magnetic energy and constantly spewing out particles. As the sun and Earth rotate, we often find ourselves in perfect alignment to receive huge blasts of energy and particles being expelled out into space as a result of coronal mass ejections (CME) and solar flare eruptions in the solar corona, the outermost portion of the solar atmosphere. Some of these eruptions have the capability to disturb GPS and telecommunication activities in regions, and the potential to disrupt or damage power grid infrastructure. Some analysts have determined that extreme events could cause blackouts that may cost the U.S. tens of billions of dollars per day.

In recent research, scientists tracked coronal brightpoints — small, luminous features observed on the sun that are directly tied to magnetic activity beneath the surface. The data show the existence of Rossby waves which are a type of inertial wave driven by the physical properties of a planet's, or in this case, the sun's rotation, flowing beneath the solar surface. On Earth, Rossby waves are recognizable as the wavy pattern of the jet stream in the upper troposphere that we see on weather maps. Rossby waves are responsible for day-to-day weather patterns at mid-latitudes as they form the high and low pressure systems. On the sun, Rossby waves could play a similar role for space weather events originating from the sun.



Caption: The researchers discovered a series of westward traveling brightpoints that slowly circled the sun, revealing the magnetized Rossby waves which were flowing beneath the surface. Data taken from the NASA Heliophysics STEREO A,B and SDO missions between 2010-2013. Credit: NASA/Genna Duberstein

Currently, we can only forecast the space weather impacts from a CME or solar flare event after it happens and haven't yet been able to reliably predict when and where an eruption may occur. Applying what we know about how Rossby waves behave on Earth can help us understand solar Rossby waves and the interior process that drive them, which may allow for predictions of when the eruptions might happen in the first place.