Evidence for Rossby Waves in the Solar Atmosphere

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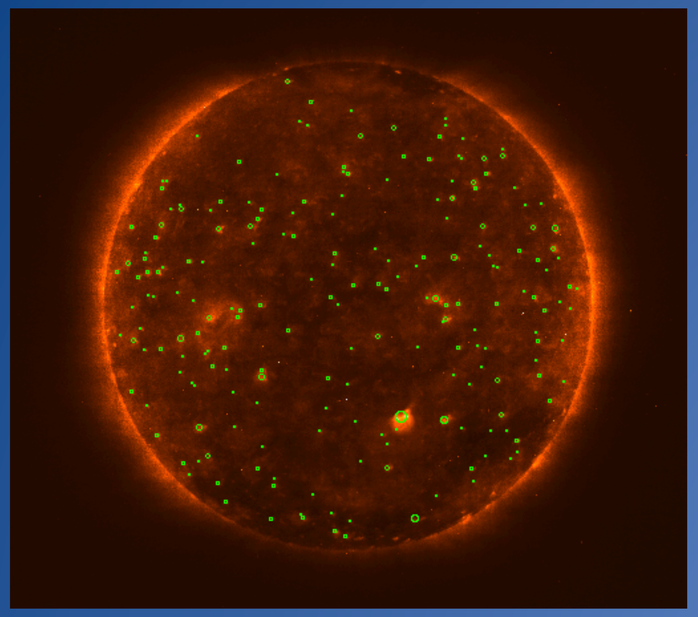
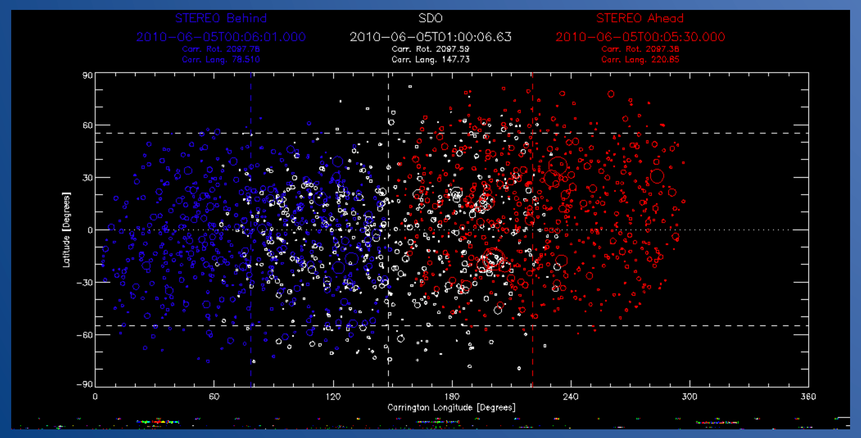
Bright Points



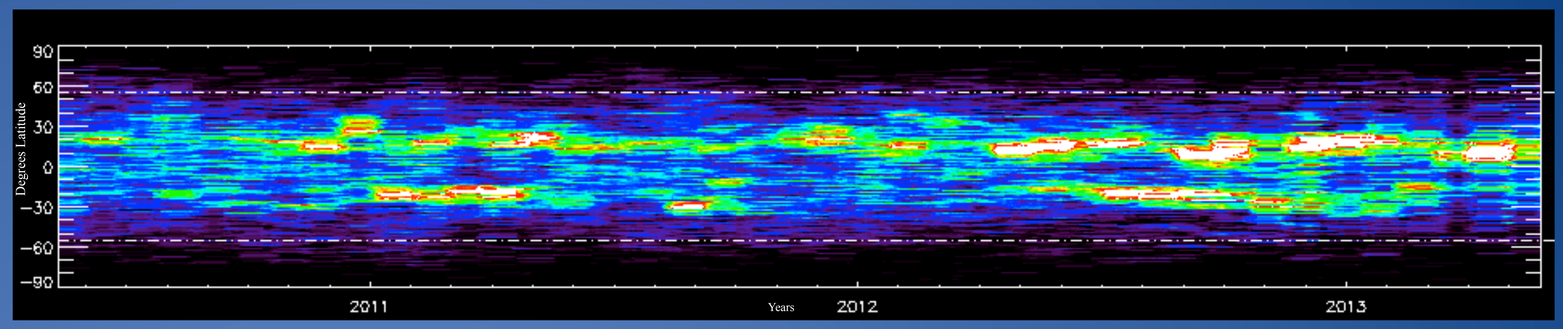
Bright points are regions in the solar corona of intense EUV and/or X-ray activity. They are of ~2-5 Mm in diameter, and are distributed mostly between ±55° latitude. They are associated with regions of small bipolar fields in the photosphere, and regions of magnetic reconnection in the corona (McIntosh & Gurman 2005). The specific method for deriving the bright points from the raw data, such that points of a value of 3σ or higher are kept, is also described in that paper.

Data

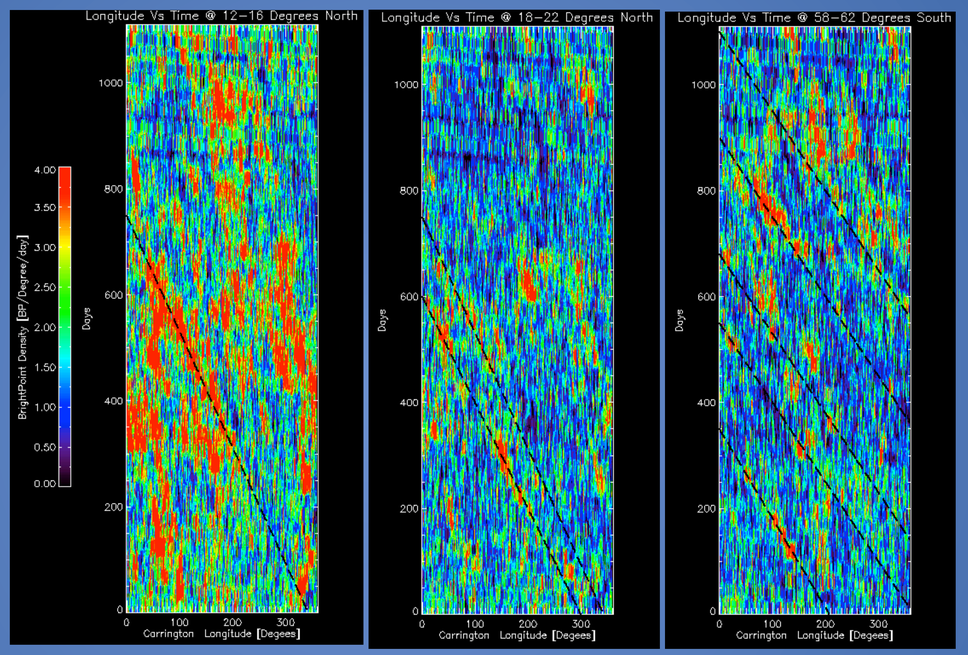


Using the reduction method devised by my McIntosh & Gurman (2005), bright point data, including location, radius, and the time of the observation were taken from more than three years worth of data from AIA and STEREO A and B, thus providing a good deal of full coverage of the sun's surface. To account for the greater resolution of AIA, a radius restriction on the bright points was used to assure a roughly equal number of data points from each satellite.

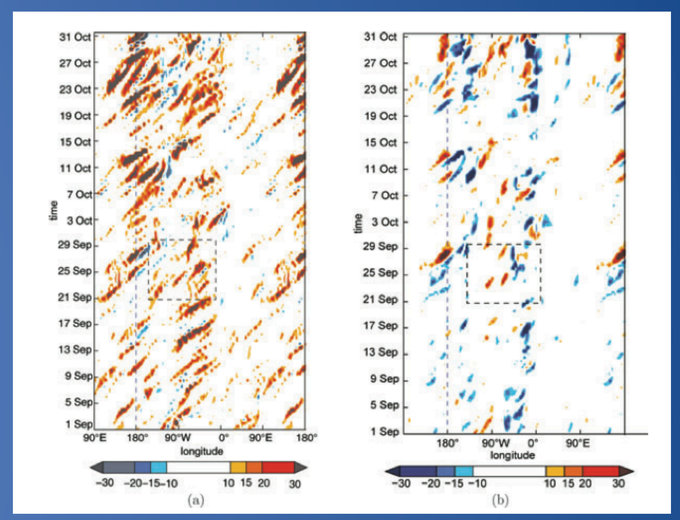
Accumulated Histograms of the Full Dataset of Bright Points



Longitude Slices of Above Data Cube



Example of Rossby waves on Earth



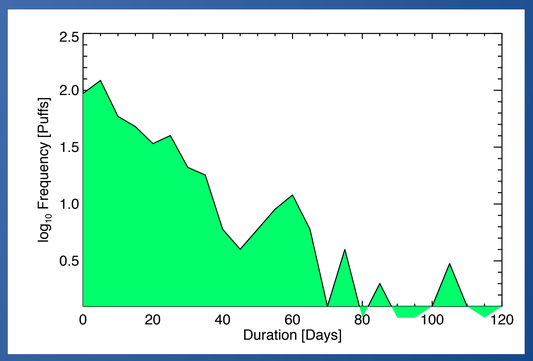
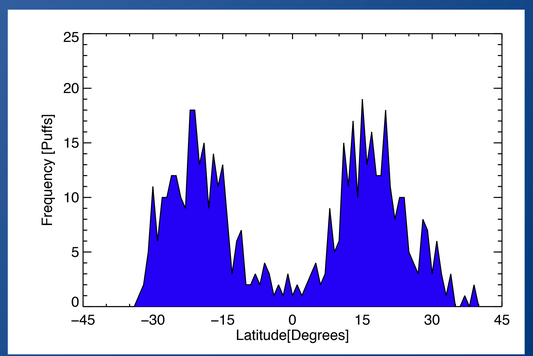
Source: Glatt et. al. *Tellus* 2011

Analysis

Through compiling accumulating histograms derived from the 3+ years of observation, we were able to make a 3D data cube. Pictured at the topmost, this cube confirmed, first, that bright points appear preferentially between ±55° latitude, as shown previously. Furthermore, when the data cubes were sliced longitudinally, in order to make "Hovmöller diagrams", clear evidence of Rossby wave type patterns could be found. These patterns are traced in black on the diagrams above, and when compared to diagrams made of eddy kinetic energy Rossby waves observed on Earth by Glatt et. al. (*Tellus* 2011) the similarity of the diagrams suggests that the same phenomenon is present.

Beyond identification of Rossby waves, there are many further interesting features of this method of compiling the data. For example, by selecting only bright point clusters greater than a given threshold, we can examine the largest clusters of nearby bright points. Along with tracking the movement of these clusters by taking latitudinal slices of the data, we can also examine the average location and duration of these "puffs" as they move towards the equator and dissipate.

BP Cluster Preferred Duration



BP Cluster Preferred Latitude