Background

The Interface Region Imaging Spectrograph (IRIS), launched in the summer of 2013, is designed specifically to observe and investigate the transition region and adjacent layers of the solar atmosphere, obtaining images in high spatial, temporal, and spectral resolution. Our particular work is focused on the evolution of inter-moss loops which have been detected in the lower corona by the Atmospheric Imaging Assembly (AIA) and the High-Resolution Coronal Imager (HICO), but are known to have foot points below the transition region. With the high-resolution capabilities of IRIS and its 31 arcsecond pixel size, which measures activity in the upper chromosphere, we can study these magnetic loops in detail and compare their characteristic lengths and time scales to those obtained from several AIA image sets. Our particular data set was recorded on October 23, 2013 at 07:09:30, lasting for 3219 seconds with a cadence less than or equal to that of AIA (~12 seconds). This particular data set was recorded on October 23, 2013 at 07:09:30, lasting for 3219 seconds with a field of view of 128.6 by 128.1 arcseconds, centered on -53.9 by 59.1 arcseconds from disk center.

Conclusions

For the IRIS data set, the algorithms outlined here have found more than a 50 million events, resulting in more than 400,000 groups. For the purpose of only finding inter-moss loops, these results would be considered a bit extreme. However, by setting a very low standard for the qualification of an event, we have collected a valuable set of statistics that can potentially be used to define the events that we want. Two examples of these statistics are shown just below.

Original Data (OD)    Minimo Finder (SMO)    First Min Detaller (SM1)    Second Min Detaller (SM2)    Minimo (SMO)    Maximo (OD)    Event Start    Event Peak    Event End    Frame of 2D Images

IRIS SJ 1400  AIA 171  AIA 193  AIA 211

Light Curve Analysis, Event Detection, and Comparison Between IRIS SJ1400, AIA 171, AIA 193, and AIA 211

Top Row: Progress Data - Start, Peak, End - Bottom Row: Group Data - one group = one color

Grouping Demonstration

This panel shows the first three steps A, B, & C and the final result D of the grouping process for two example events over three time frames (1.25). One can follow along with the numbers in the last row, which show the order that the pixels are collected in.

The first pixel is chosen by a simple scan of the first time frame. While focused on that pixel, the surrounding cube of pixels is also scanned for the event information. If a pixel fits the criteria, it is added to the collection for another scan, just like the first pixel. This can be seen in rows B and C, where the second and third pixels are the focus to look for more event pixels. Once a pixel is built up, the process is repeated until the entire data cube is scanned.

Statistical Results

It can be seen in the light event detection results above that there are a few notable events that peak at nearly identical times within the four data sets. We use an orange marker in the linear plots to show the point in time that is associated with the white arrows in all 2D plots above. In the row just below the 1D results, the arrows are pointing to a blue pixel, which signifies the processing of the event detection algorithm to the entire data set. These progress values along with lifetimes of events are then used as a limiting criteria when the pixels are grouped. A simple example of the grouping algorithm is shown to the left with explanation. While a pixel is in the spot light, the surrounding box of pixels is also scanned for the event information. If a pixel fits the criteria, it is added to the collection for another scan, just like the first pixel. This can be seen in rows B and C, where the second and third pixels are the focus to look for more event pixels. Once a pixel is built up, the process is repeated until the entire data cube is scanned.