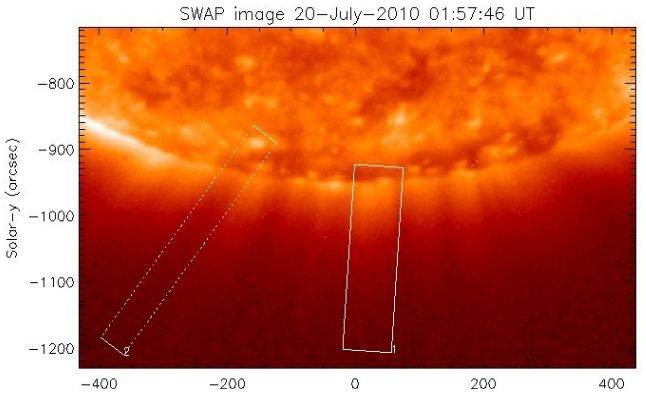
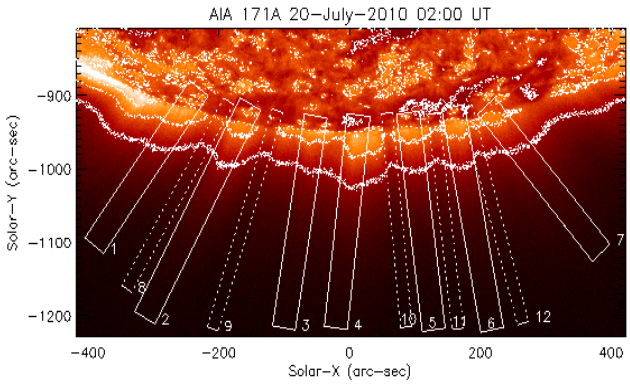
Report on work with swap data

In our quest for propagating waves, that play an important role in heating of solar corona, we have chosen south polar sub field from the swap data on 20th july 2010. Study of the waves in polar region, is also important for their significance in acceleration of fast solar wind. To make an overlap with AIA data where we find some propagating intensity disturbances traveling outward, we have selected the swap data between 02:00 and 04:00 hrs for our analysis. Plume and interplume structures are clearly visible in the sothern region and is ideal to study any difference in properties between plume and interplume structures as well. During this 2 hrs duration swap data contains around 42 images of alternating cadence between 4 min and 2 min. After removing the blurred images, which are due to rotation of space craft every 15 min and are unusable, we are left with around 37 images. These images are then interpolated to an uniform cadence of 4 min. Four min cadence is chosen to minimise the interpolation. Since, most of the previous results indicate the detection of long period oscillations (> 10 min), this is not a big constraint for our analysis. Our analysis method consists of three steps.

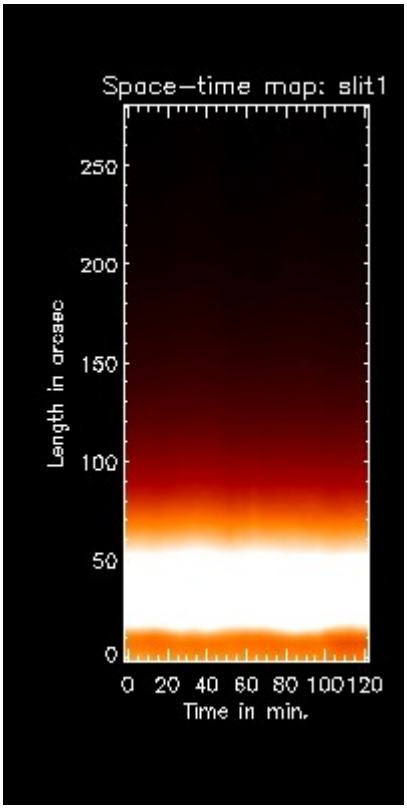
1. To construct space time maps by following different structures (plume or interplume).
2. Use appropriate enhancement techniques, to bring out the few % variation.
3. Estimate the propagation speeds from slopes and apply wavelet technique to study the periodicites present.

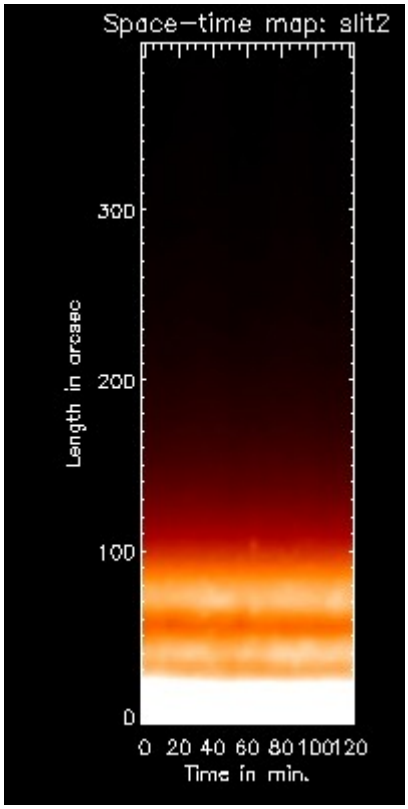
In the current analysis, we traced various plumes and interplumes by constructing artificial slits. Following is a swap image (top) and AIA image (bottom) showing the various slits constructed across several plume and interplume structures.



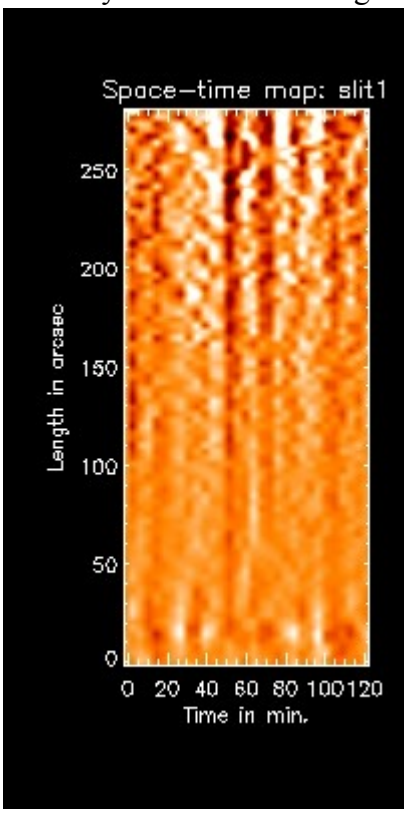


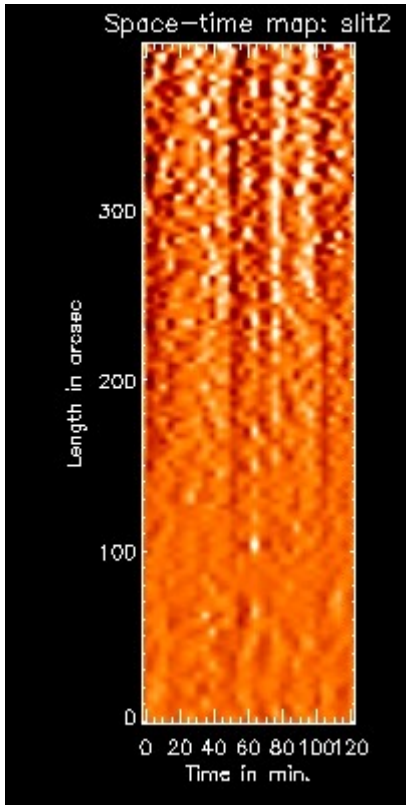
We have just shown two slits in swap image, one in plume and one in interplume, just for comparison, but other slit locations shown in AIA image are also studied. The following is an example of space time map constructed from slits 1 (left) and 2 (right), from SWAP data.



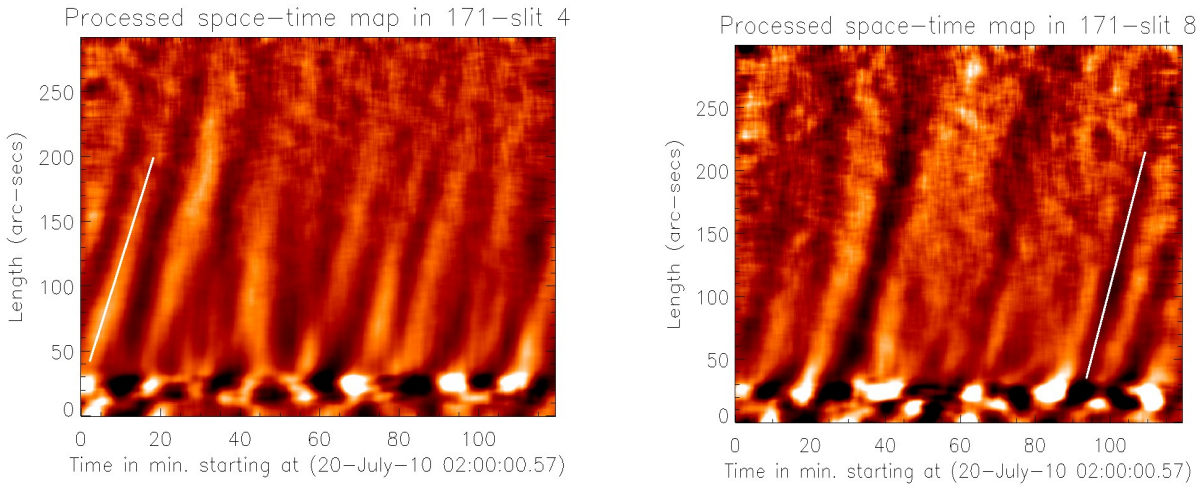


Now to enhance the few % variations, we have smoothed the space time image and subtracted from the original and then divided the resultant by the smoothed image, which will compensate the radial fall of intensity. The resultant images can be seen below.





Corresponding maps of AIA constructed following same analysis is shown below. Slit 4, plume region (left) and slit 8, interplume region (right).



Here we see the clear signatures of propagating intensity disturbances, almost upto 250 arcsec off-limb, whereas the results from swap data doesn't indicate their presence. These disturbances ar found to be in 10-30 min periodicity range and traveling with 100-170 km/s projected speeds. It is important to note that the poor temporal and spatial resolutions of SWAP compared to AIA, will not affect our analysis much, to detect this periodicity range. Still they didn't show up in swap probably because of because of the following reason. The off-limb counts in swap are in the range 60-70 DN/s/pixel, close to limb. Few % (<5) variation implies, 2-3 counts per second which might be lost due to compression or some other processing applied to raw data.

We still didn't work with the polar region data of swap, observed for tomography studies along with HOP plan. Though, we think that the swap may not be capable of detecting few % variations, we can definitely use its offset capabilities to study long term variations in structure and properties of plumes.