High-frequency dynamics of a moss region as observed by IRIS

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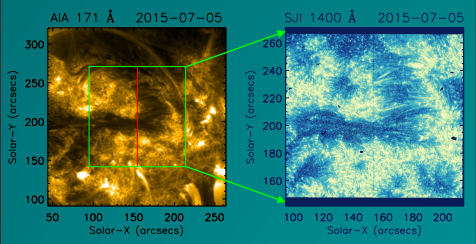
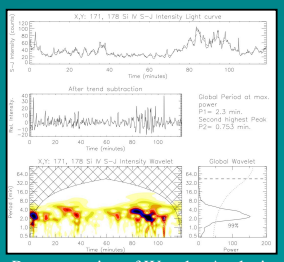
Abstract: The high temporal, spatial and spectral resolution of IRIS has provided a new insight into the understanding of different small-scale processes occurring at the chromospheric and transition region heights. We study the dynamics of high-frequency oscillations of an active region (AR 2376) moss as recorded by simultaneous imaging and spectral data of IRIS. Power maps generated from slit-jaw images in Si IV 1400 Å passband and sit-and-stare spectroscopic observations of Si IV 1403 Å spectral line reveal the presence of high-frequency oscillations with 1-2 minutes periods. The presence of such low periodicities is further confirmed by intrinsic mode functions (IMFs) as obtained by empirical mode decomposition (EMD) technique. We find the high-frequency oscillations possess significant power in the small localised regions within the bright moss, which indicates finer structuring in the active regions moss. These high-frequency oscillations could be due to presence of magnetohydrodynamic (MHD) waves, or quasi-periodic flows, or combination of both.

Observations

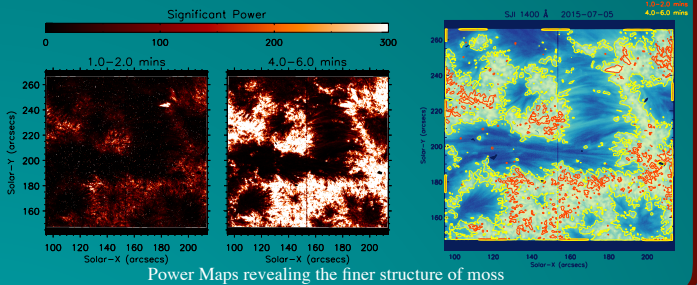


Active region (AR 2376)
2015-07-05 from 05:16:15 UT to 07:16:23 UT

Power Maps from SJIs

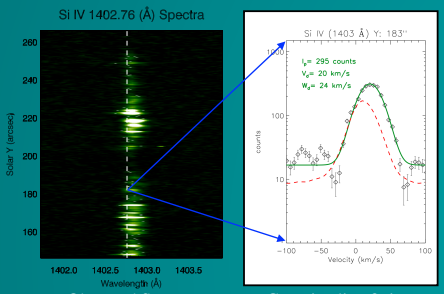


Representation of Wavelet-Analysis

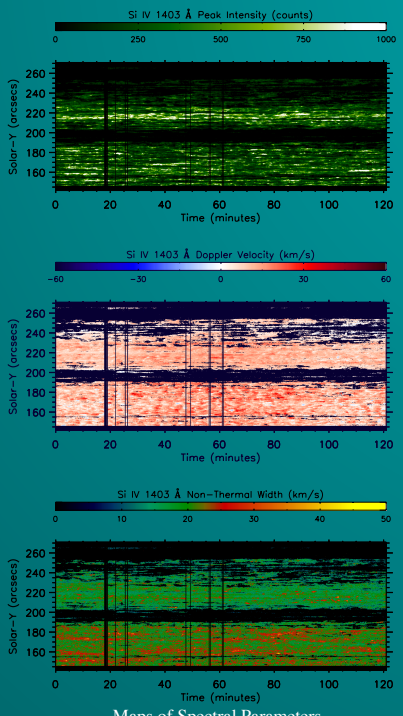


Power Maps revealing the finer structure of moss

Spectral Analysis

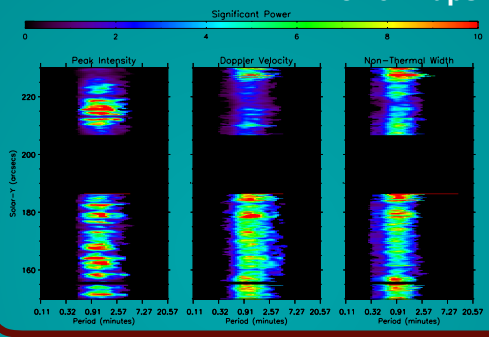


Observed Spectra — Gaussian line fitting



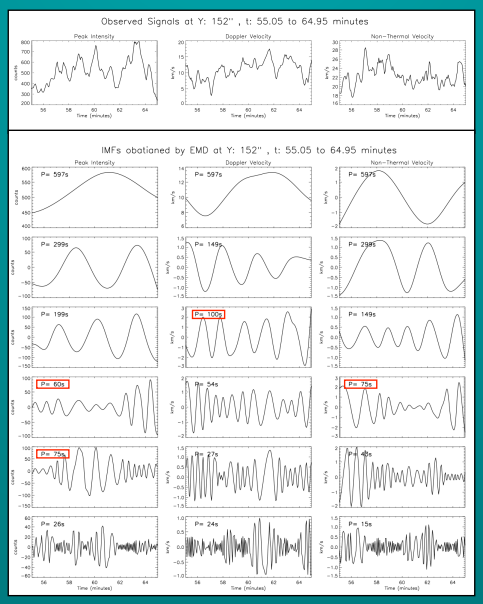
Maps of Spectral Parameters

Power Maps from Spectra



- These power maps confirm the presence of significant power in high frequency oscillations in the range of 1-2 minutes.
- The fine structure of the active region moss can be observed in the spectral power maps also.
- The high significant power is concentrated in the localised regions with small spatial extent within the bright moss.

EMD Analysis



- Different IMFs (intrinsic mode functions) obtained using EMD (empirical mode decomposition) technique.
- The period for each IMF is obtained using FFT (Fast-Fourier Transform).
- The presence of periods from 60 s to 120 s are marked in red.

Conclusions

- We study the dynamics of High-Frequency Oscillations of a moss region by employing Wavelet and EMD techniques.
- We detect high frequency oscillations from the power maps obtained using SJIs in Si IV 1400 Å passband and sit-and-stare spectroscopic observations of Si IV 1403 Å line.
- Our preliminary results show high-frequency oscillations to posses significant power in the small localised regions within the bright moss.
- IMFs obtained from EMD confirms the presence of periodicities of ~1-2 mins.

Future Work

- We would further study the nature of these high- frequency oscillations. These could be due to MHD waves, quasi-periodic flows, or combination of both.
- This can be verified by studying the co-relation and phase difference between the spectral parameters.
- Magnetograms may provide some insight on the understanding of the sources of these oscillations.

References

Testa et al. (2013)
Morton & McLaughlin (2013)
Morton & McLaughlin (2014)
Pant et al. (2015)
De Pontieu et al. (2014)
Gupta & Tripathi (2015)
Shetye et al. (2016)
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Poster

2. Chromospheric heating and dynamics

High-frequency dynamics of a moss regions as observed by IRIS

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High-frequency oscillations have become interestingly important in very recent past and are proposed to be one of the sources of coronal heating. The high temporal, spatial and spectral resolution of IRIS has provided a new insight into understanding the different small-scale processes occurring at the chromospheric and transition region heights. We study the dynamics of high-frequency oscillations of an active region (AR 2376) moss as captured by simultaneous imaging and spectral data of IRIS, mapping the solar transition region. We detect high-frequency oscillations (1-2 minutes) while looking at the power maps deduced from the time-sequence of the slit-jaw images in Si IV 1400 Å passband and sit-and-stare spectroscopic observations of the Si IV 1403 Å spectral line. We find the small periodicities to be generally having significant power in the bright moss region. In particular, the high-frequency oscillations appear to possess high power in the small localised regions within the bright moss, which reveals the finer structures in the active regions moss. These high-frequency oscillations could possibly be manifestations of different magnetohydrodynamic (MHD) waves, or quasi-periodic flows or a combination of both, occurring at small spatial extents. This study sheds a new light on the dynamics of high-frequency oscillations observed in transition region and their role in heating the upper solar atmosphere.