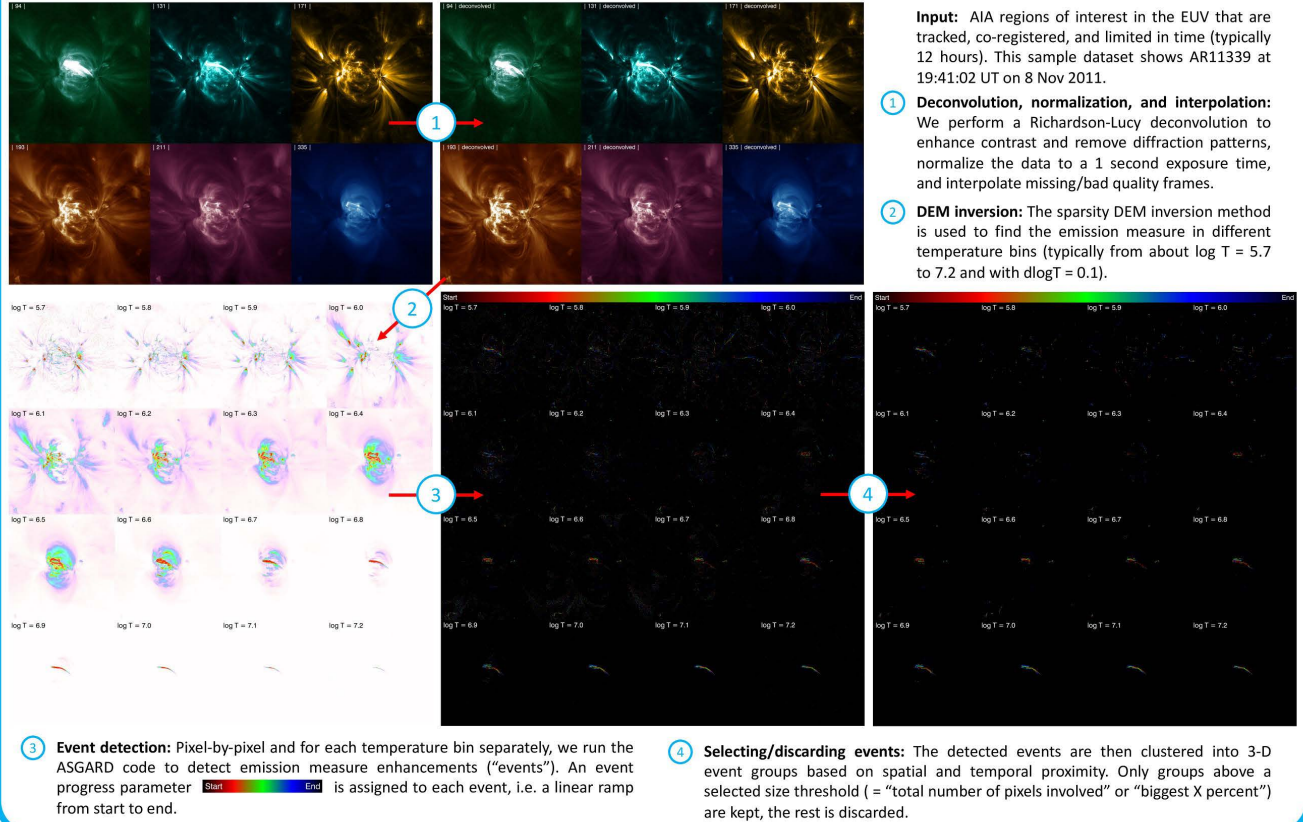


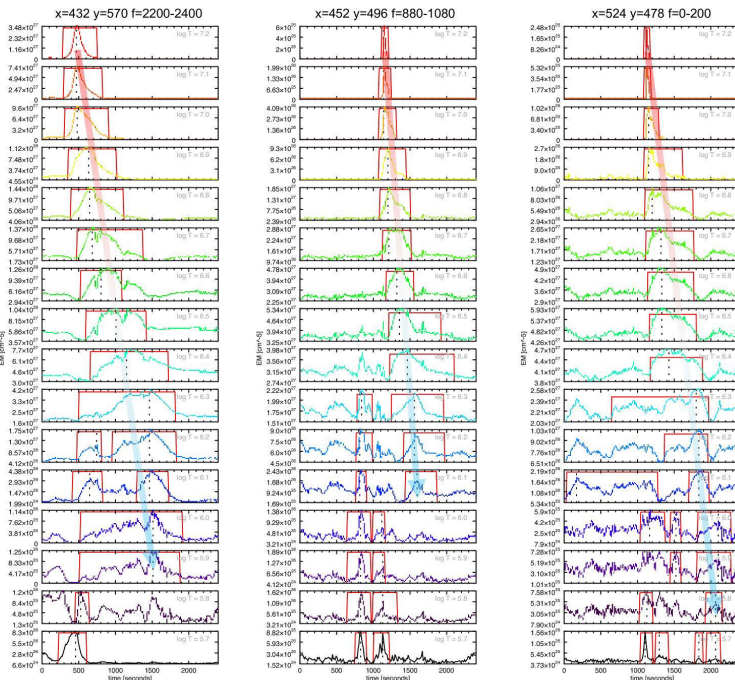
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Introduction We introduce a modified version of the ASGAR code (*Automated Selection and Grouping of events in AIA Regional Data*). Originally written to detect and group brightenings (“events”) in the AIA EUV channels, it now includes the sparsity DEM inversion method (Cheung et al. 2015)¹ and instead detects emission measure enhancements in different temperature bins. Ultimately, the goal is to automatically determine heating and cooling rates in different coronal structures.

Procedure



Sample events: cooling plasma



The above plots show the emission measure (EM) from the sparsity DEM inversions vs. time and temperature, averaged over a region of 3x3 pixels in AIA. The red boxes indicate events picked up by the ASGAR code, the dotted black lines mark the position of highest EM during the event. The overplotted arrows in these examples illustrate coronal plasma cooling over different temperature ranges and at different rates.

Future work

Grouping algorithm: We are currently working on an algorithm to automatically select sequential event groups over adjacent temperature bins, and, as an alternative, on extending the selection/grouping described in (4) to 4-D, with the fourth dimension being the temperature. This would enable us to automatically determine heating and cooling rates in the corona from AIA data.

Validation: The grouping algorithm will then have to be validated against several datasets where the heating and cooling rates in different structures have been determined manually from the emission measure maps.

Choosing a set of general parameters: The event detection takes several input parameters to allow the user to optimize what is considered an event by the code. In order to pipeline the code (see next item), a set of general parameters that works for various scenarios needs to be chosen and validated.

Pipelining to increase statistics: Despite the sparsity DEM inversion being comparatively fast with about 10000 pixels/s on an off-the-shelf laptop, the entire procedure is still computationally expensive. However, with most of the code being parallelized and therefore scalable, and with everything in place to pipeline the entire data stream from AIA images to DEM inversions to grouped events, this could significantly increase statistics about heat exchange rates in the corona.

¹Cheung, M. C. M., Boerner, P., Schrijver, C. J., et al., “Thermal Diagnostics with the Atmospheric Imaging Assembly on board the Solar Dynamics Observatory: A Validated Method for Differential Emission Measure Inversions”, 2015, ApJ, 807, 143