



FDL 2021 HELIOPHYSICS UNCOVERING THE ORIGIN OF THE SOLAR WIND



Classification of Solar Wind Discontinuities Using Supervised Machine Learning

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WHAT IS THE SOLAR WIND?

- The Sun has an extended atmosphere that radiates outward into space made of charged particles, or plasma, that we call the Solar Wind
- Earth is constantly bathed in solar wind which can impact communication systems, GPS, long term space exploration and astronaut safety
- Understanding solar wind is essential to understanding the space weather in which we live

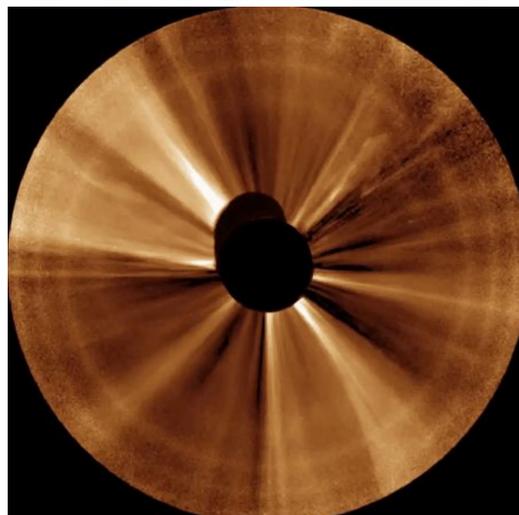
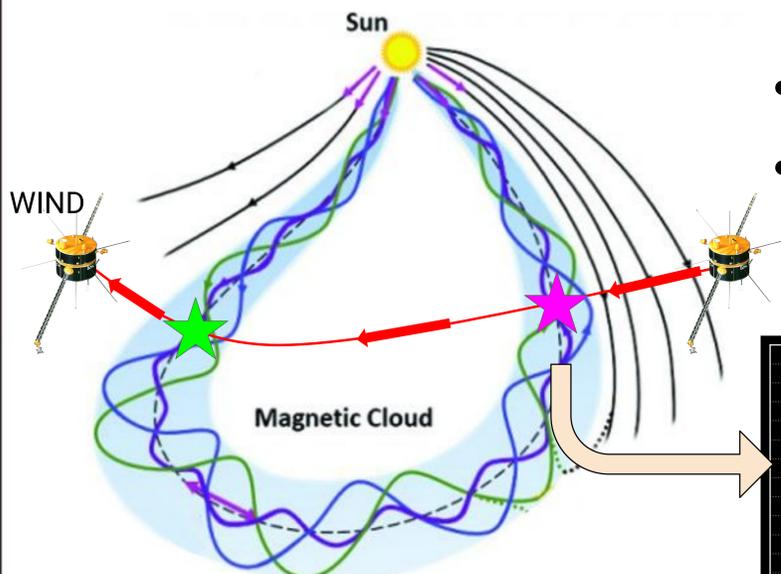


Image Courtesy of NASA/SwRI/STEREO

HOW IS IT MEASURED?



- The WIND spacecraft collects magnetic field data of the solar wind
- Magnetic discontinuities appear as abrupt changes in the timeseries when a boundary is passed

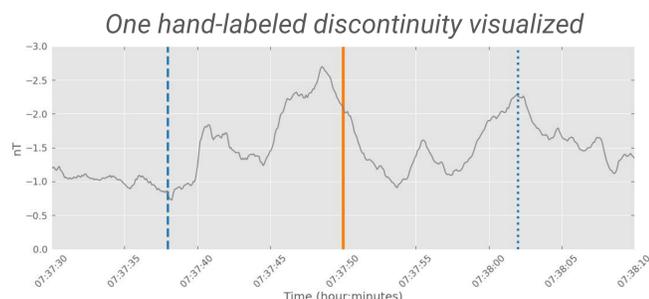
SOURCE: Wang et al. [2018]

LABELED DATA

- We worked with hand-labeled data (1 day) and heuristically labeled data (15 years) from experts annotating the start and end of a discontinuity

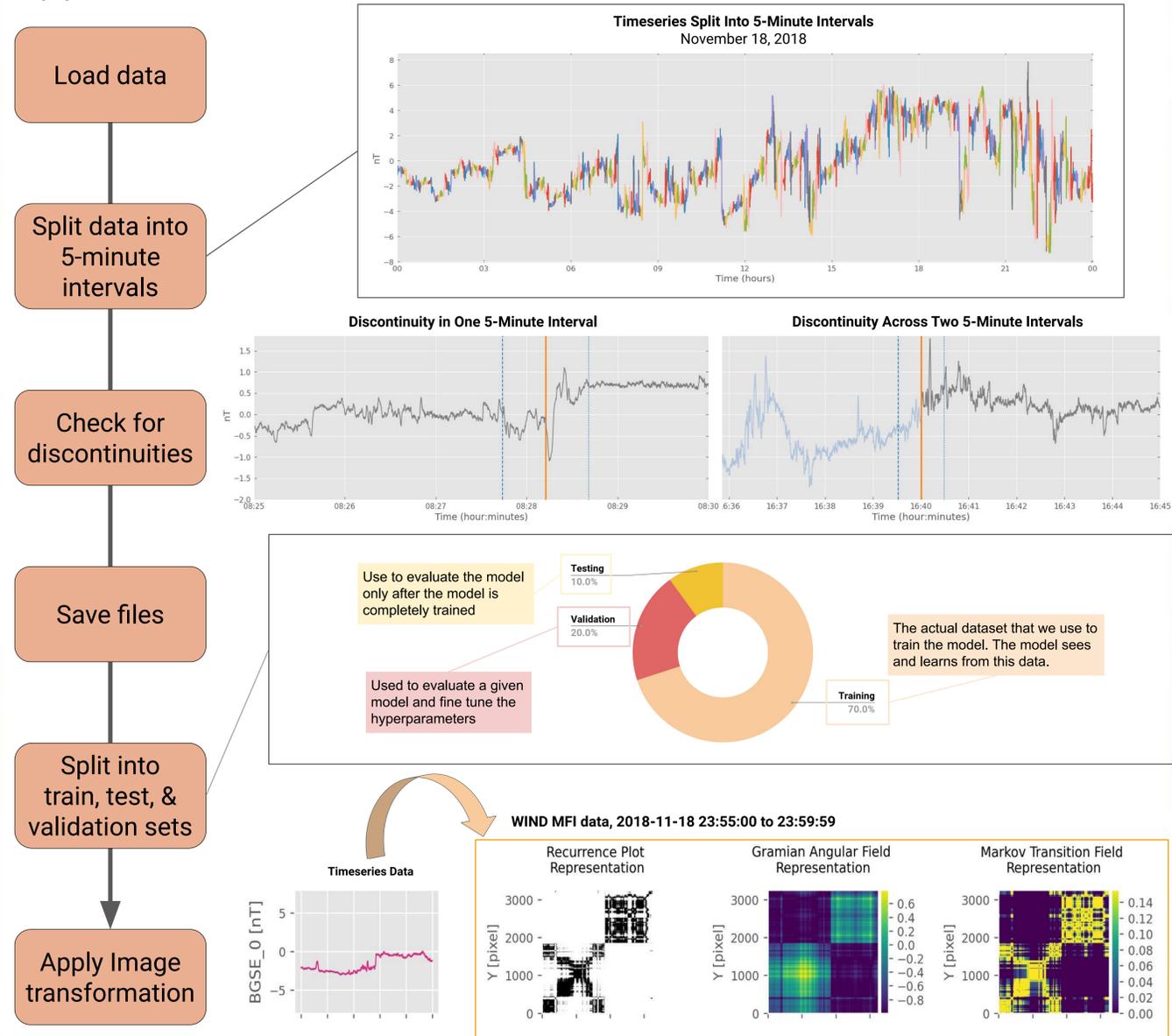
Date	Start Time (h:mm:ss)	End Time (h:mm:ss)	Mean Time (h:mm:ss)
11-18-2018	07:37:38	07:38:02	07:37:50

One hand-labeled discontinuity



OUTCOMES

- The goal of the project was to develop a pre-processing pipeline to prepare the magnetic field data and labeled discontinuities for a supervised machine learning pipeline



NEXT STEPS

- Implement techniques to overcome small training dataset size (contrastive learning, hard example mining)
- Create a catalogue of 15 years worth of labeled data

ACKNOWLEDGEMENTS

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