



# A Statistical Study of Regions of Enhanced Ion Temperatures in the Magnetotail in the TWINS Ion Temperature Maps

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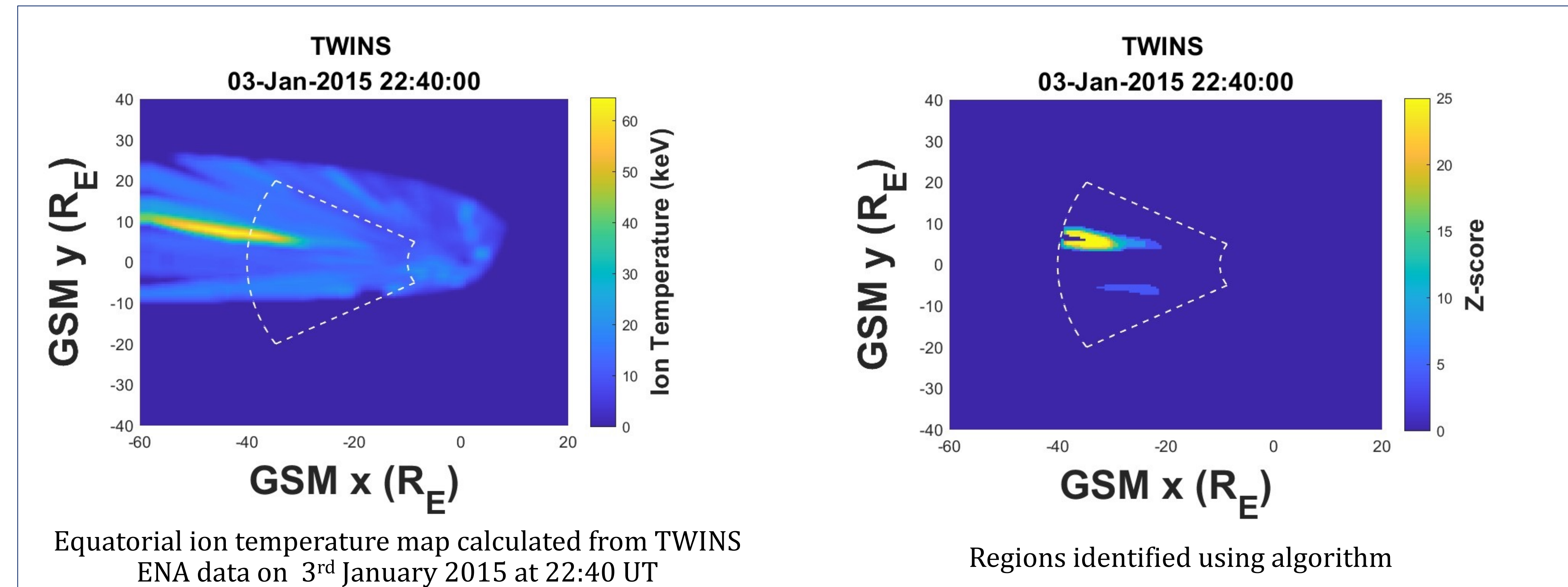
## Introduction

- We are conducting a statistical analysis of regions of enhanced ion temperature in NASA's Two Wide-angle Imaging Neutral-atom Spectrometers TWINS ion temperature maps.
- Magnetic reconnection in the magnetotail during substorms accelerates ions and electrons both earthward and tailward.
- These particles travel within narrow flow channels and these are called bursty bulk flows (BBF) and dipolarizing flux bundles (DFB) depending on the measurements used to describe these features.
- An increase in ion temperature is observed within these flow channels.
- The regions of increased ion temperature will be identified in ion temperature maps calculated from TWINS imagers using Energetic Neutral Atom (ENA) imaging with the help of an automated detection algorithm.
- We are conducting a statistical analysis of these identified regions.

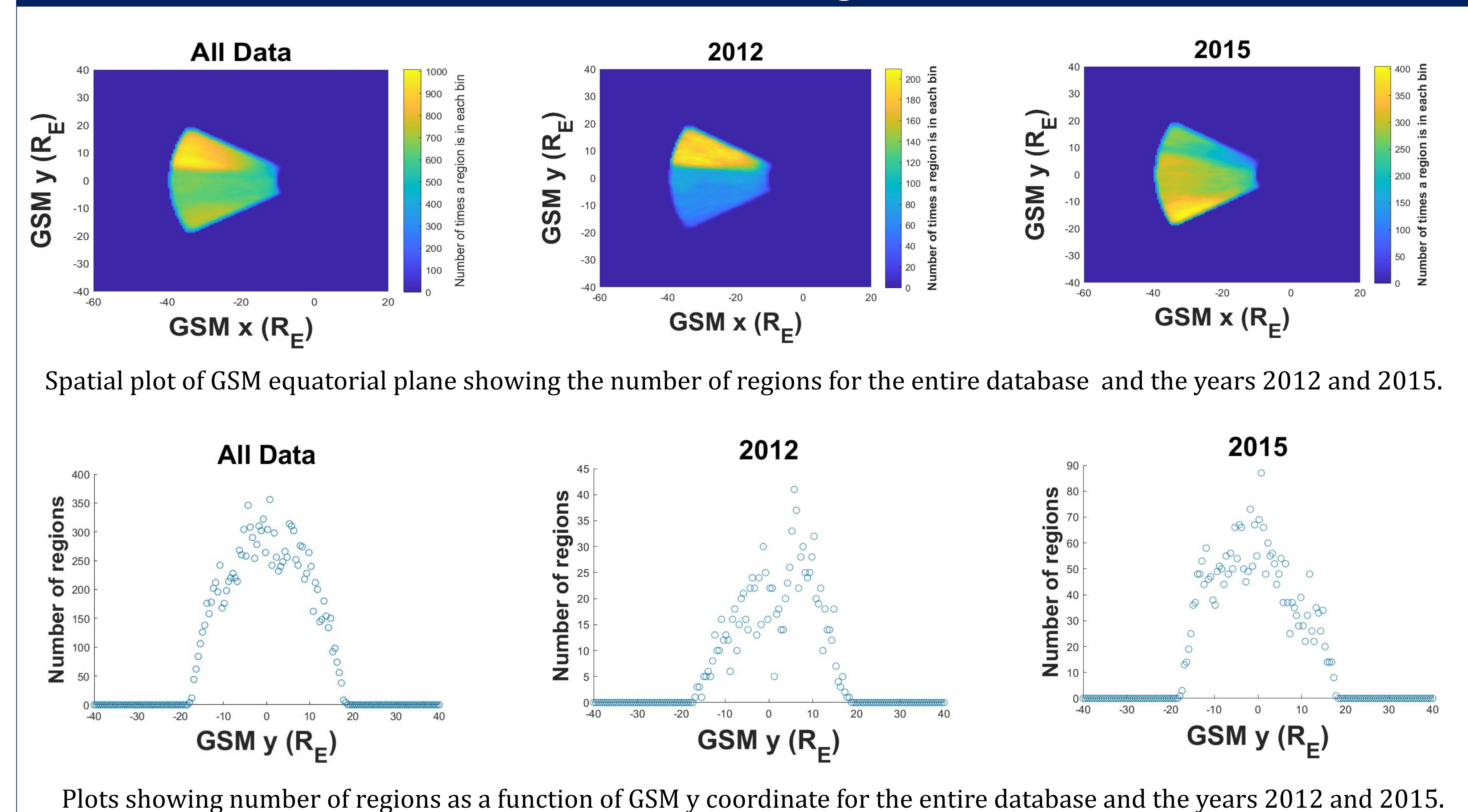
## Methodology

- A method to calculate the ion temperature maps from TWINS ENA data has been developed by Dr. Amy Keesee.
- This has been used to calculate ion temperature maps from TWINS ENA imagers with 10-minute cadence. The database will be available on CDAWeb.
- An automated detection algorithm has been developed by Dr. Roxanne Katus and Dr. Amy Keesee to identify the regions of enhanced ion temperature which are likely to be associated with the mesoscale phenomena in the magnetotail.
- We are conducting a statistical study on the identified regions to understand their general characteristics such as size, location, storm phase, etc.

## Regions Identified using the Algorithm



## Number of Regions



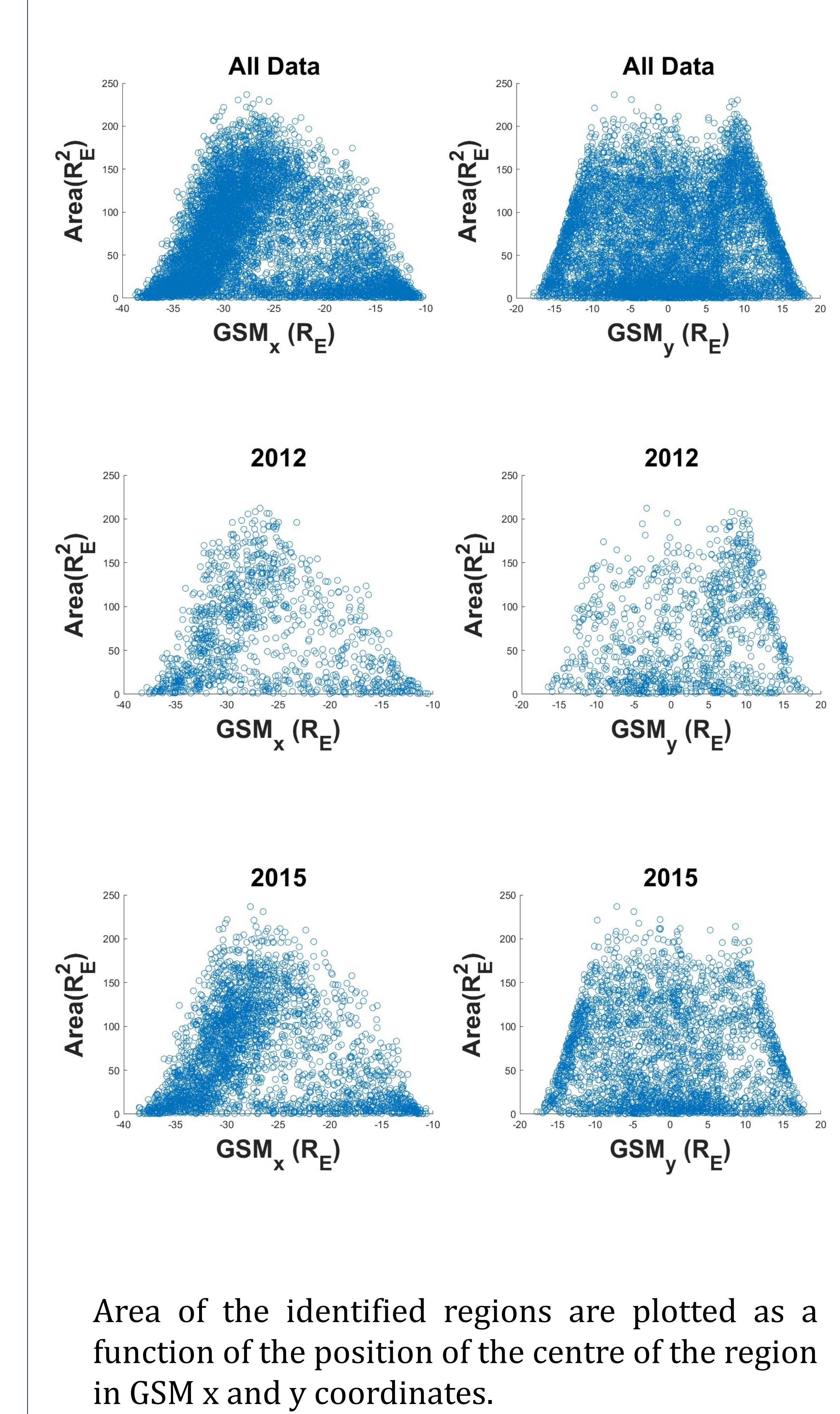
## Discussion and Future Work

We calculated the area, location of the identified regions and the number of regions identified in each bin were plotted spatially (GSM equatorial plane) and as a function of GSM y coordinate for the entire database. We observed there to be more regions towards the dawn for certain years, as seen in 2015. We will conduct further statistical analysis of the identified regions and study their characteristics and correlation to storm phase, solar cycle, season, etc.

## Acknowledgements

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## Area of the regions identified



## References

Keesee, A. M., Katus, R., Tibbetts, J., Liu, J., Zhang, X., & Sorathia, K. A. (2022). Automated detection algorithm for mesoscale heated regions in TWINS ion temperature maps. *Journal of Geophysical Research: Space Physics*, 127, e2022JA030464. <https://doi.org/10.1029/2022JA030464>

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