Auroral omega bands: Solar wind drivers and role in storm and substorm processes

Vivian Cribb (1, 2), T. I. Pulkkinen (1), B. Gallardo-Lacourt (2, 3), L. Kepko (2), N. Partamies (4)

(1) University of Michigan, Ann Arbor, MI, USA (2) NASA GSFC, Greenbelt, MD, USA
(3) Catholic University of America, Washington D.C., USA (4) University Centre in Svalbard, Longyearbyen, Norway

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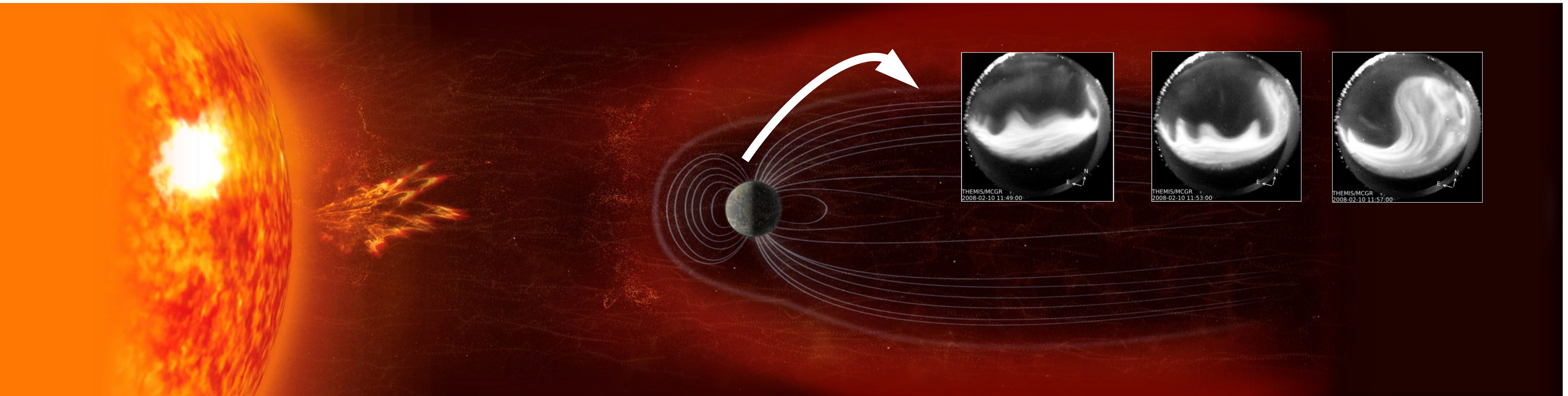
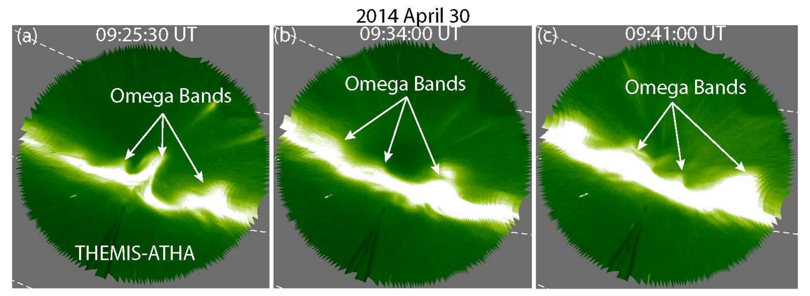


Introduction

- Omega bands are mesoscale auroral structures
- Omega bands appear as eastward-moving quasi-periodic protrusions in the auroral oval
- Typically observed in the post-midnight sector



Omega bands seen over Athabasca on 2014-04-30

- Historically seen in geomagnetically active conditions
- Possible drivers include bursty bulk flows in the tail or Kelvin-Helmholtz instability in the plasma sheet
- Our previous statistical study shows omega bands are associated with sustained enhancements in solar wind density (Cribb et al. 2024)
- **We expand our analysis of to 205 omega band events from 1996-2007 (Partamies et al. 2017)**
- We classify our list by concurrent solar wind events (**CME**, **SIR**, **Neither**) and concurrent solar wind density (**low**, **mid**, **high**) to determine the variation in the solar wind, inner magnetosphere, and ionosphere

Table 1. Solar Wind Categorization of Omega Band Events Used in this Study

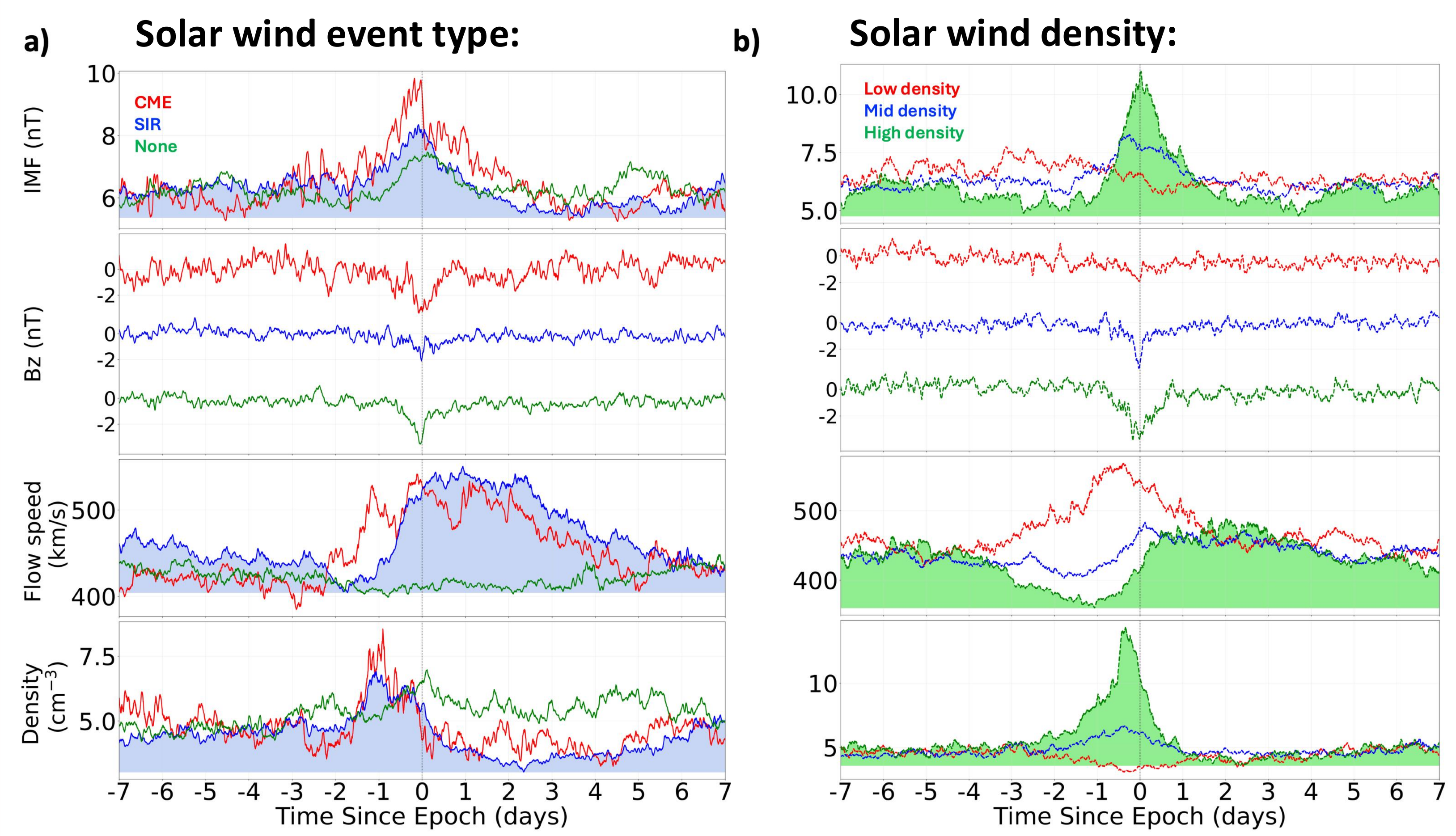
	CME	SIR	None	Total
$n < 5$	10	27	25	62
$5 \leq n < 10$	9	37	46	92 (one duplicate)
$10 \leq n$	8	22	21	51
Total	27 (one event missing data)	86	92	

Instrumentation

- Partamies et al. (2017) use MIRACLE to identify omega band events
- We use Cane & Richardson (2010) to identify CME events and Grandin et al. (2019) to identify SIRs
- Solar wind measurements are taken from OMNI, inner magnetosphere magnetic field measurements are taken from GOES, and auroral electrojet/ring current measurements are taken from SuperMAG (Gjerloev 2012)

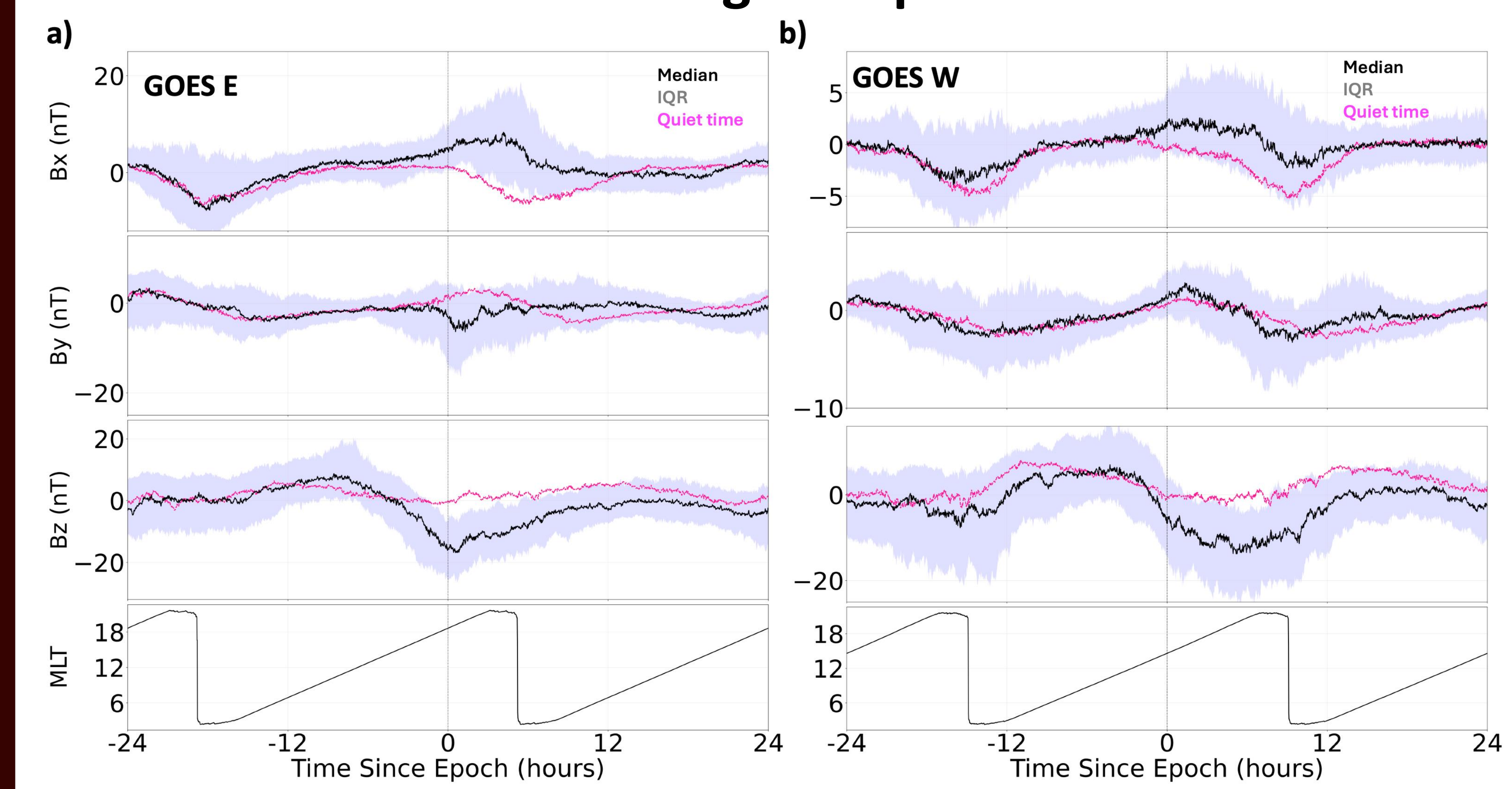
Abstract **Preprint** **CV**

Solar Wind



Two-week superposed epoch analysis of solar wind IMF, Bz, flow speed, and density taken during 205 omega band events separated by (a) concurrent solar wind events and (b) solar wind density. Time zero is the time of the omega band observation.

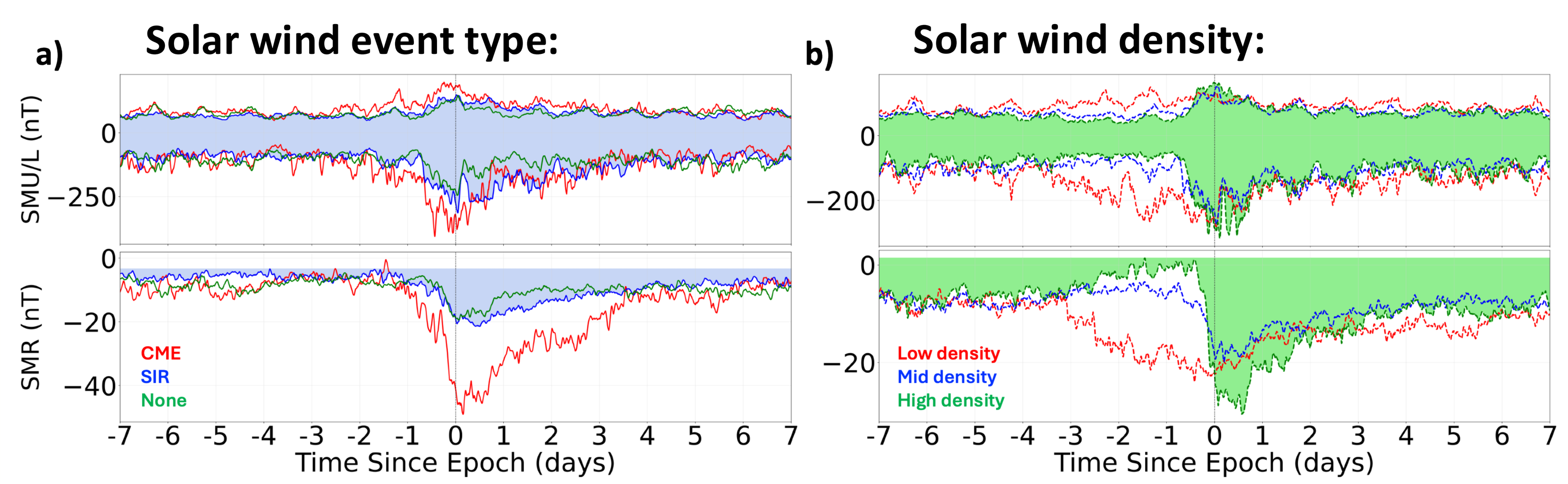
Inner Magnetosphere



Two-day superposed epoch analysis of the components of the magnetic field and the magnetic local time measured by (a) GOES East and (b) GOES West during all 205 Ʊ band events. Time zero indicates the time of the omega band observation.

- **Omega bands are observed during solar wind configurations characterized by either high solar wind flow speed or high solar wind density**
- **The appearance of omega bands is found to correlate with peaks in the intensity of the ring current and auroral electrojets**
- **An inner magnetospheric response consistent with an intensification of a global current system is measured when omega bands appear**

Geomagnetic Response



Two-week superposed epoch analysis of the auroral electrojets and ring current measured during 205 omega band events separated by (a) concurrent solar wind events and (b) solar wind density. Time zero is the time of the omega band observation.

Acknowledgments

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References

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