



Royal Netherlands  
Meteorological Institute  
*Ministry of Infrastructure  
and Water Management*

# Space Weather Timeline Viewer

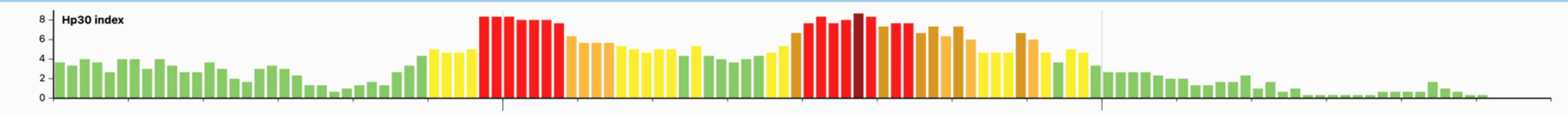
Demo for the Data, Analysis, and Software in Heliophysics meeting  
Oct 9-11, 2023 at JHU/APL in Laurel MD

**Eelco Doornbos, KNMI - presenting remotely - 2023-10-11**

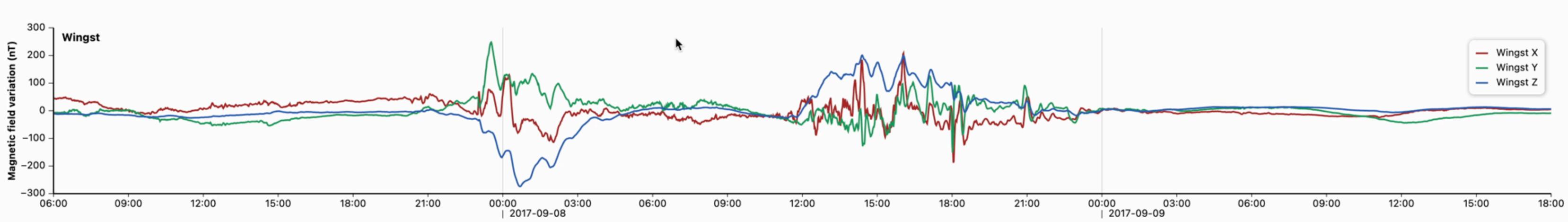
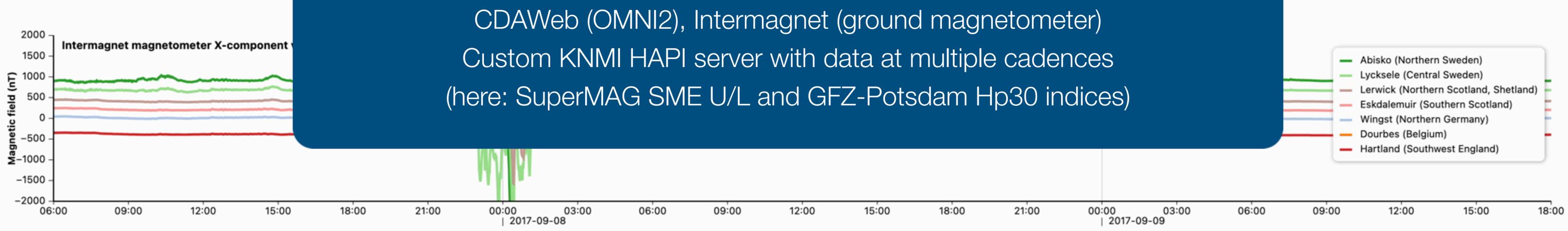
# Project goals

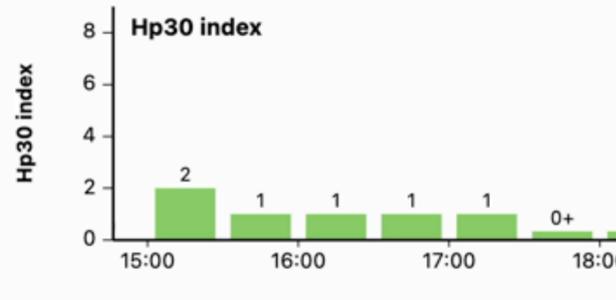
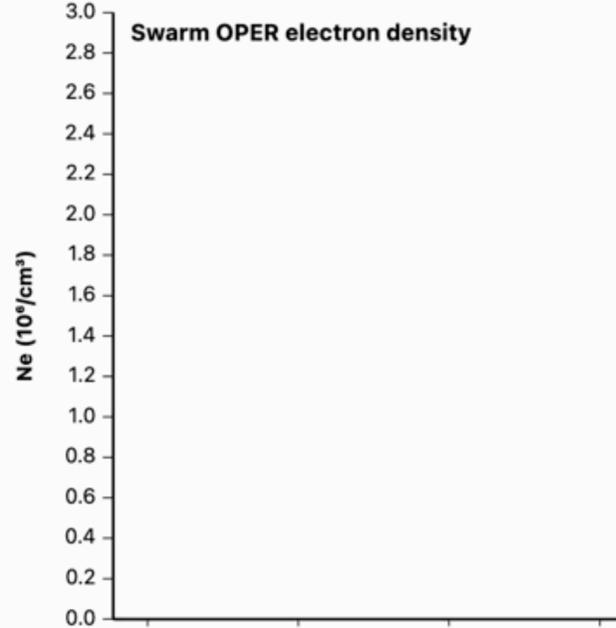
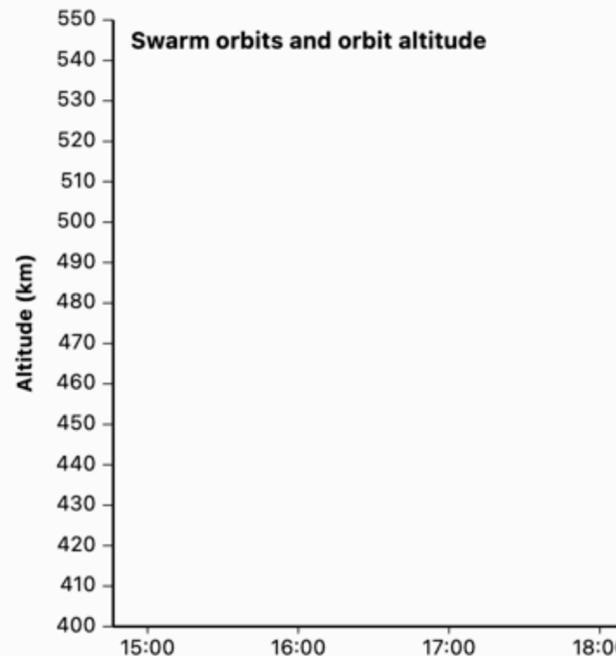
- Real-time monitoring of space weather data for overview and context:
  - Show geomagnetic indices together with solar wind data,
  - Show model forecasts together with observations.
- Training for space weather monitoring operators:
  - Look at important events in the past, so not just recent data,
  - Assist in space weather case studies.
- Investigate use cases for underutilised and new data sources:
  - Currently funded project from ESA Swarm-DISC: visualisation of (in-situ) data and models on the thermosphere-ionosphere, Swarm, GDC, ...





**Plot time series data from any HAPI server:**  
CDAWeb (OMNI2), Intermagnet (ground magnetometer)  
Custom KNMI HAPI server with data at multiple cadences  
(here: SuperMAG SME U/L and GFZ-Potsdam Hp30 indices)

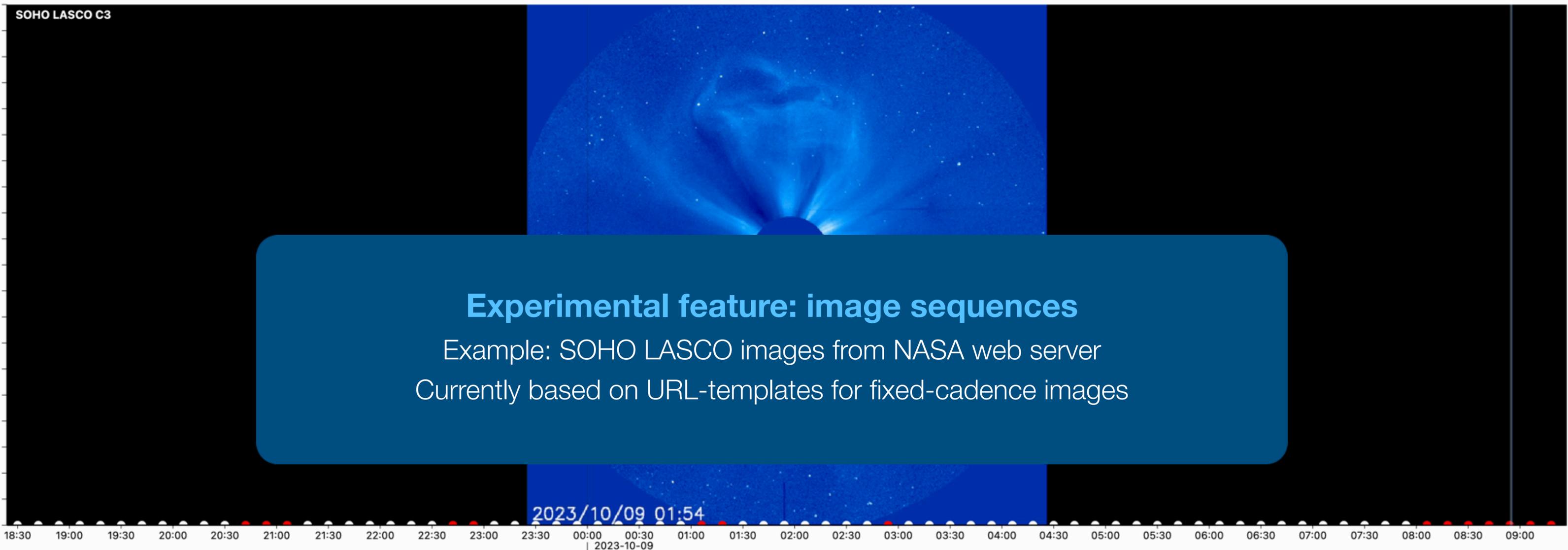




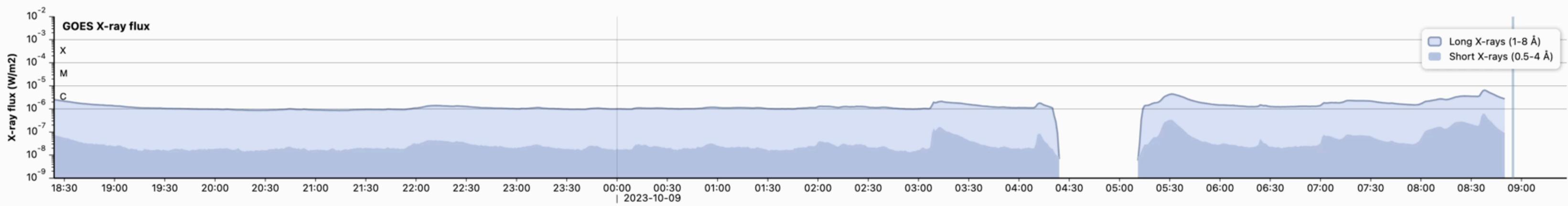
**In-situ thermosphere-ionosphere data from LEO satellites**  
Demonstration in the framework of the Swarm-SWITCH project  
3D-rendered Earth with solar illumination, geomagnetic grid and satellite orbits

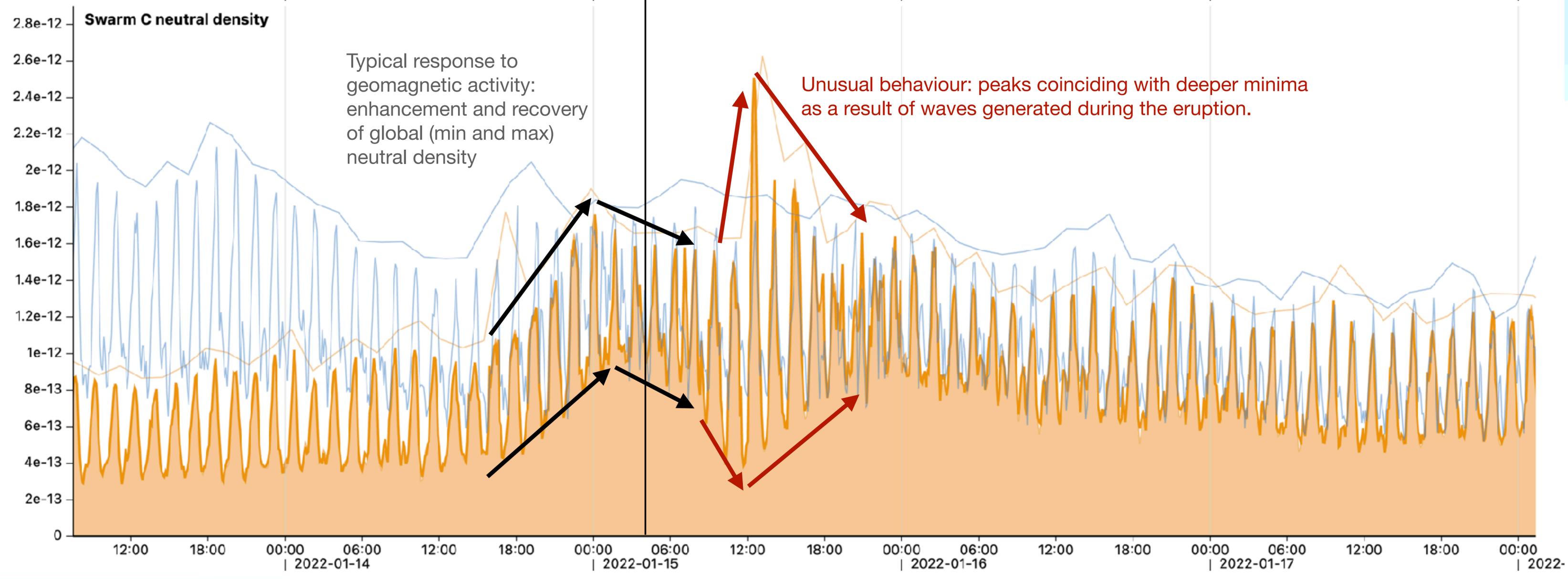
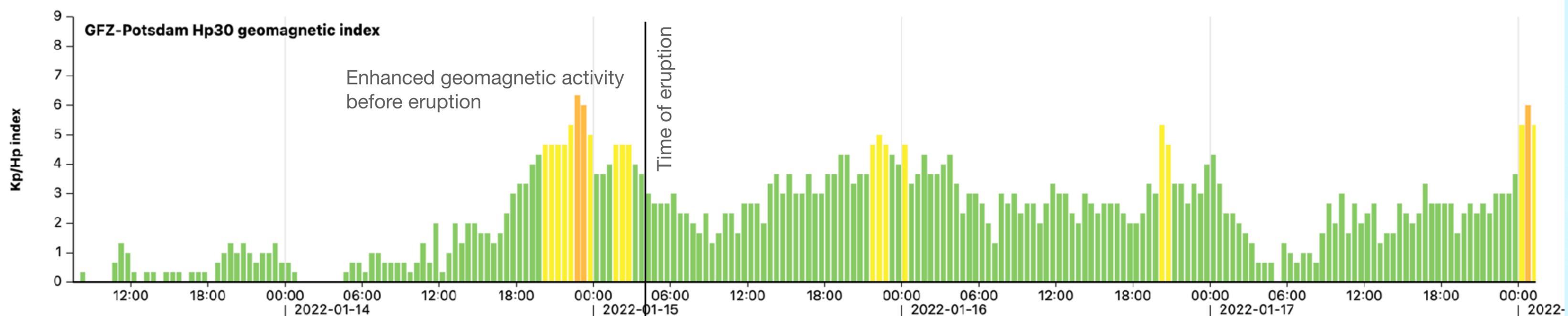
- Swarm A Ne long-term min/max
- Swarm B Ne long-term min/max
- Swarm A Ne long-term mean
- Swarm B Ne long-term mean
- Swarm A Ne 2Hz OPER data
- Swarm B Ne 2Hz OPER data
- Swarm C Ne 2Hz OPER data

Hp30 index



**Experimental feature: image sequences**  
Example: SOHO LASCO images from NASA web server  
Currently based on URL-templates for fixed-cadence images





# Outlook

- Invitation to collaborate:
  - Try the timeline viewer at: <https://spaceweather.knmi.nl/viewer/>
  - Data providers: make use of the HAPI-server standard
  - Space scientists and space weather operators: create and share your own viewer layouts
  - Current development goals: 1. robustness, 2. documentation, 3. reusable components. Keeping good UI performance and reasonable data server load
- Project is open-source:
  - <https://gitlab.com/KNMI-OSS/spaceweather/knmi-hapi-timeline-viewer>
  - <https://gitlab.com/KNMI-OSS/spaceweather/knmi-hapi-server>
  - <https://gitlab.com/KNMI-OSS/spaceweather/hapi-ingest-scripts>

