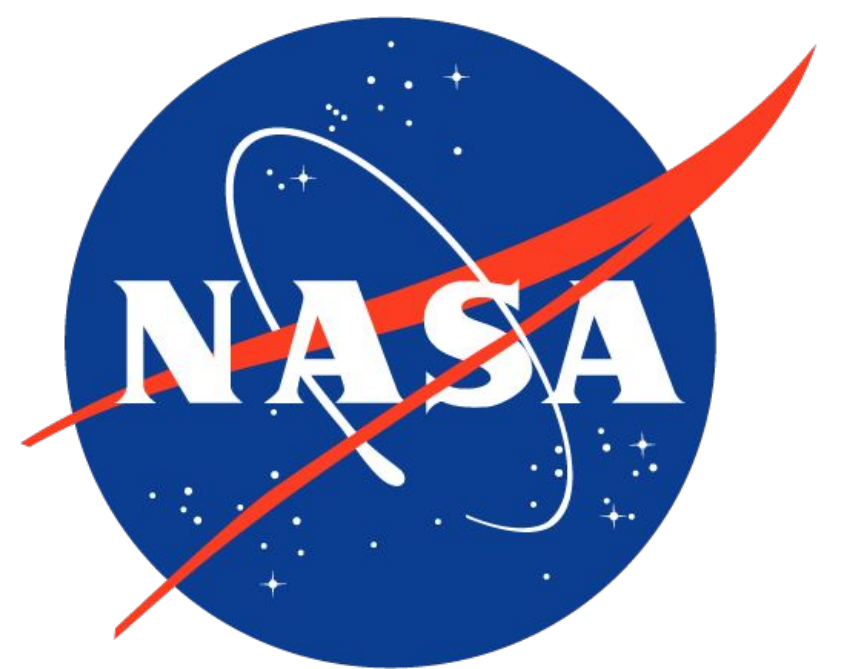# SEA5: Space Environment Automated Alerts & Anomaly Analysis Assistant

Computer Science & IT
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1. Context

An understanding of space weather is critical to the success of all of NASA's missions. With knowledge of the space weather environment, mission operators can preempt the possibly damaging effects of space weather anomalies. **Existing space weather tools lack the ability to easily organize information by relevance to a particular mission or location.** The Community Coordinated Modeling Center (CCMC) recognized this need and proposed the Space Environment Automated Alerts & Anomaly Analysis Assistant (SEA5).
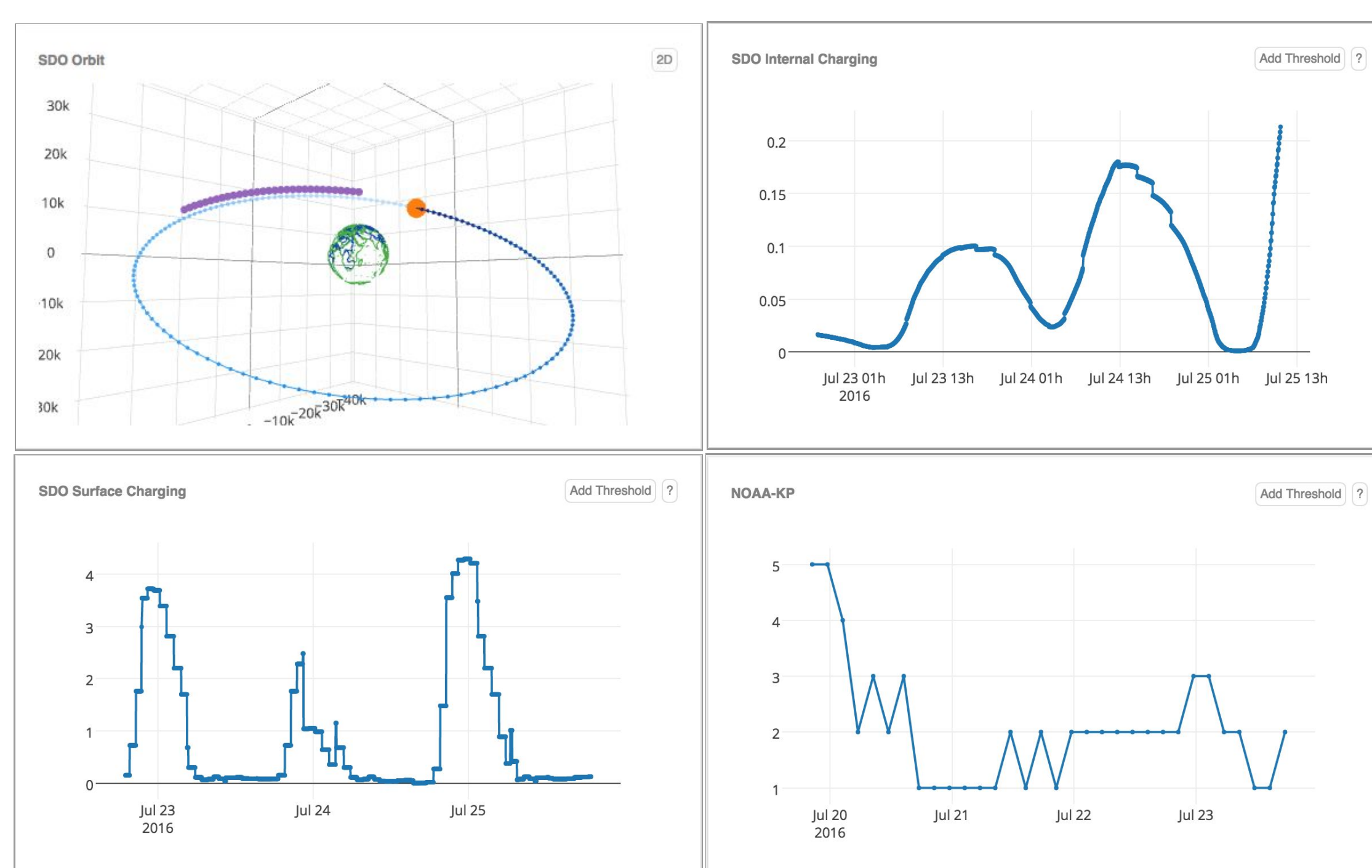
2. Overview of SEA5
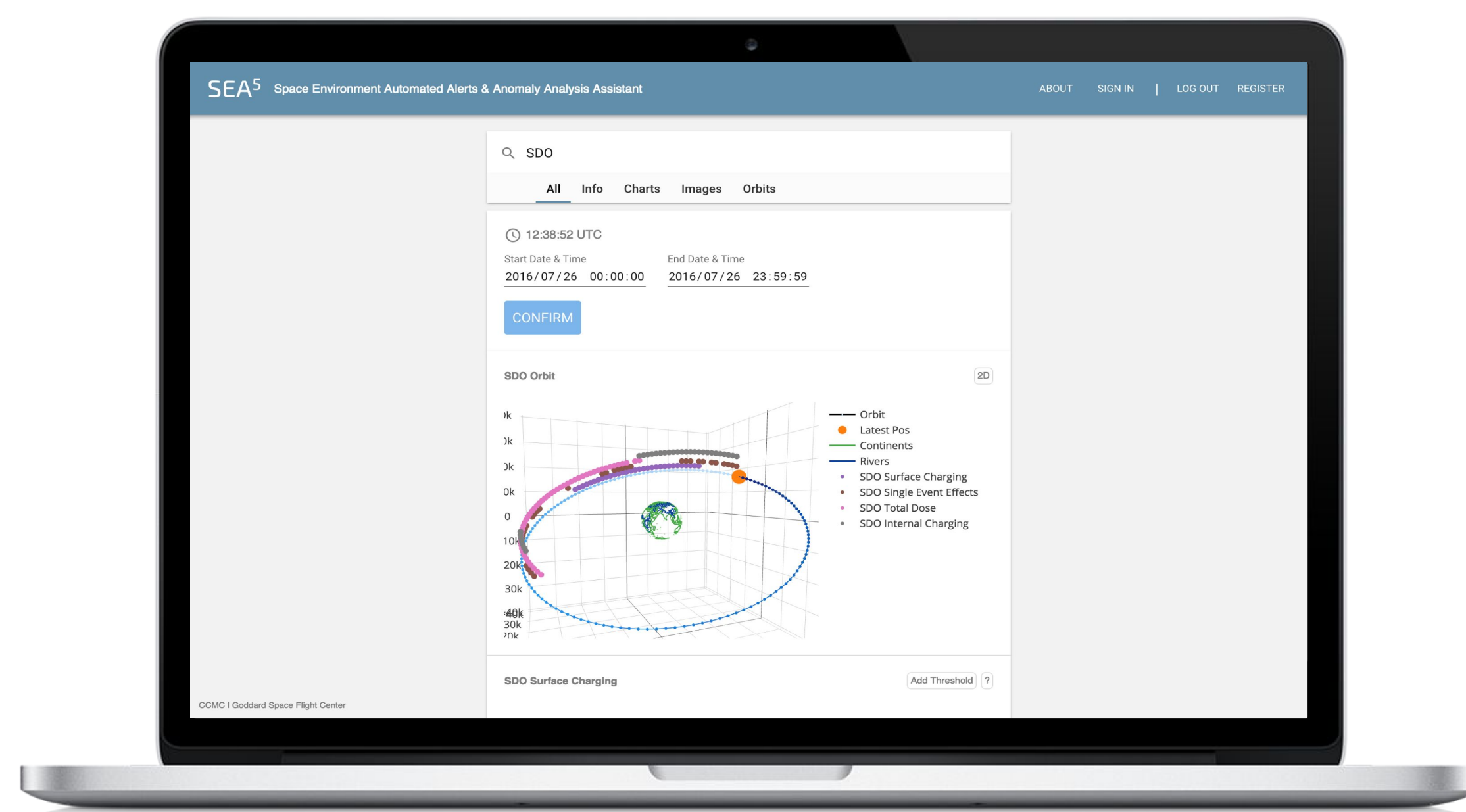
Screenshot of the current state of SEA5

SEA5 is a web application that aims to provide **past, present, and predicted space environment information** for specific missions, orbits, and user-specified locations throughout the heliosphere, geospace, and on the ground.
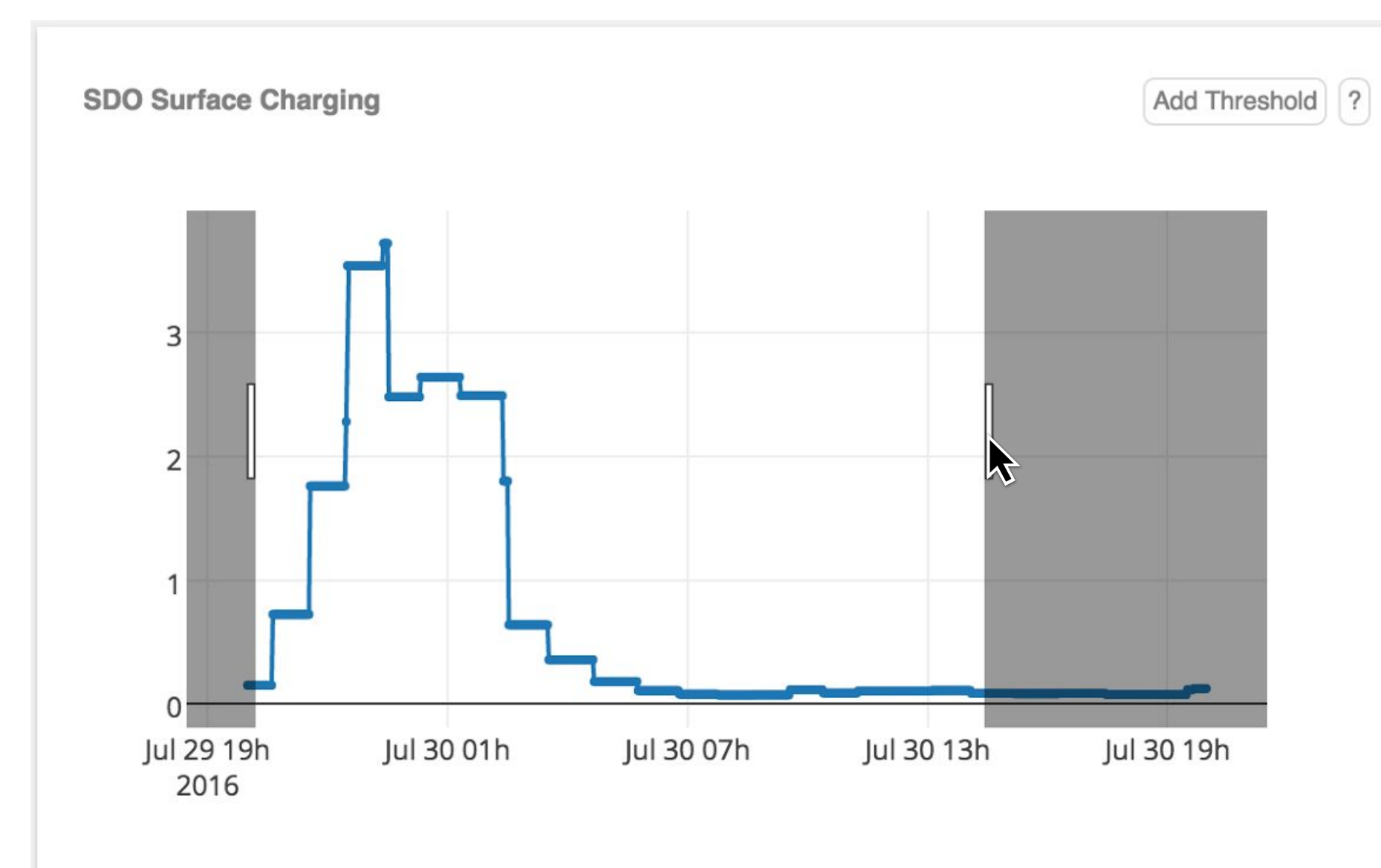
Relevant space weather information

Four SEA5 cards displaying data of the SDO orbit, SDO internal charging, SDO surface charging, and NOAA KP index

SEA5 allows users to pick a satellite and then see a **dynamically generated list of cards that present spatially relevant space weather information**.

Intuitive and interactive data

Example of a SEA5 card displaying a hazard quotient. Hazard quotients represent the instantaneous likelihood of a space weather anomaly, where a value of 1 represents an average likelihood

SEA5 displays data through intuitive and interactive cards. One example of how SEA5 makes data more intuitive is by calculating hazard quotients. **Hazard quotients provide an at-a-glance way of checking the space weather conditions surrounding a satellite.**

Built for NASA mission operators and researchers

SEA5 is **primarily intended to provide NASA mission operators with a way to easily access data that is relevant to their specific mission** and to receive warnings about hazardous conditions.

However, SEA5 will also be useful to researchers who would like to view space weather information grouped by location. SEA5 could be especially useful to study the correlations between space weather and satellite operational anomalies.

3. How does SEA5 work?

Powered by a 3D spatial database
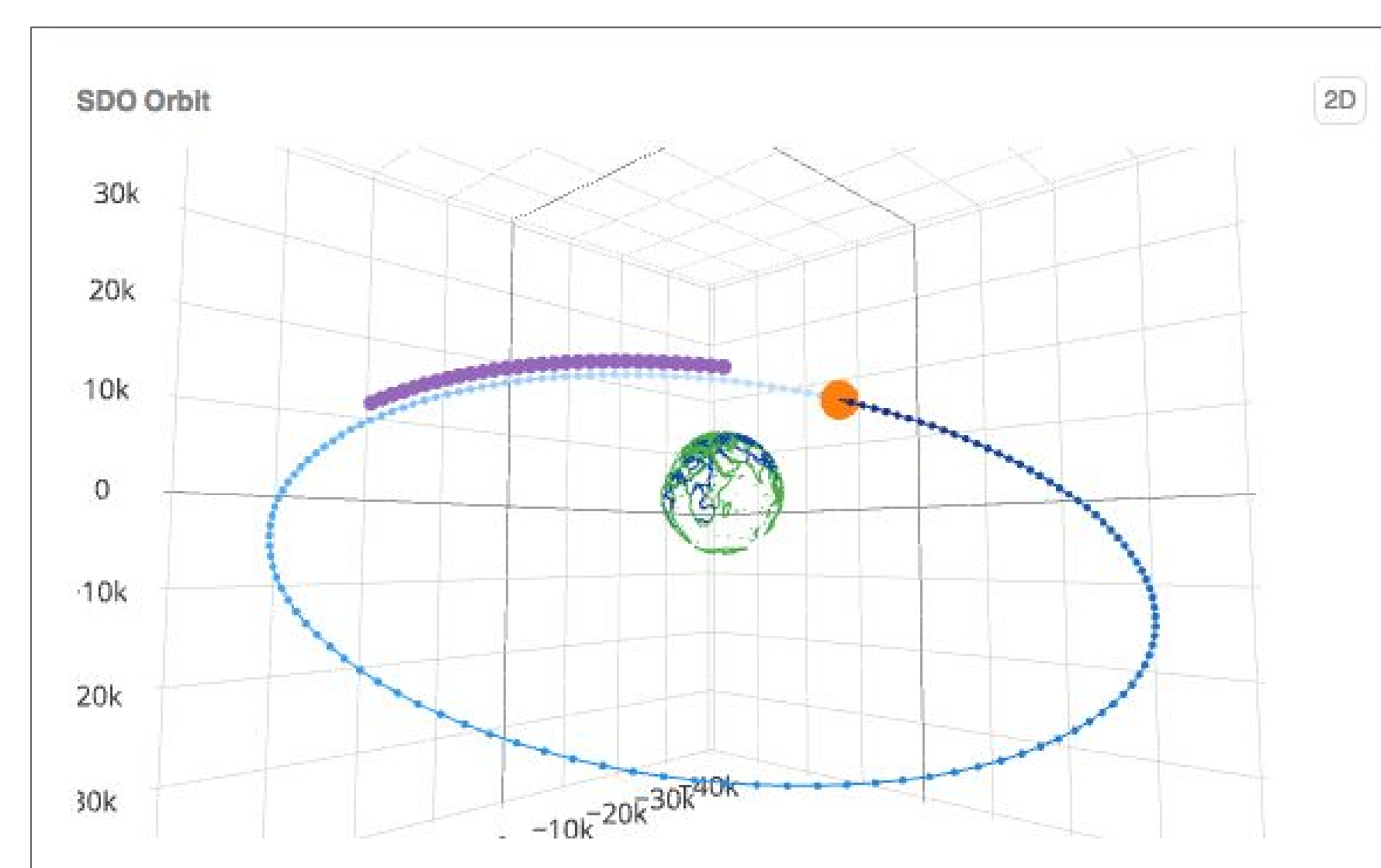

SEA5 orbit card displaying the 3D orbit of SDO

Powering SEA5 is Parallel Universe's Spacebase, a 3D spatial database that is capable of hosting a **live simulation of the solar system.** This simulation enables SEA5 to **dynamically find all of the space weather information that is within a certain radius of a satellite** or location.

Modern, modular user interface built using Google Polymer

The code:

```
1  <!-- Import element -->
2  <link rel="import" href="components/cards/card-linechart.html">
3
4  <!-- Use element -->
5  <card-linechart data="[[data]]"></card-linechart>
```

The result:
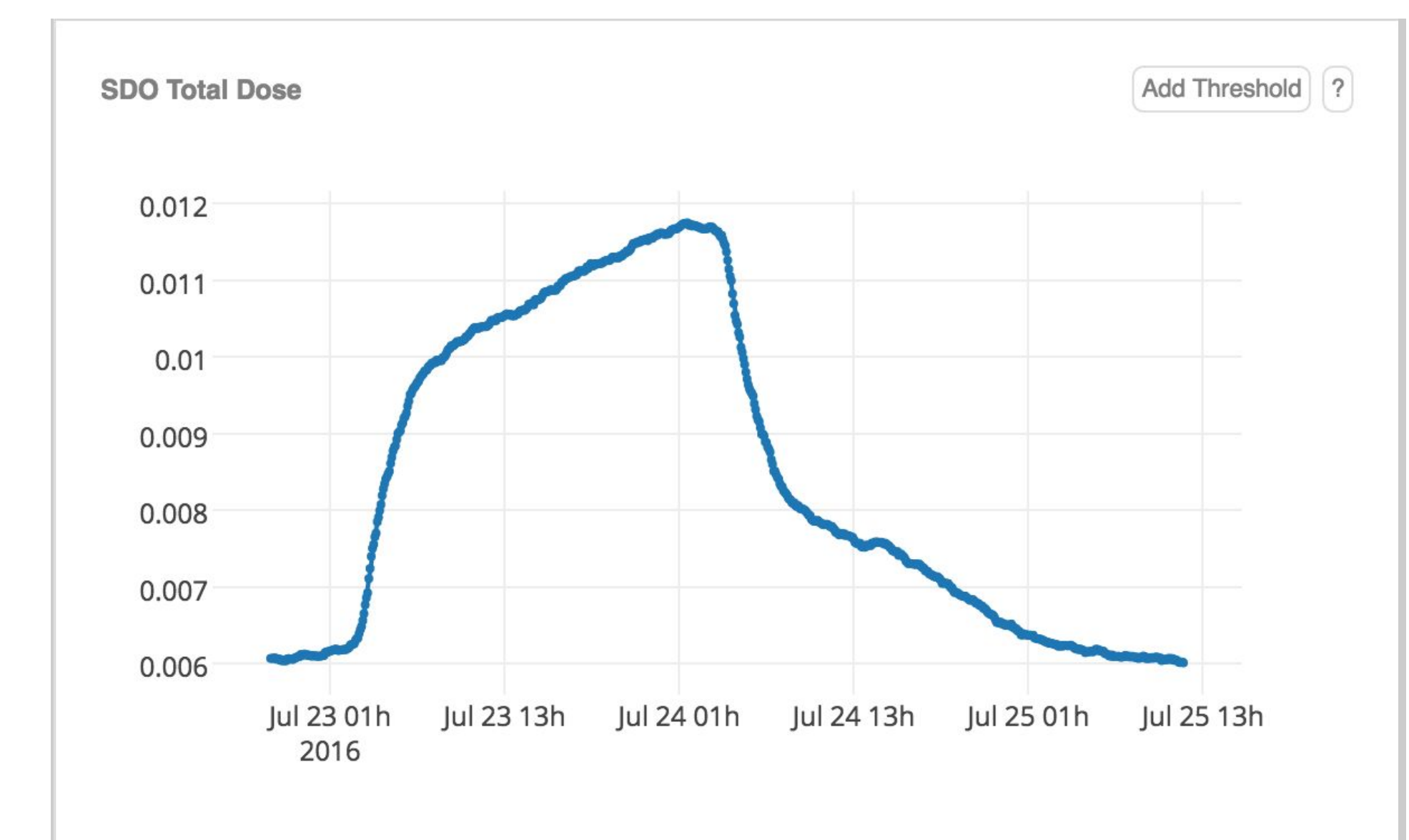
Example of the ease of developing with web components

SEA5's frontend takes advantage of Google Polymer, a JavaScript library that enables developers to define **custom, reusable web components.** By using this new web component standard, SEA5 is setting a precedent for future projects at the Community Coordinated Modeling Center (CCMC) to share web components, **reducing the time spent on coding fundamental elements and, therefore, reducing development costs.**

4. Future work

We plan to expand SEA5 in many areas, including providing **coverage for more NASA missions**, options for **default and custom thresholds and alerts**, **coronal mass ejection (CME) warnings**, and the ability to **correlate historic space weather events and anomalies**.

5. References and acknowledgements

O'Brien, T. P. (2009), SEAES-GEO: A spacecraft environmental anomalies expert system for geosynchronous orbit, Space Weather, 7, S09003, doi:10.1029/2009SW000473