

# Harnessing the Digital Continuum for Science using the National Data Platform (NDP)

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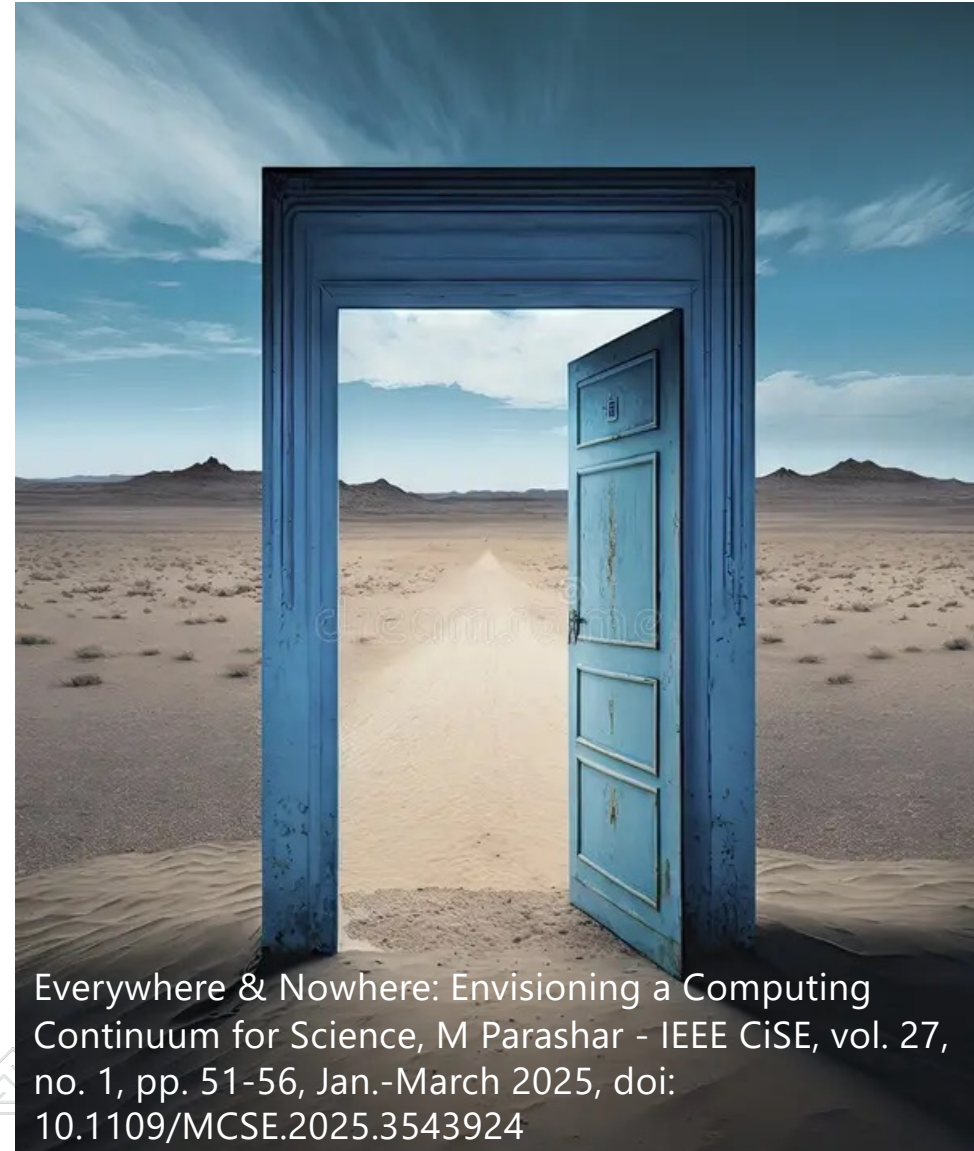
**InPEX 2026**

April 23, 2026, Brazil

# A Computing Continuum for Science

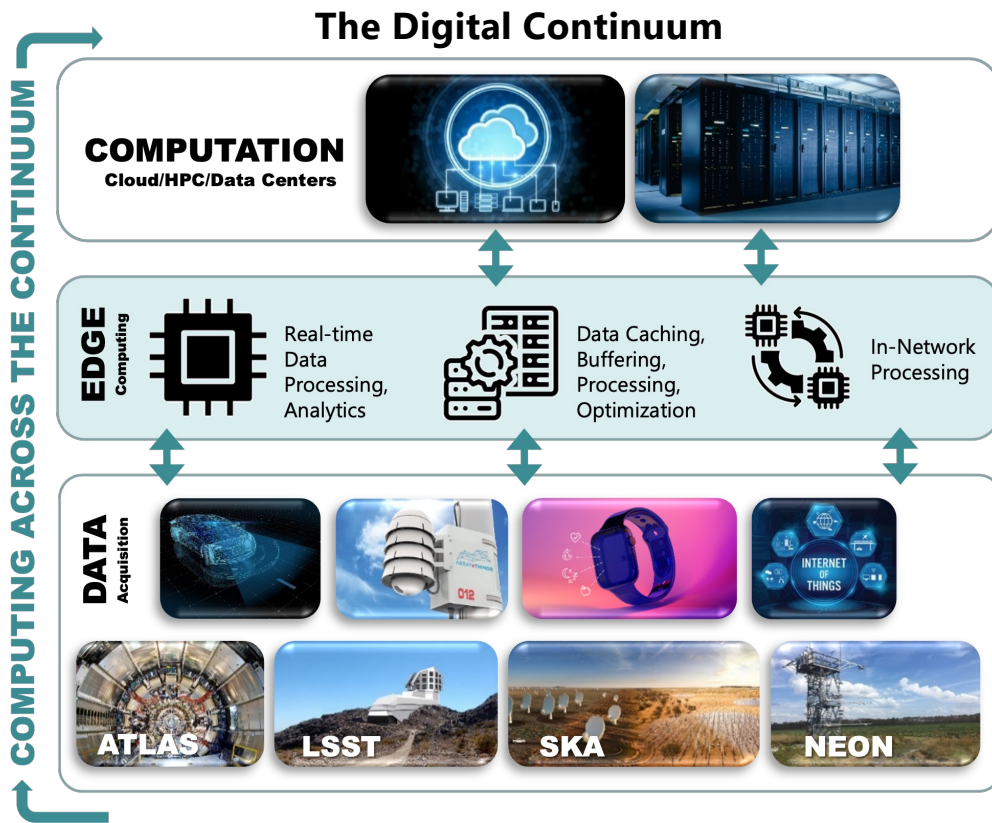
**Everywhere**

**&  
Nowhere**



Everywhere & Nowhere: Envisioning a Computing Continuum for Science, M Parashar - IEEE CiSE, vol. 27, no. 1, pp. 51-56, Jan.-March 2025, doi: 10.1109/MCSE.2025.3543924

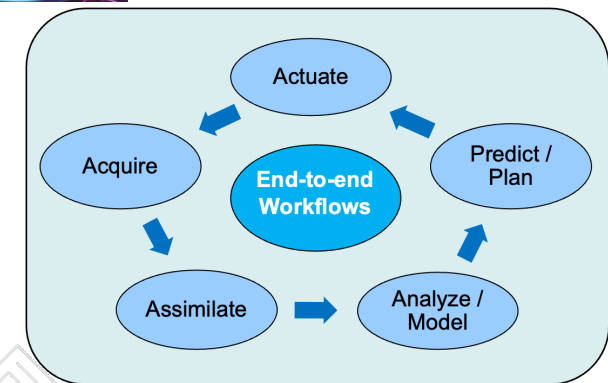
# A Computing Continuum for Science



## Transcendence of AI



## End-to-end workflows



# Urgent Computing: Computing under Uncertainty, Constraints

**DEFINITION:** Computing under **strict time** and **quality constraints** to support decision making with the desired confidence within a defined time interval



**Urgent applications need to react to unforeseen events and to manage complex cost/benefit tradeoffs to meet constraints**

- Steer online/on-demand computations based on data/content
- Support urgency constraints for timely decision-making
- Balance “costs” of computations with value added, availability of resources, etc.

• ...

# National Data Platform

.... enabling interoperable data and AI integrated workflows.



**Open Data, Available Access and AI Services**

Building the nation's federated data ecosystem. Explore data. Run analyses. Transform AI education.

Explore our catalog of datasets >

**5590**  
data collections and livestreams

**5**  
data and AI services

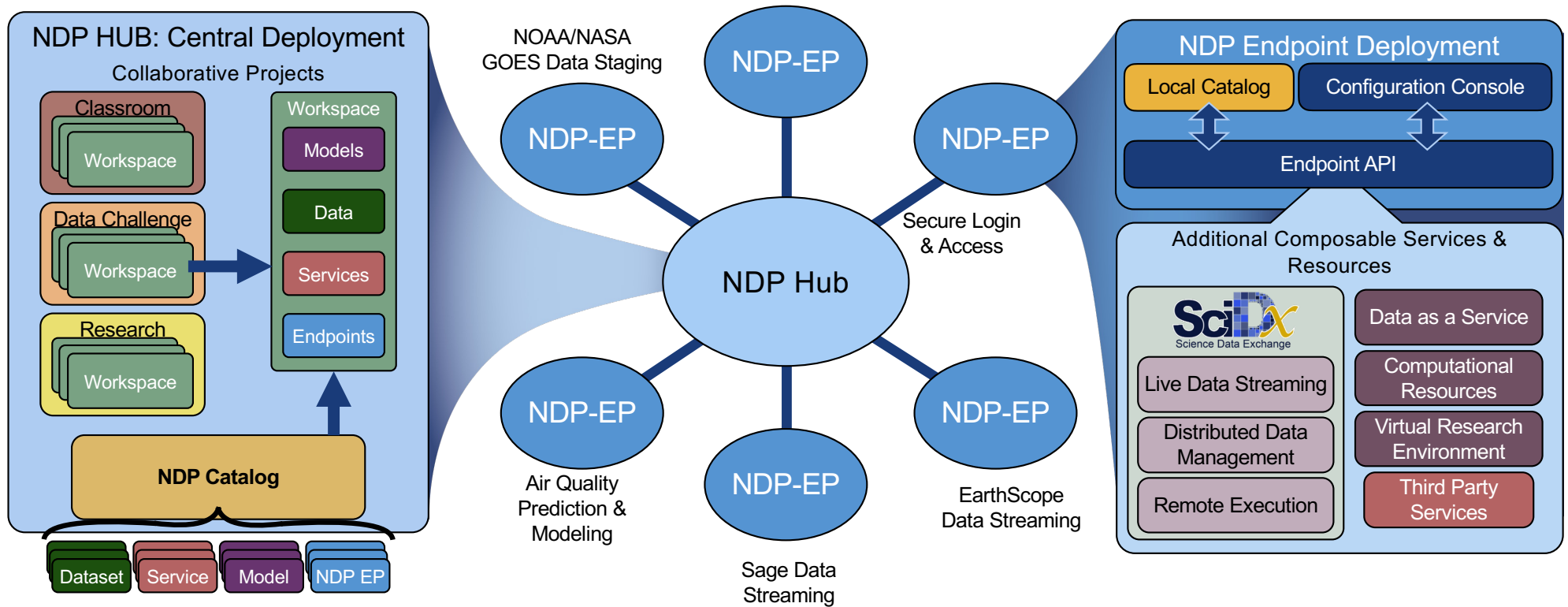
**921**  
registered users

A **broad, federated** and **extensible** data ecosystem to promote collaboration, innovation and customizable use of data on top of existing national infrastructure capabilities.

<https://www.nationaldatapatform.org/>



# NDP Architecture: A Federated Data Ecosystem



# Some NDP Endpoints

- SAGE Edge Computing Endpoint
- Adaptive Air Quality Sensing Endpoint
- EarthScope Data Streaming Smart (Agentic) Endpoint
- Remote Sensing Earthquake Visualization Endpoint
- Image-Based Water Monitoring Endpoint

The collage features several key components:

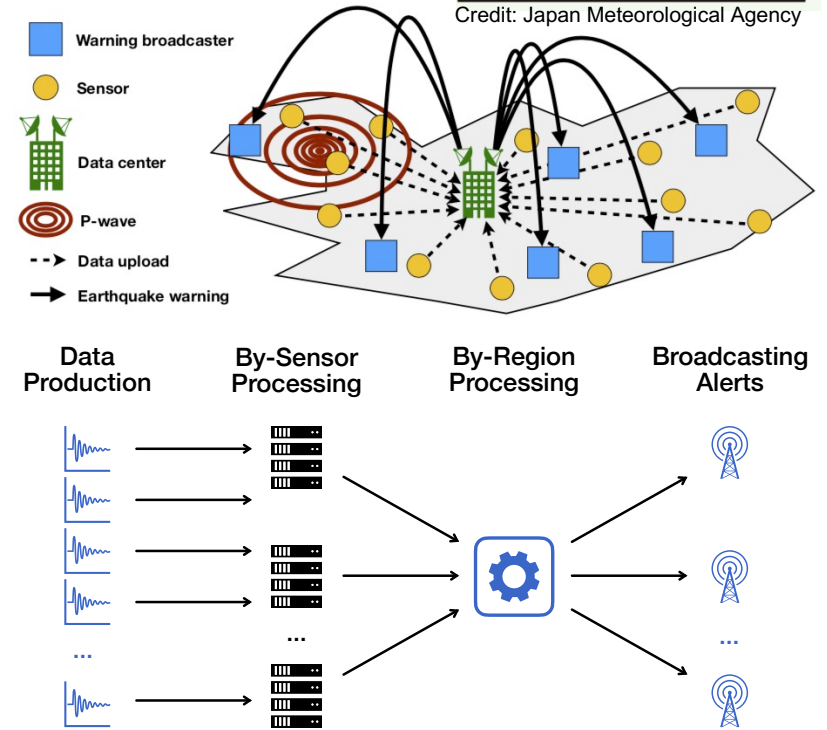
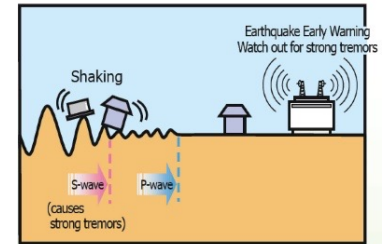
- SAGE Architecture Diagram:** Shows the SAGE NDP-Endpoint (Kafka Server, Dataset Catalog, SciDx MCP Server, Sage MCP Server) connected to Sage Cloud and Sage Nodes (Sensor Nodes Data).
- EarthScope Consortium:** A data visualization showing a "Moving average of all stations in the derived stream" with a line graph and a map of the EarthScope Consortium.
- Remote Sensing Earthquake Visualization:** A map showing a color-coded earthquake visualization with a line graph below it.
- Image-Based Water Monitoring:** An aerial photograph of a river with a red line indicating a monitoring path.

Each image is accompanied by a QR code for access.

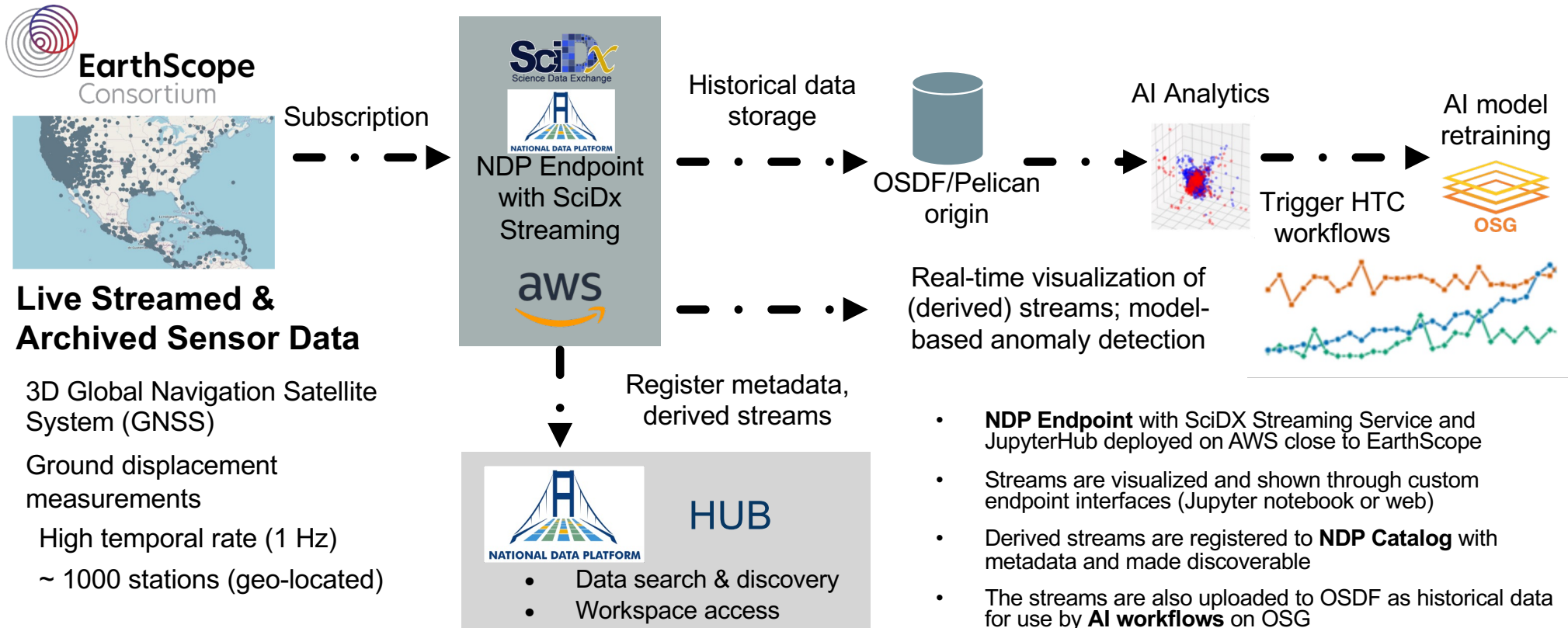
# Earthquake Early Warning

- **Earthquake Early Warning (EEW)** requires earthquakes to first be characterized (magnitude, location, speed of displacement, etc.)
  - A **single data source** doesn't able to cover a whole spectrum of events:
    - Seismometers are good for the smaller earthquakes (< 6.5); High-precision GPS are good for larger earthquakes.
  - **Centralized data processing** cannot support real-time, high volume data processing
- **Goal:** Combine **multiple data sources** to cover the whole spectrum of events; leverage the **CI continuum** for preserving latency and resiliency

Fauvel, K, et al. "A distributed multi-sensor machine learning approach to earthquake early warning," Proceedings of the AAAI 2020, **Outstanding Paper Award in Artificial Intelligence for Social Impact.**



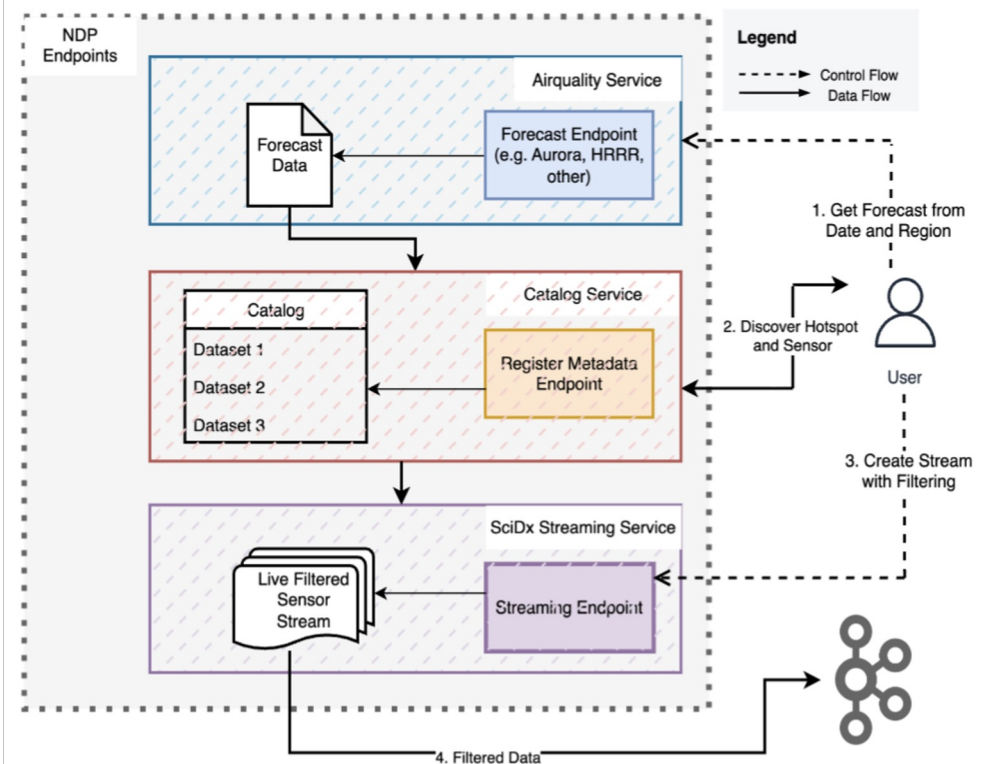
# EarthScope Early Earthquake Detection Workflow



Contact: Charles Meertens, University of Colorado and Dave Mencin, EarthScope Consortium

# Adaptive Air Quality Sensing

- **Forecast ingestion:** Run Aurora on forecast inputs and catalog the forecast output in NDP.
- **Hotspot detection:** Find PM2.5 hotspots and turn them into persistent trigger events.
- **Adaptive ingestion:** Use triggers and NDP metadata to select nearby sensors and create streams only from those sensors.
- **Dissemination:** Publish activated streams via SciDx Streaming to downstream consumers (alerts/analytics/storage).



# Thank you!



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