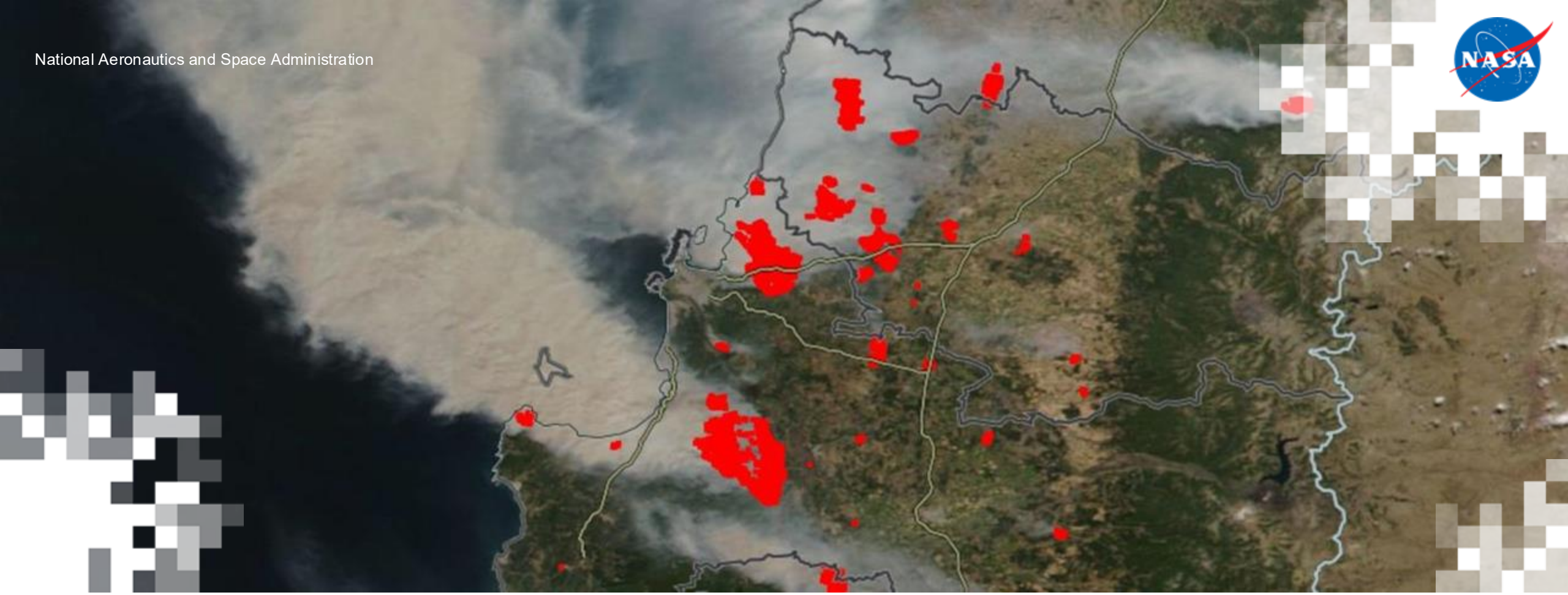
National Aeronautics and Space Administration



Introduction to NASA Earth Observations and Tools for Wildfire Monitoring and Management

Part 3: Data Access and Visualization

Otmar Olsina (GST), Dylan Mendes (SSAI), Asen Radov (ESSIC), & Melanie Follette-Cook (NASA GSFC)

April 30, 2025

Training Outline

Part 1

Introduction to Satellite-Based Active Fire Detection using FIRMS

April 16, 2025

Part 2

Wildfire Monitoring and Evaluation

April 23, 2025

Part 3

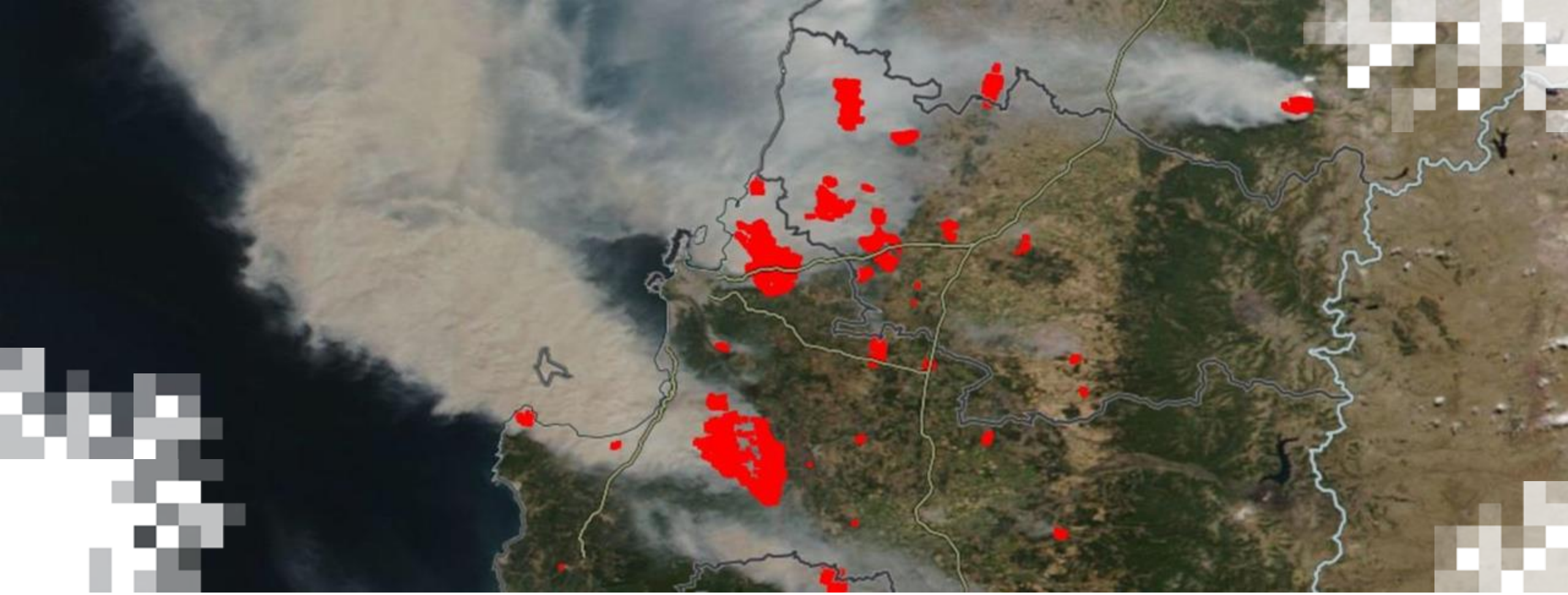
Data Access and Visualization

April 30, 2025

Homework

Opens April 30 – Due May 14 – Posted on Training Webpage

A certificate of completion will be awarded to those who attend all live sessions and complete the homework assignment(s) before the given due date.



Introduction to NASA Earth Observations and Tools for Wildfire Monitoring and Management

Part 3: Data Access and Visualization

Part 3 – Trainers

Otmar Olsina

Principal Software Engineer
GST

Dylan Mendes

Senior Application Developer
SSAI

Asen Radov

Software Engineer
ESSIC

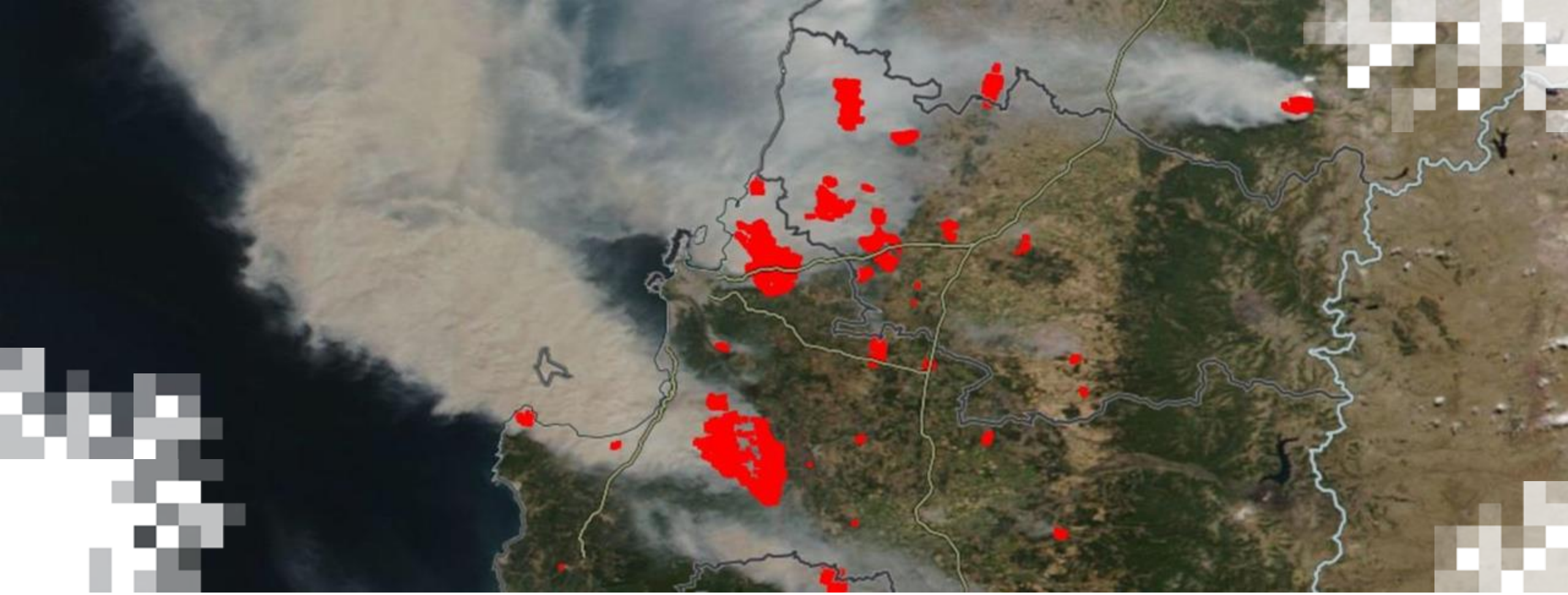
Part 3 Objectives

By the end of Part 3, participants will be able to:

- Access active fire detection data through file download, Web Map Feature (WMF), Web Map Service (WMS), and Application Programming Interface (API)
- Subscribe to receive automatic email alerts when active fire information is available for a region of interest
- Download historical fire detection data
- Visualize fire detection data in Google Earth, ArcGIS, and QGIS

How to Ask Questions

- Please put your questions in the Questions box and we will address them at the end of the webinar.
- Feel free to enter your questions as we go. We will try to get to all of the questions during the Q&A session after the webinar.
- The remainder of the questions will be answered in the Q&A document, which will be posted to the training website about a week after the training.



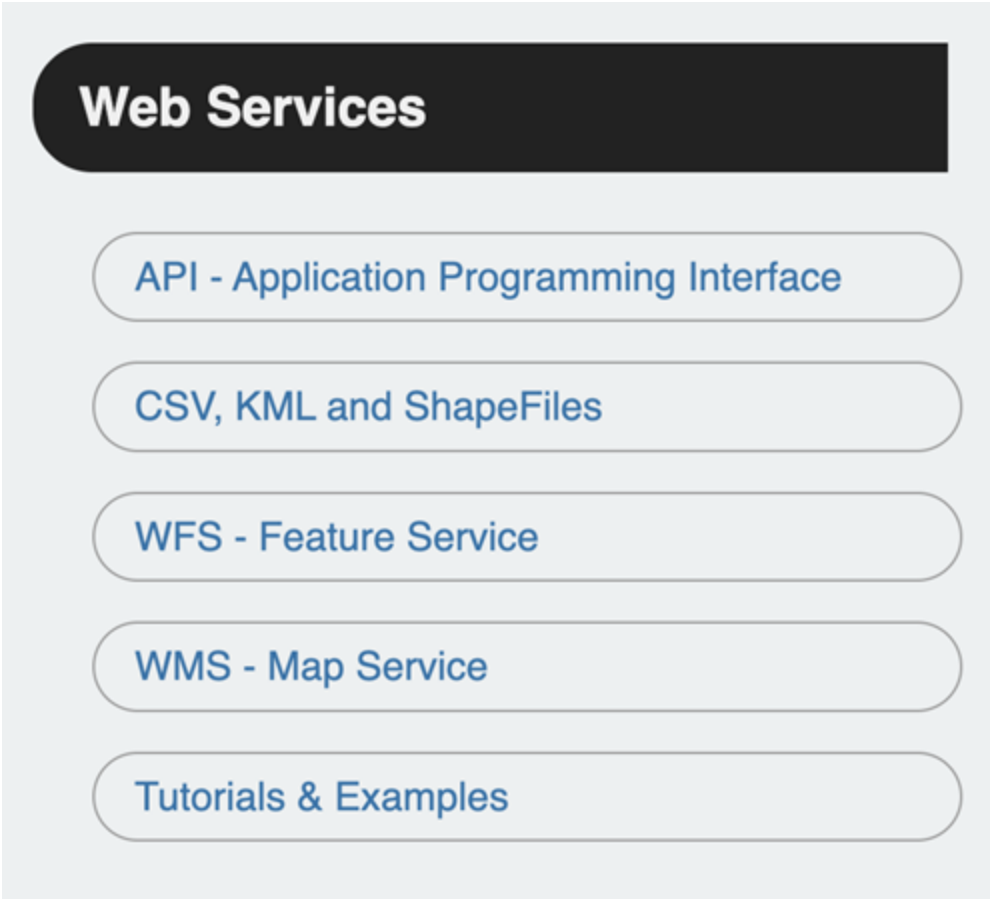
Accessing Active Fire Information

Data Access and Visualization – Outline

- Accessing Active Fire Detections through:
  - Simple download as CSV, KML or Shapefiles
  - Web Map Service (WMS)
  - Web Feature Service (WFS)
  - Application Programming Interface (API)
- Downloading archive (historical) fire/hotspot detections
- Notifications through email alerts
- Visualizing fire/hotspot detections in Google Earth, ArcGIS, and QGIS
- Tutorials and additional resources

Web Services

- Provide access to all Active Fire Detections services available through FIRMS
- **API** – Application Programming Interface
  beneficial for writing download scripts
- **CSV, KML, and Shapefiles**;
  for a quick view of recent fires, easily opened in most GIS applications (ArcGIS, Google Earth, QGIS)
- **WFS** – Feature Service
  Used in GIS or web applications for accessing real time or near-real time detailed fire data information (high-bandwidth)
- **WMS** – Map Service
  Used in GIS or web applications for quick and easy way to visualize current active fire detections (low-bandwidth)
- **Tutorial and Examples**; showing how to integrate data



Active Fire Data – CSV, KML and Shapefiles

- Easy to download file formats:
  - .csv – Comma Separated Value file can be opened in text editor or Excel spreadsheet
  - .shp – ShapeFile used primarily in ArcGIS, QGIS
  - .kml – Keyhole Markup Language can be used in Google Earth
- Downloadable as whole world or major geographical subsets
- Dataset available as 24 hours, 48 hours, or 7 days (except for KML)
- Files are available for:
  - MODIS 1km (includes both Aqua and Terra)
  - VIIRS 375m: SNPP, NOAA-20 and NOAA-21
  - Landsat 30m (currently only North America)

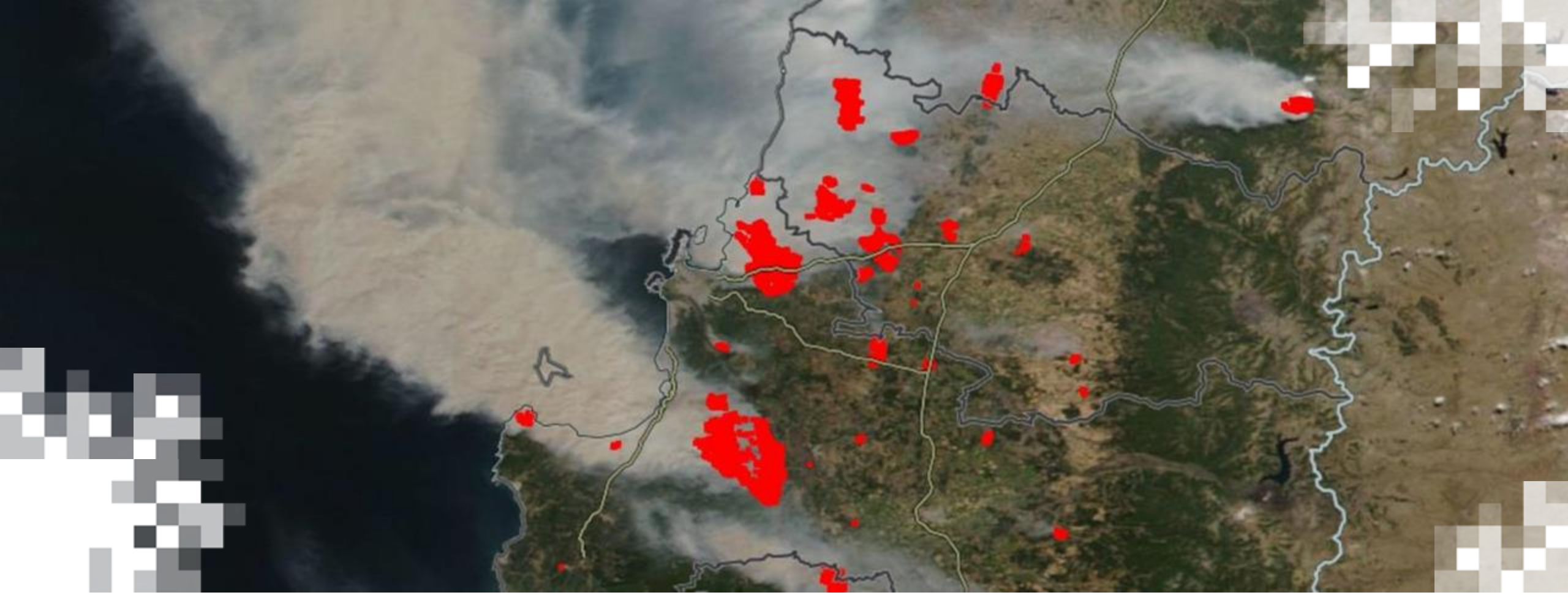
* Files are **updated once per hour**.

Archive Download

- Allows download of all FIRMS historical active fire/hotspot detections
- Custom geospatial sub-setting available for:
  - Countries
  - Protected Areas as provided by The World Database on Protected Areas (WDPA)
  - Draw custom bounding box or polygon
- Date Range
  Note: only requests with valid date range for a specific satellite are processed. List of satellites and their date range availability is provided beneath the date range selection.
- Format:
  - Shapefile
  - CSV (Comma Separated File)
  - JSON
- Once the download request is submitted, a notification email will be sent out when the data is available for download. You may receive two separate download files if it includes both NRT and SP data.

Fire Alerts

- Feature provides email alert notification when fires/hotspots are detected, or as a summary of all fires from previous day or week
- Fire alerts provide following options:
- Custom geospatial sub-setting available for:
  - Countries
  - Protected Areas as provided by The World Database on Protected Areas (WDPA)
  - Draw custom bounding box or polygon
- Currently Supports: MODIS (Aqua and Terra); VIIRS SNPP, NOAA-20 and NOAA-21
- Alert Frequency: Daily, Weekly or Rapid (Near Real-Time NRT; within 5-10 mins of data availability)
- Email preference with only text summary or with attached map image
- Alerts support English, Spanish, and French
- Optionally, alert may provide CSV file list of detected fires/hotspots

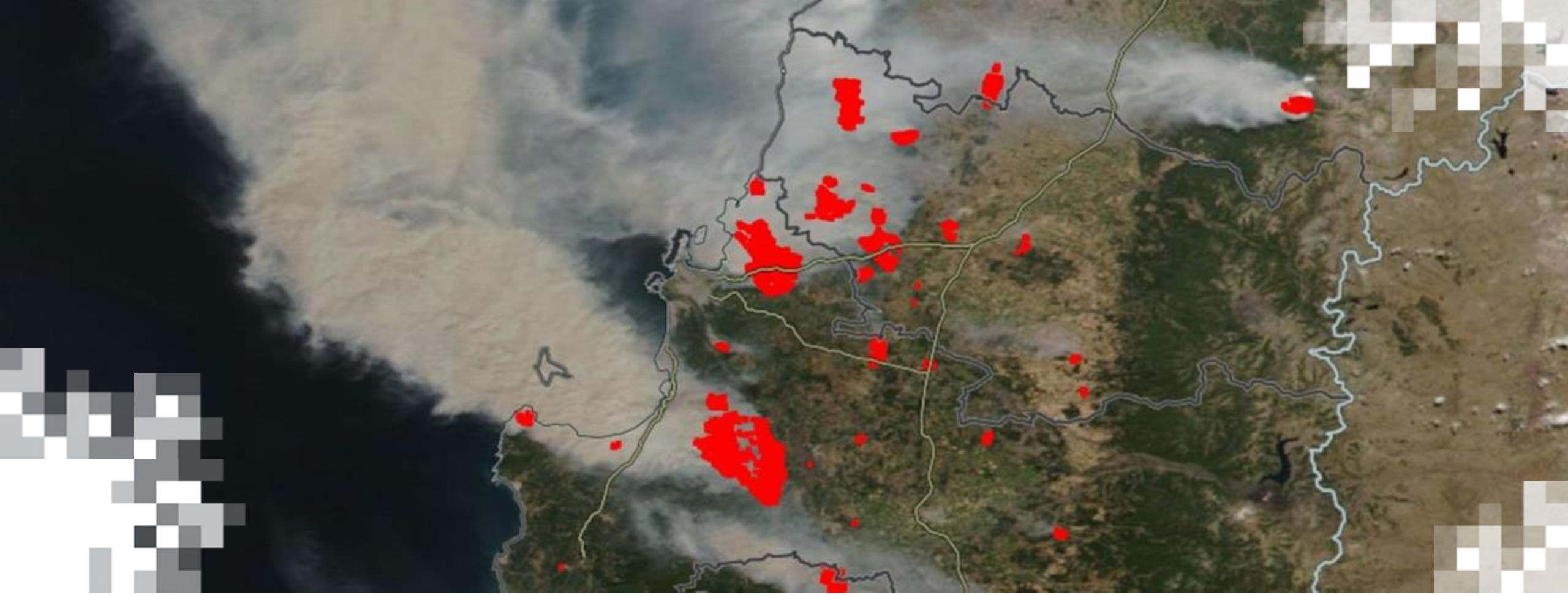


FIRMS In Separate GIS Applications

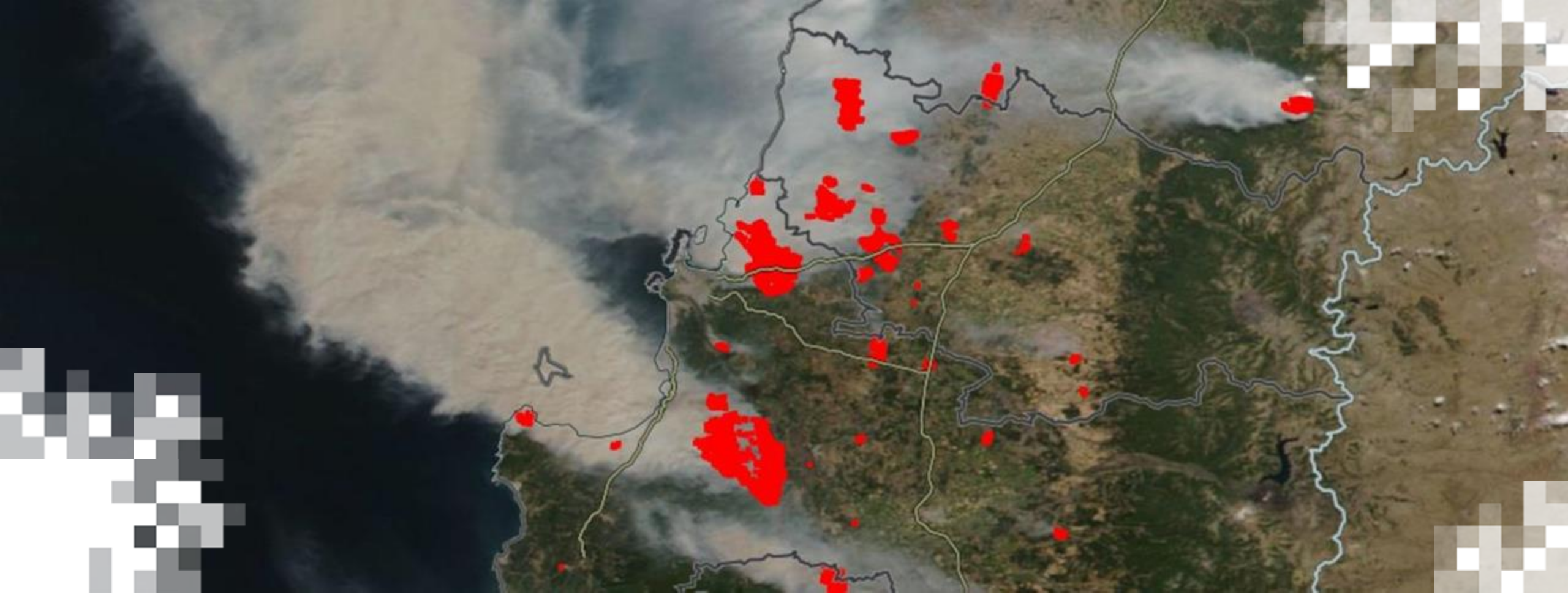
What I will cover in this section…

- What are Web Mapping and Feature services
- Why you would choose WMS/WFS over a downloaded dataset from FIRMS
- Which to pick, WMS or WFS

- Demonstration
  - How do you ingest downloaded data into a GIS platform
    - QGIS and ArcGIS Online (both free)
  - How do you generate a MapKey to access Web Services
  - How do you ingest WMS/WFS data into a GIS platform
    - QGIS and ArcGIS Online (both free)



Ingesting Downloaded Files



MapKey Site:

Generating a MapKey

API / map_key

In order to use FIRMS API and/or FIRMS mapservices, sign up for free MAP_KEY using your email.
The key will be sent to your email.

Map Key

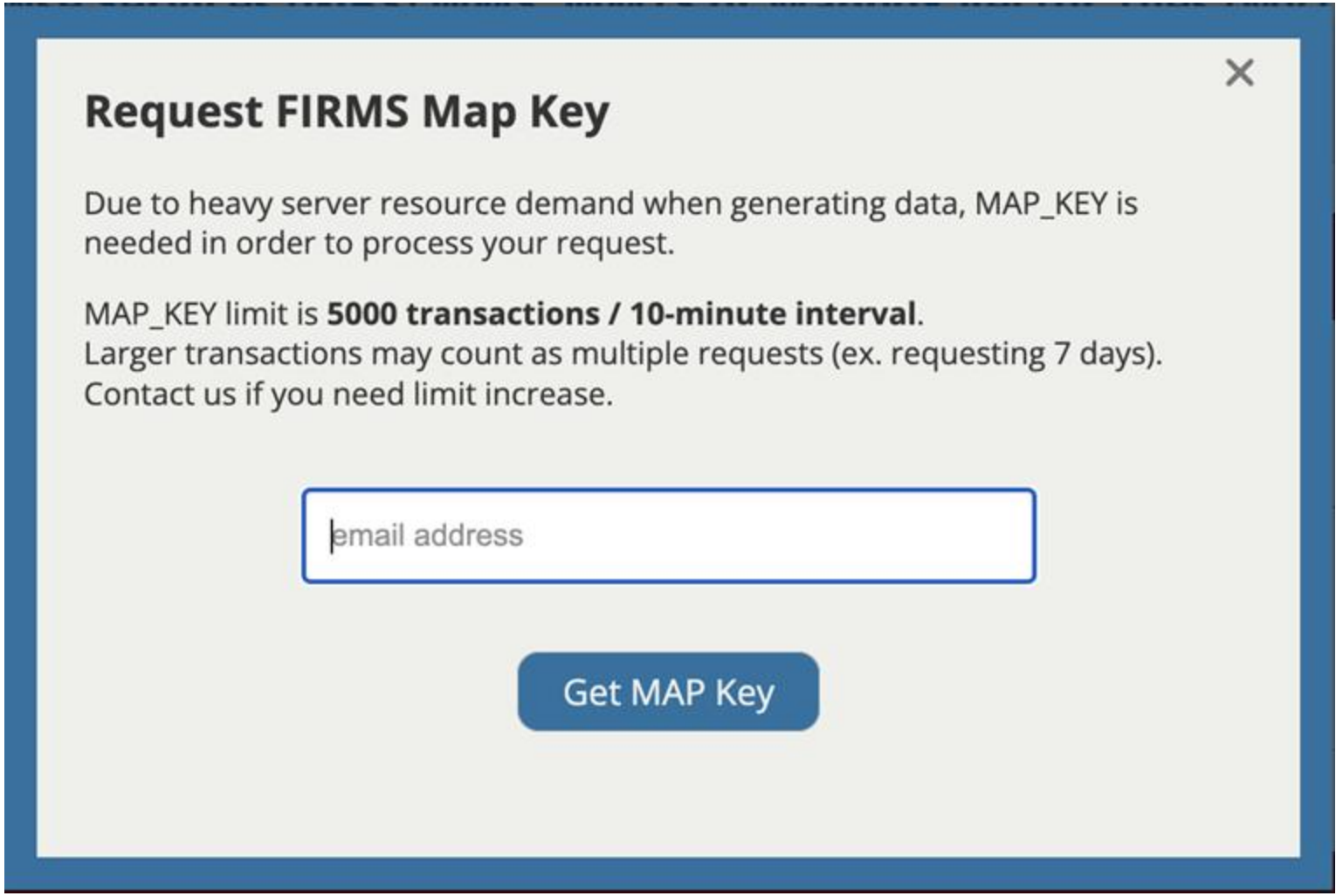
To use FIRMS web services, request **free** MAP_KEY

Get MAP_KEY

To check number of available map transactions

Your Map Key

Check status


Request FIRMS Map Key
Due to heavy server resource demand when generating data, MAP_KEY is needed in order to process your request.
MAP_KEY limit is 5000 transactions / 10-minute interval.
Larger transactions may count as multiple requests (ex. requesting 7 days).
Contact us if you need limit increase.
email address
Get MAP Key

FIRMS MAP KEY

MAP KEY: **abcdef0123456789abcdef0123456789**

Note: The MAP KEY is valid for both FIRMS (Global) and FIRMS (US/Canada) sites.

Transaction limit: 5000 transactions / 10 minutes (view status)

WMS Tutorials & Examples:

WMS data source and layer information

Fires MODIS 24hr Image
Get capabilities for 'fires'

How to use MAP KEY in ArcGIS Pro
How to use MAP KEY in QGIS

WFS Tutorials & Examples:

WFS data source and layer information

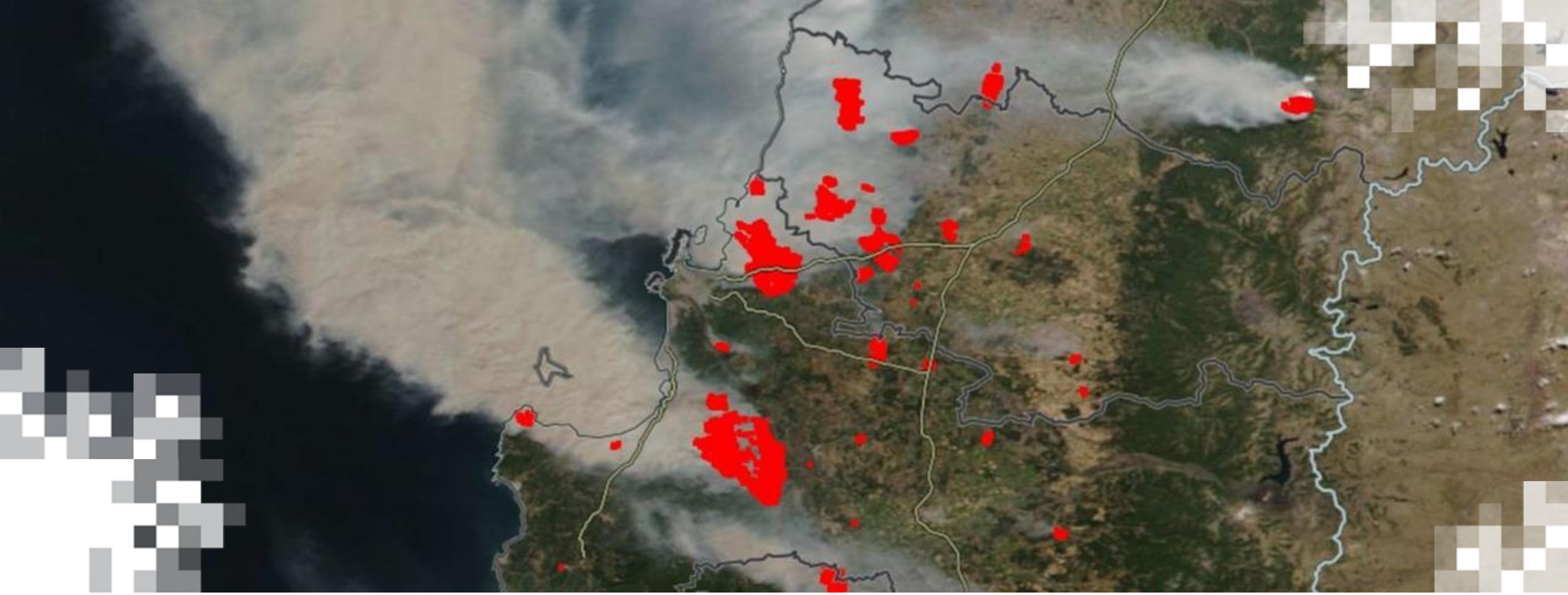
MODIS 24hr USA (Conterminous) and Hawaii (1000 records)
Get capabilities for USA (Conterminous) and Hawaii

How to use FIRMS WFS in ArcGIS Pro
How to use FIRMS WFS in ArcGIS Desktop

If you have any questions or comments, please contact us at support@earthdata.nasa.gov.

Thank you,
FIRMS Team

More information on FIRMS can be found on the NASA FIRMS home page.



Web Mapping & Web Feature Services

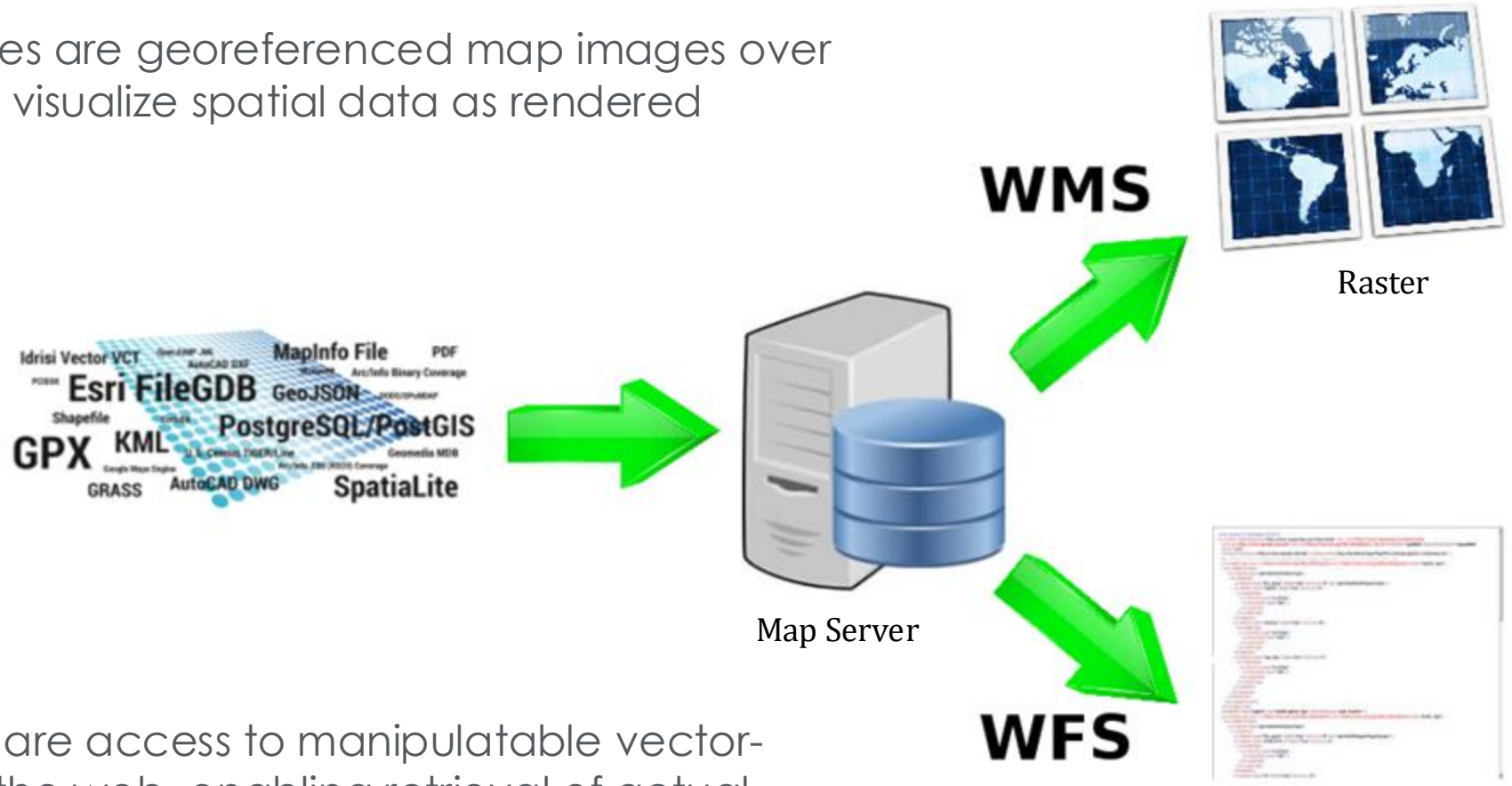
WMS/WFS vs. Downloaded Data…

- Why you would want downloaded data…
  - Isolated Event
  - Access to the Internet
  - Example
    - Comparison

- Why you would want WMS/WFS…
  - Immediate Access
  - Data Consistency
  - Resource Efficiency
  - Interoperability

What are Web Mapping and Feature Services?

WMS or Web Mapping Services are georeferenced map images over the internet, allowing users to visualize spatial data as rendered images.

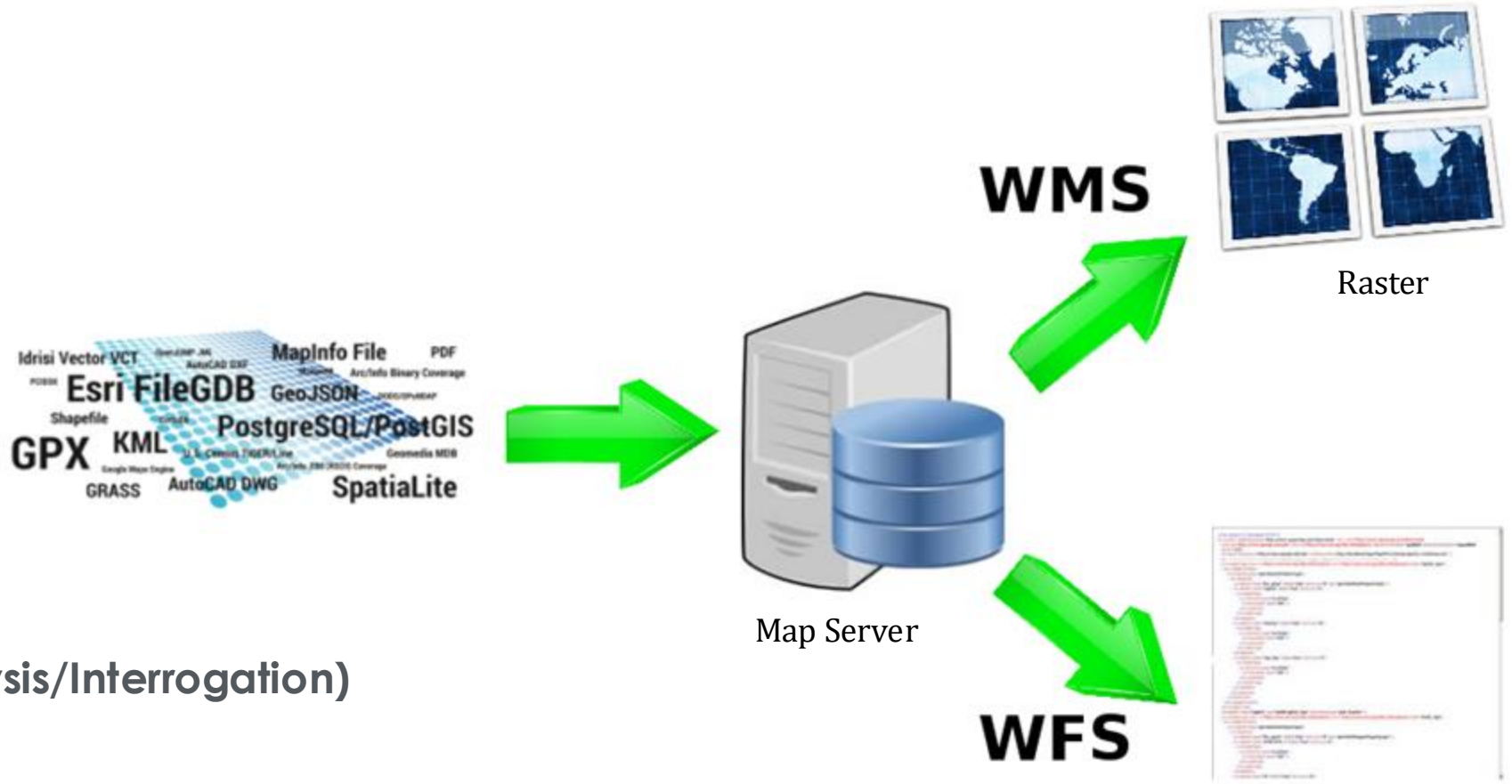


WFS or Web Feature Services are access to manipulatable vector-based geospatial data over the web, enabling retrieval of actual feature geometries and attributes.

Image Credit

Web Mapping vs. Feature Services

- **WMS (Visualization)**

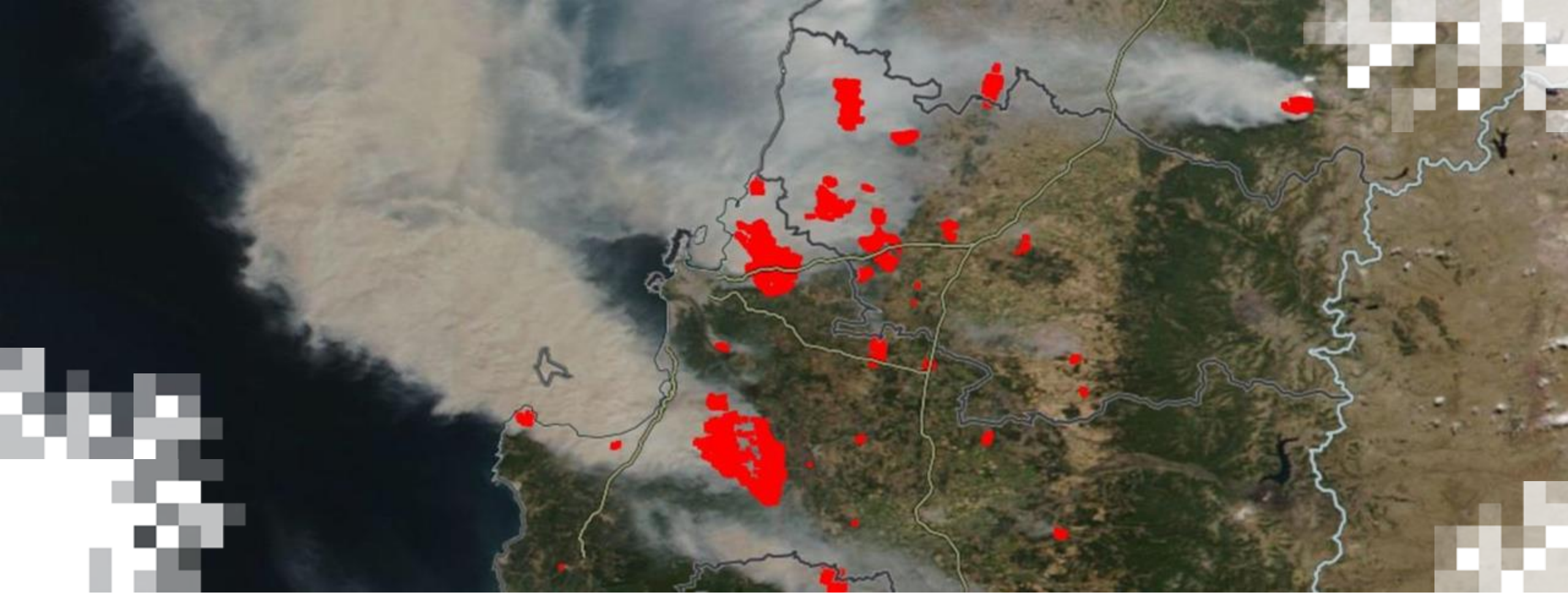


- **WFS (Visualization + Analysis/Interrogation)**

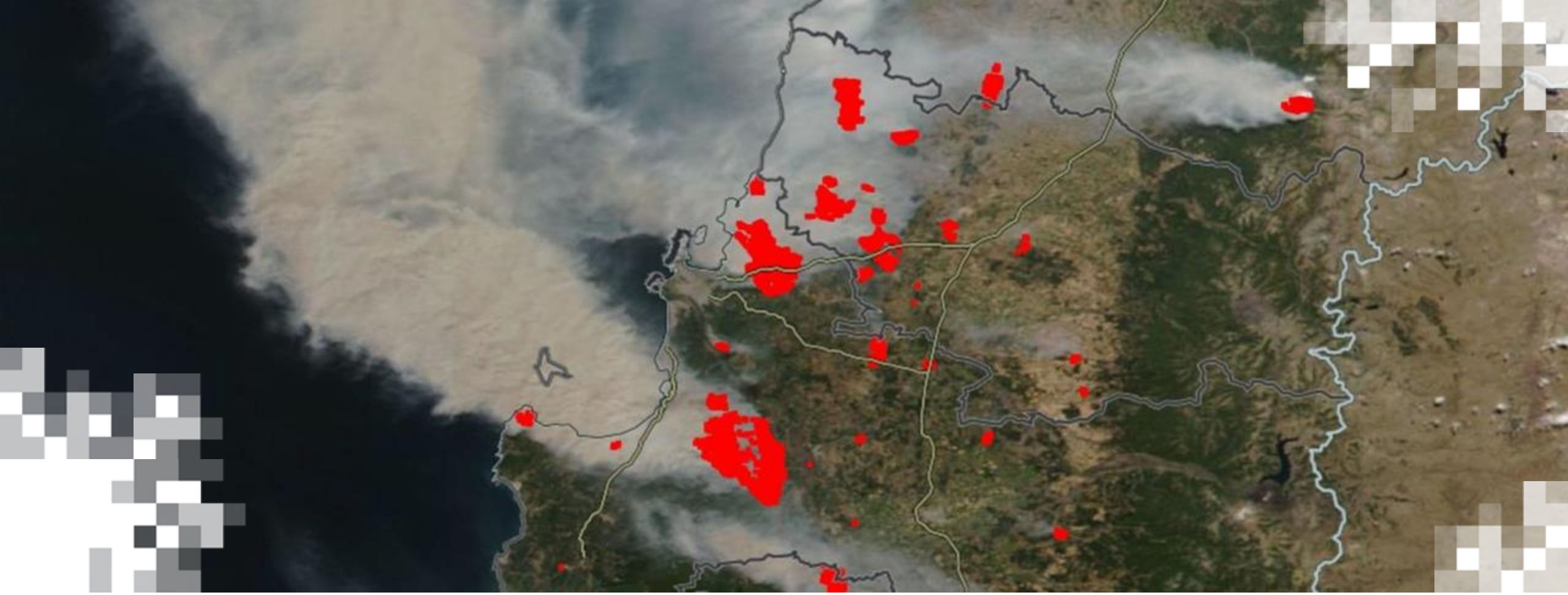
Image Credit

For More Information on WFS & WMS

FIRMS WMS & WFS Informational Page



WMS & WFS in ArcGIS & QGIS



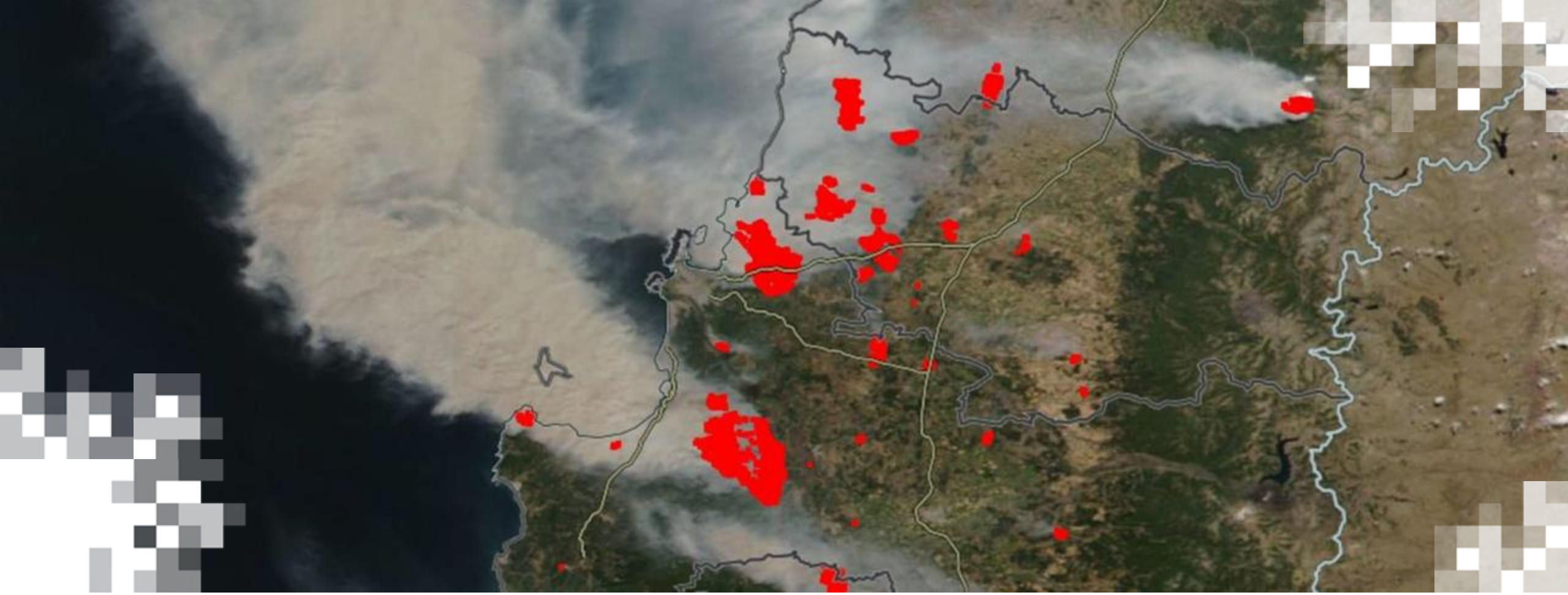
API Overview

API Overview – Outline

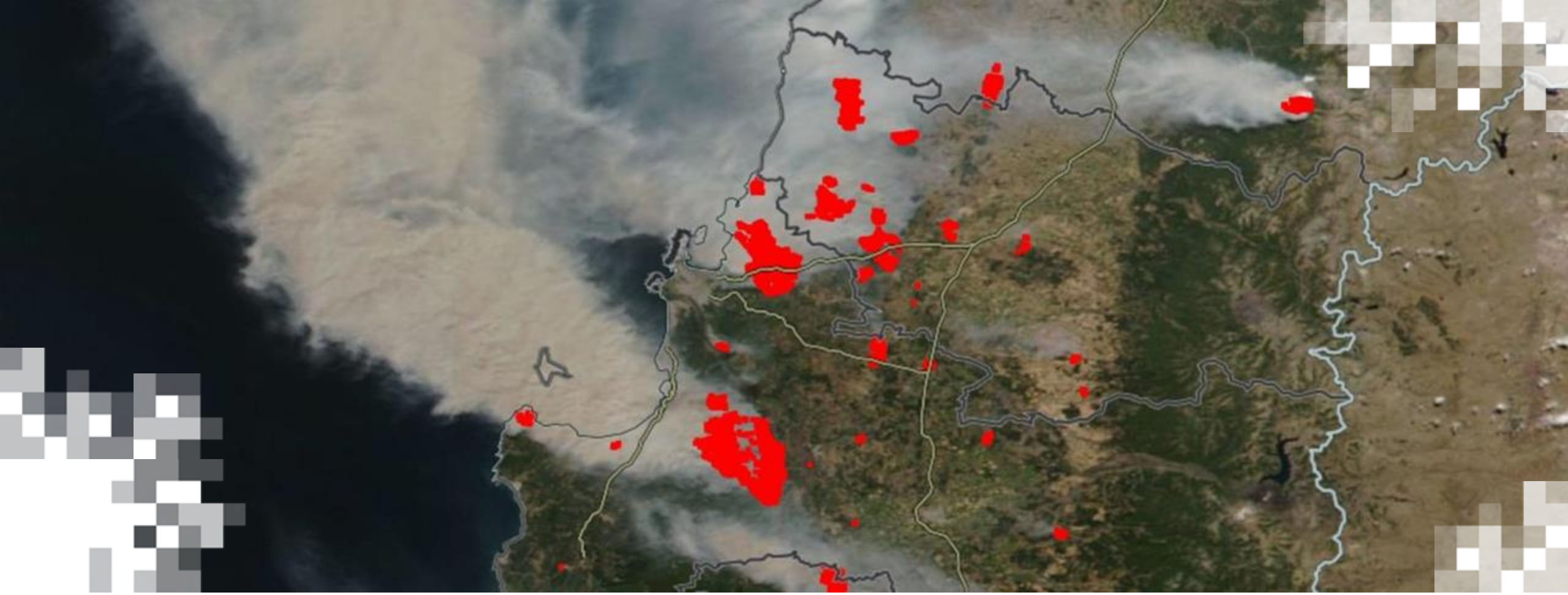
- What APIs does FIRMS provide and how to use them
- How to generate a MapKey
- data_availability (SP vs NRT)
- missing_data
- kml_fire_footprints
- country
- area (world vs. custom area)
- Tutorials and Examples

API

Service	Description
area	Fire detection hotspots based on area, date and sensor in CSV format
countries	List of supported countries
country	Fire detection hotspots based on country, date and sensor in CSV format
data_availability	Date availability of SP and NRT data
kml_fire_footprints	KML fire detection footprints
map_key	Setup MAP_KEY
missing_data	View dates with missing satellite data
API Code Examples	



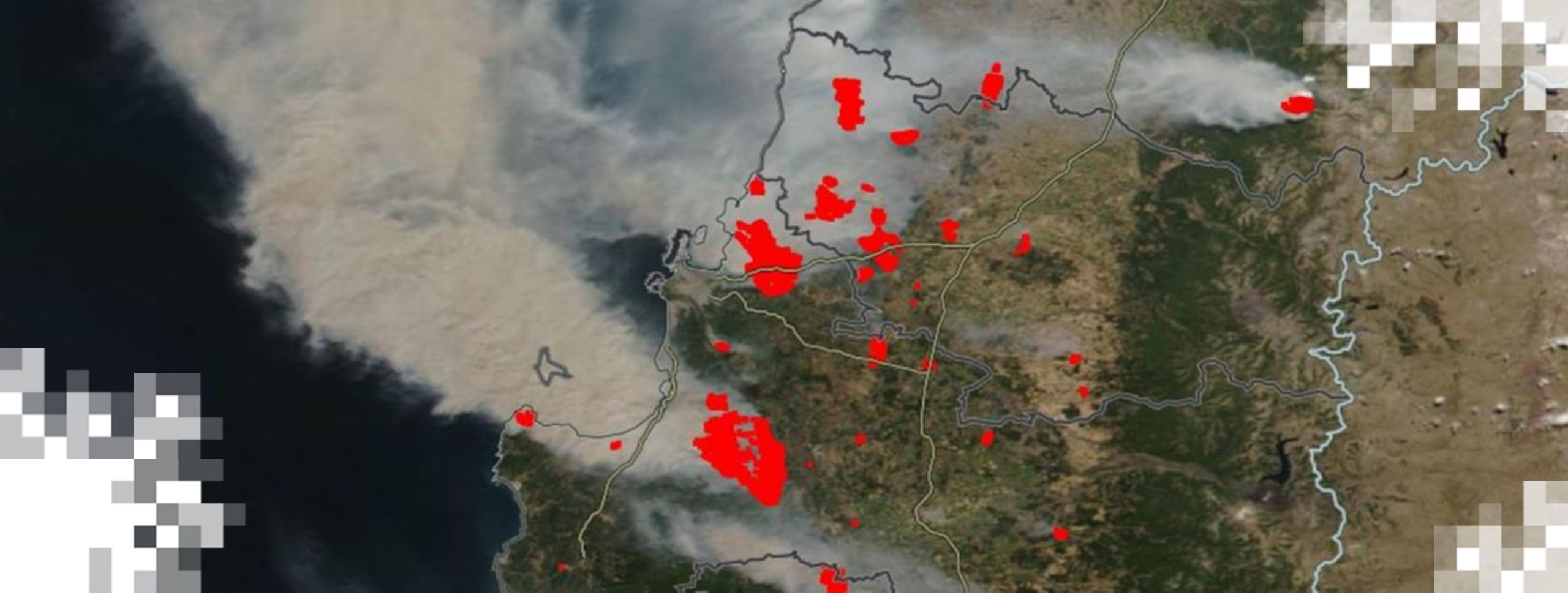
Accessing Active Fire Information Through FIRMS API Demo



Part 3:
Summary

Summary

- Active fire detection data from FIRMS can be accessed through:
  - **Download**
    - Recent data CSV, KML or Shapefiles
    - Submit an Archive Download request for data older than seven days
  - **Web Map Service (WMS) or Web Feature Service (WFS)**
    - Require Map Key
    - WMS generates georeferenced map images for visualization
      - Most recent 24, 48, 72 hours or 7 days, or previous 31 days using WMS-Time service
    - WFS generates vector-based geospatial data for visualization and analysis
      - Most recent 24 hours or 7 days
    - Can be used to ingest data into GIS platforms like ArcGIS or QGIS
  - **Application Programming Interface (API)**
    - Requires Map Key
    - Can access historical data, similar to Archive Download, but for a maximum 10-day range
- Visualize fire detection data using Google Earth, ArcGIS, and QGIS
- Create automatic email alerts for a region of interest



Introduction to NASA Earth Observations and Tools for Operational Wildfire Monitoring and Management

Summary

Training Summary

- FIRMS provides geospatial data, products, and services for detecting, monitoring, and evaluating fires
  - **Active fire detections** represent the center of a pixel that has been flagged as containing one or more fires
  - **Polar sensors**: mature detection algorithms, higher spatial resolution, repeat frequency varies (daily to 8-9 days depending on swath)
  - **Geostationary sensors**: lower spatial resolution, cover entire hemisphere, multiple observations per hour
- **Data Latency** – time between observation and when the data are available
  - Active fire detections are available with URT, RT, and NRT latencies, depending on the sensor
- Factors that can impact wildfire detection
  - Sensor spatial resolution, view angle, diurnal cycle of fire activity, atmospheric and biophysical factors (e.g., clouds, smoke, fog, dense forest canopy, terrain)
- FIRMS data services include data download, WMS, WFS, API, and email alerts

Homework and Certificates

- **Homework:**
  - One homework assignment
  - Opens on 05/01/2025
  - Access from the training webpage
  - Answers must be submitted via Google Forms
  - **Due by 05/14/2025**

- **Certificate of Completion:**
  - Attend all three live webinars (attendance is recorded automatically)
  - Complete the homework assignment by the deadline
  - You will receive a certificate via email approximately two months after completion of the course.

Acknowledgements

Jenny Hewson

Brad Quayle

Diane Davies

LANCE Operations Manager

Otmar Olsina

Dylan Mendes

Asen Radov

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Thank You!