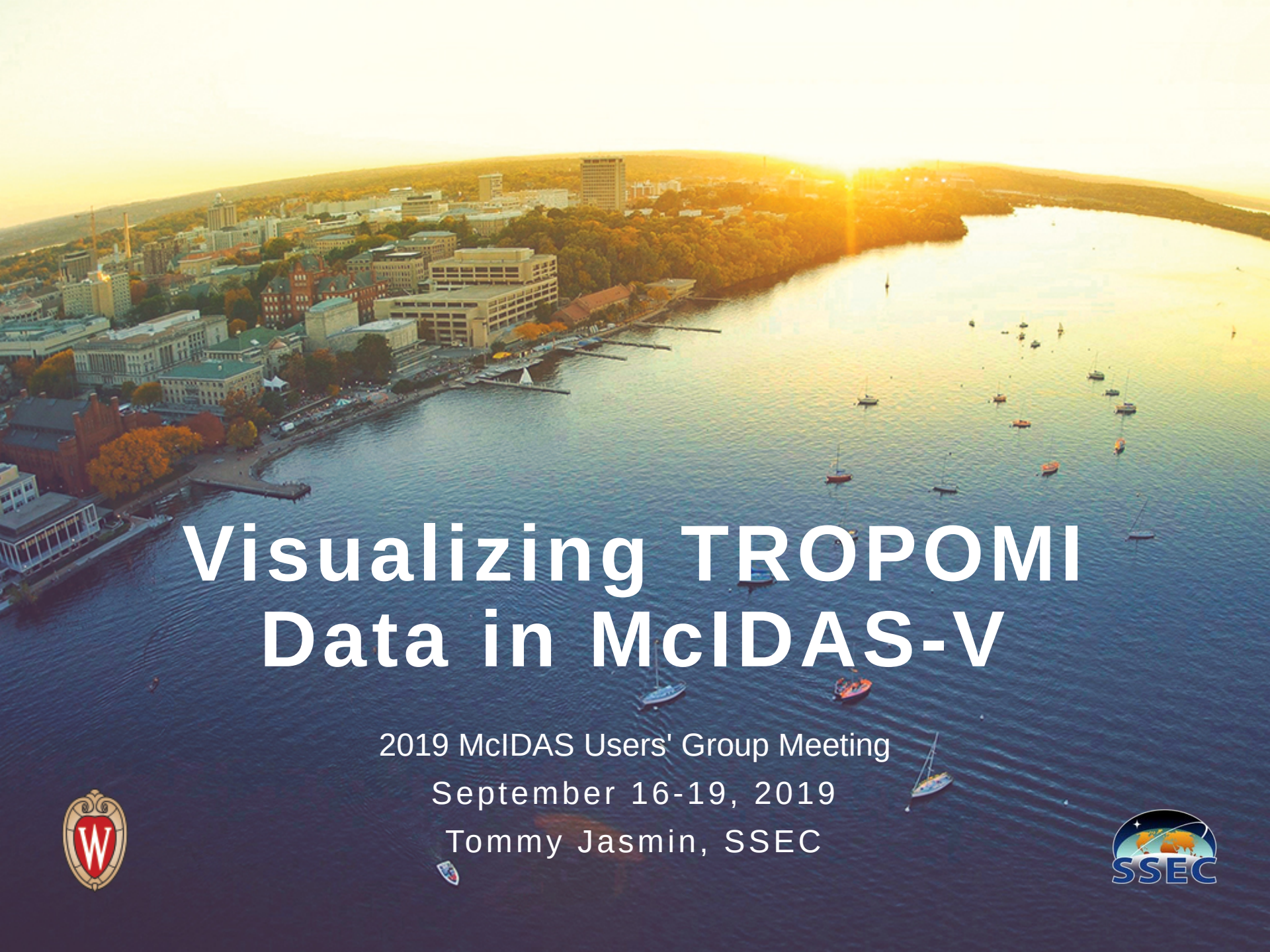


Visualizing TROPOMI Data in McIDAS-V

2019 McIDAS Users' Group Meeting

September 16-19, 2019

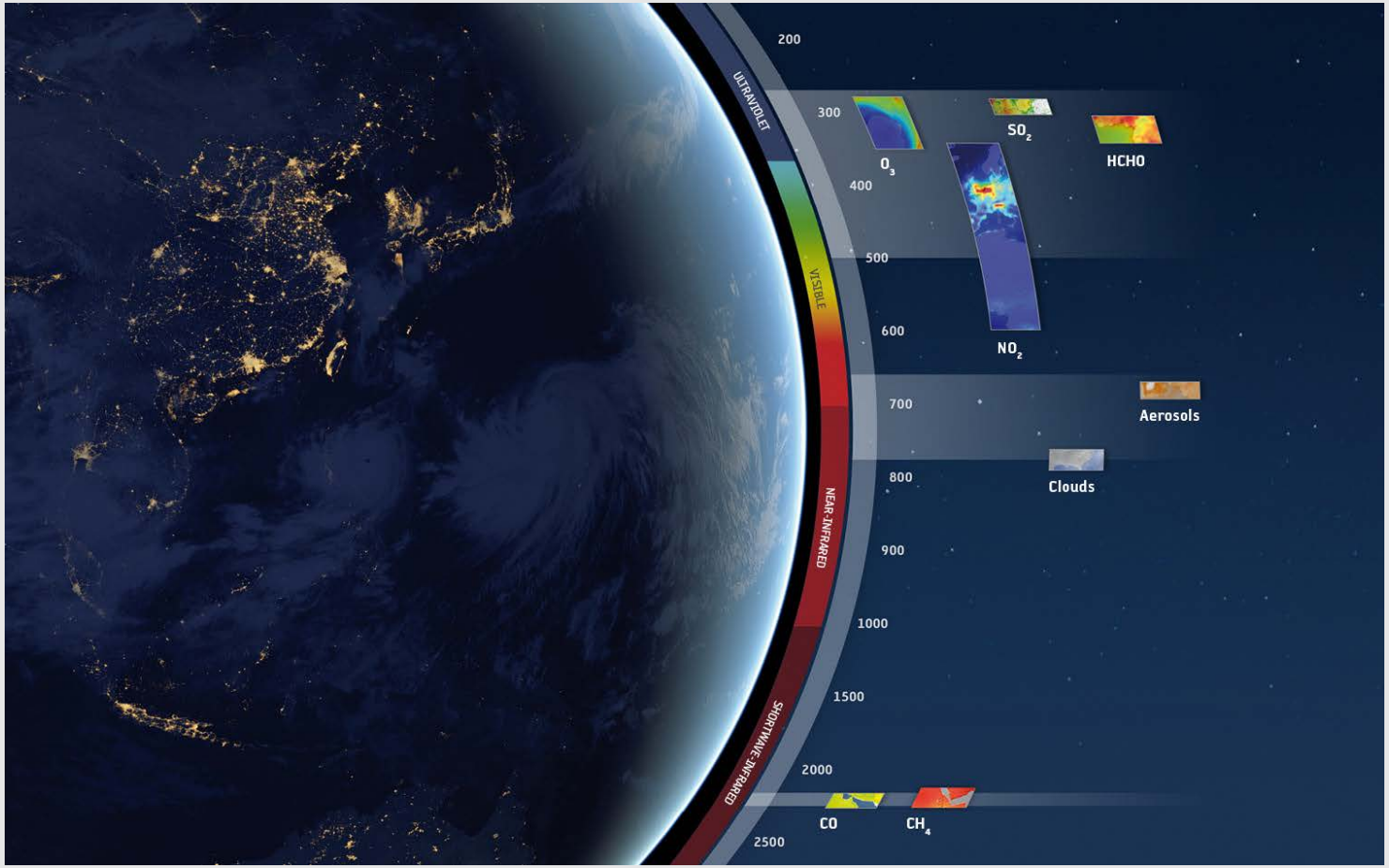
Tommy Jasmin, SSEC

Main Points of Today's Talk

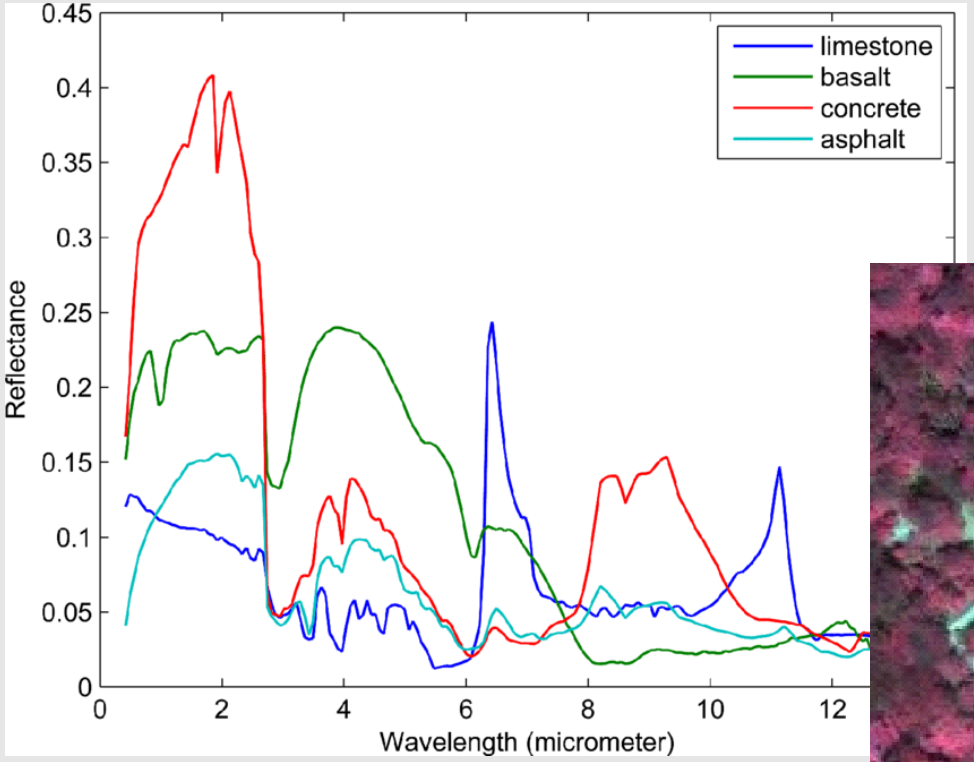
- Vital new instruments/sensors coming online often.
- Need to integrate and support this data with relative ease.
- McIDAS-V (and IDV) is pretty good at this.
- Interoperability value is not always obvious, but matters.

TROPOMI on Sentinel 5P

Developed by ESA and NSO, TROPOMI measures trace gases at unprecedented resolution.

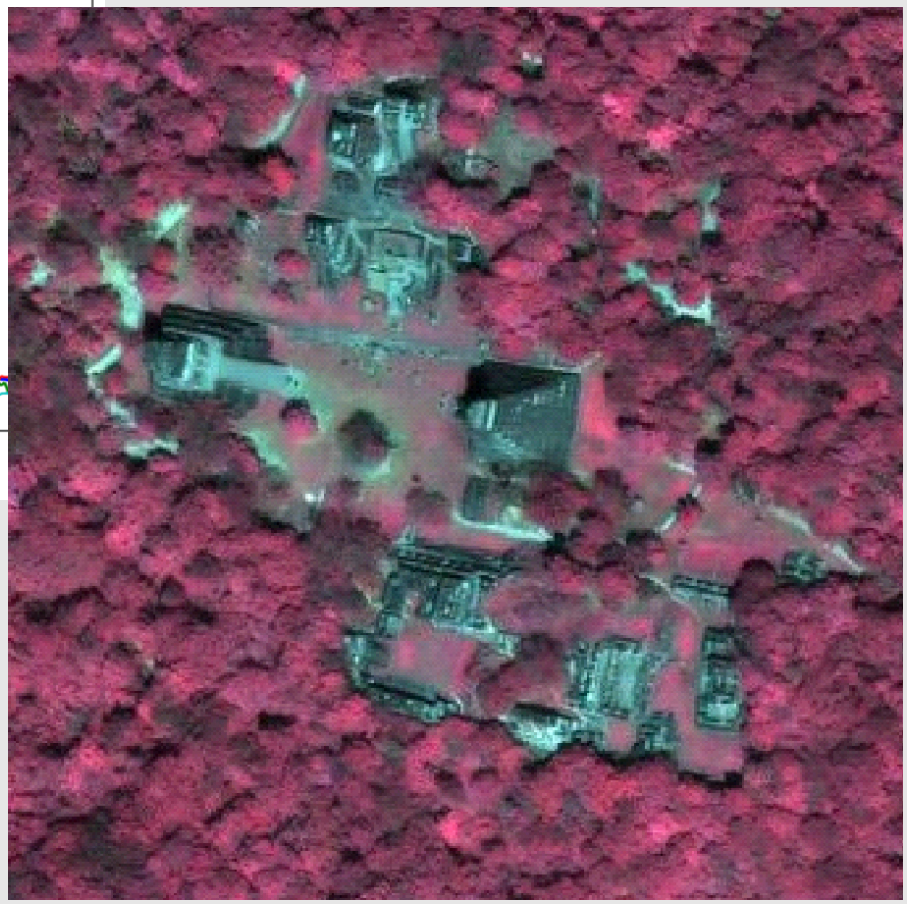


How Does That Work?

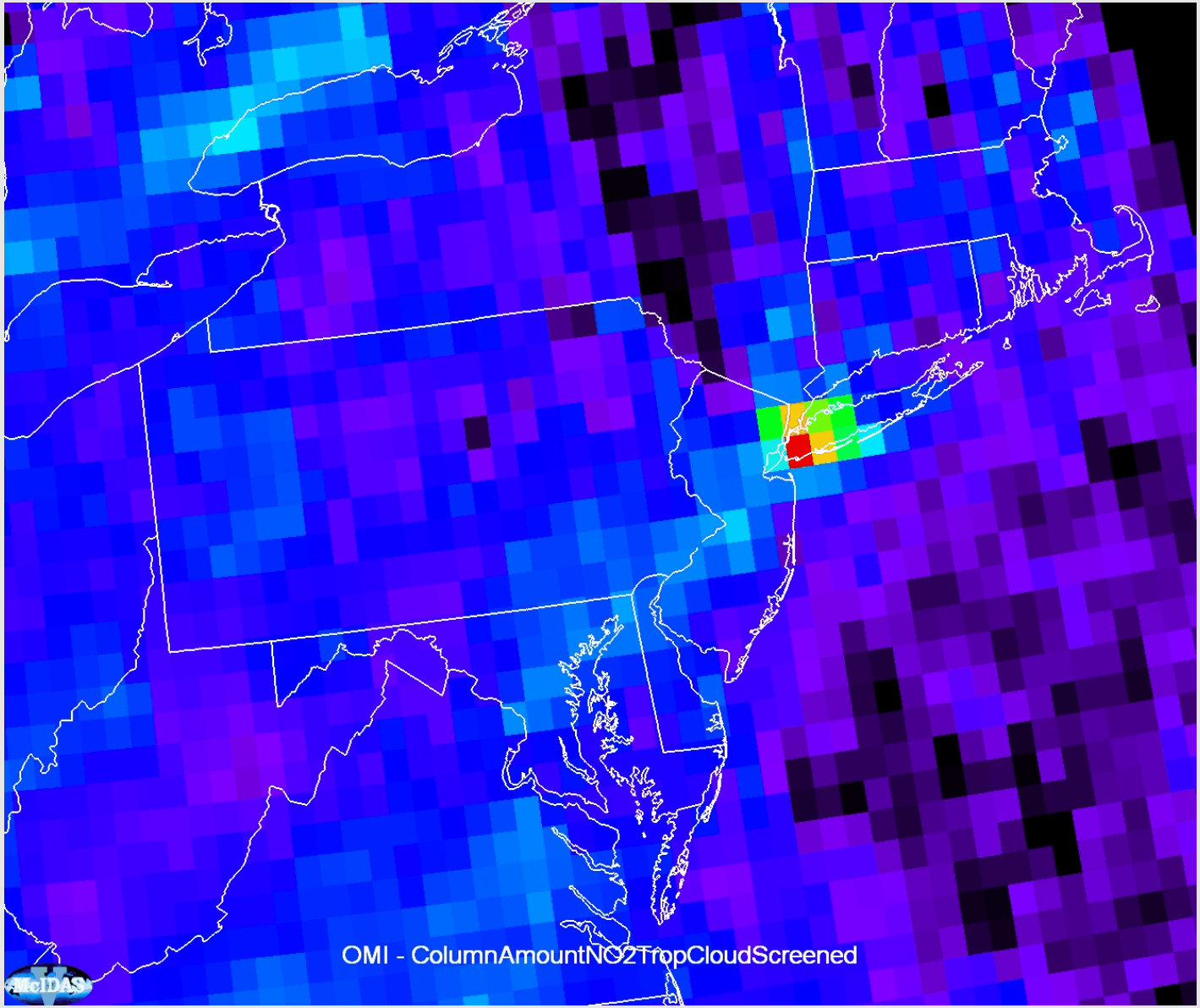


Spectral Signatures

Mayan city of Tikal



OMI vs. TROPOMI vs. DNB



Implementing a Service Provider

Class: ucar.nc2.IOServiceProvider

Do you feel lucky?

For all known data types <DataType>:
    Is this data a valid example of <DataType>?
        Yes : Use the defined Service Provider to handle data
        No: Move on and check the next known data type

If we were not able to find an IOSP, let user know

IOSP examples: Gempak Grid, Nexrad2, DMSP, etc.,
    and now, TROPOMI

IOSP: isValidFile()

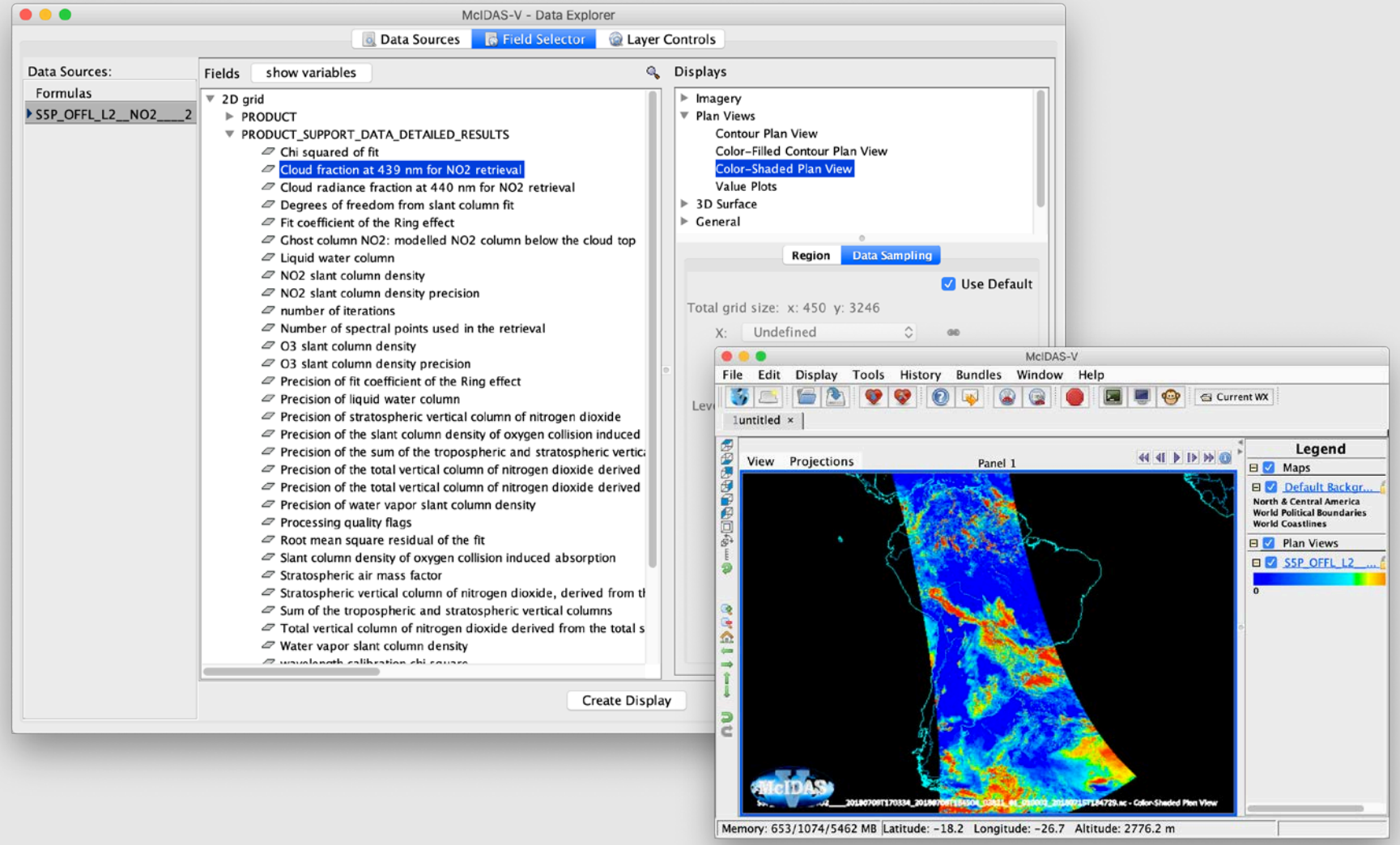
1. Must be **really** fast
2. Must be **really** accurate

S5P_OFFL_L2__O3_____20181122T022910_20181122T041039_05742_01_010102_20181128T035132.nc

TROPOMI uses a very specific Regular Expression:

```
// This regular expression matches TROPOMI L2 products
private static final String TROPOMI_L2_REGEX =
        // Mission Name (ex: S5P)
        "\\w\\w\\w" + TROPOMI_FIELD_SEPARATOR +
        // Type of data: Real-Time, Offline, or Reprocessed
        "(NRTI|OFFL|RPRO)" + TROPOMI_FIELD_SEPARATOR +
        // Product Identifier
        "(L2_|L1B)" + TROPOMI_FIELD_SEPARATOR +
        // Product (can be up to six characters, separator-padded if less, e.g. CH4___)
        "\\w\\w\\w\\w\\w\\w" + TROPOMI_FIELD_SEPARATOR +
        // Start Date and Time (ex: YYYYmmddTHHMMSS)
        "20[0-3]\\d[0-1]\\d[0-3]\\dT[0-2]\\d[0-5]\\d[0-6]\\d" + TROPOMI_FIELD_SEPARATOR +
        // End Date and Time (ex: YYYYmmddTHHMMSS)
        "20[0-3]\\d[0-1]\\d[0-3]\\dT[0-2]\\d[0-5]\\d[0-6]\\d" + TROPOMI_FIELD_SEPARATOR +
        // Orbit Number
        "\\d\\d\\d\\d\\d" + TROPOMI_FIELD_SEPARATOR +
        // Collection Number
        "\\d\\d" + TROPOMI_FIELD_SEPARATOR +
        // Processor Version Number : MMmmpp (Major - Minor - Patch)
        "\\d\\d\\d\\d\\d\\d" + TROPOMI_FIELD_SEPARATOR +
        // Creation Date and Time (ex: YYYYmmddTHHMMSS)
        "20[0-3]\\d[0-1]\\d[0-3]\\dT[0-2]\\d[0-5]\\d[0-6]\\d" +
        // NetCDF suffix
        ".nc";
```

If Data is Geolocated, Let User See It!

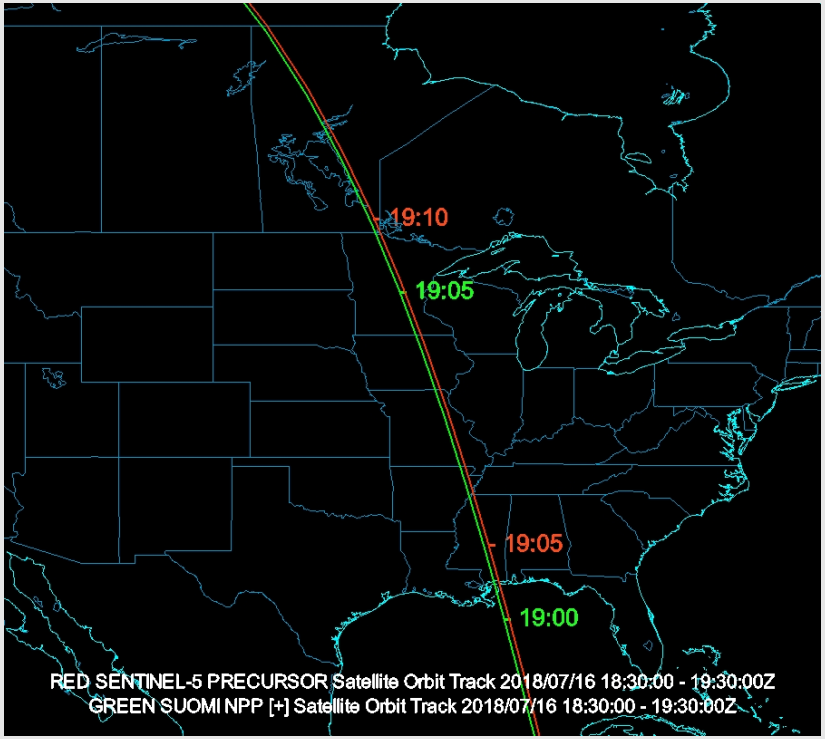


IOSP: populateDataTree()

Populate the available data tree:

```
/*
 * Create the group structure and data products for our McV output
 */

private static void populateDataTree(NetcdfFile ncOut, Map<String, List<Variable>> groupsToVars)
{
    for (Map.Entry<String, List<Variable>> e : groupsToVars.entrySet()) {
        Group g = new Group(ncOut, null, e.getKey());

        logger.trace("Adding Group: " + g.getFullName());
        // Newly created groups will have path separators converted to underscores
        // We'll need to map back to the original group name for file access
        groupMap.put(g.getFullName(), e.getKey());

        ncOut.addGroup(null, g);

        for (Variable v : e.getValue()) {
            logger.trace("Adding Variable: " + v.getFullNameEscaped());
            addVar(ncOut, g, v);
        }

    }
}
```

Temporal Synergy with Suomi NPP



ORBIT

SP5 is in a “loose formation” 3.5 minutes behind Suomi NPP.

WHY DO THIS?

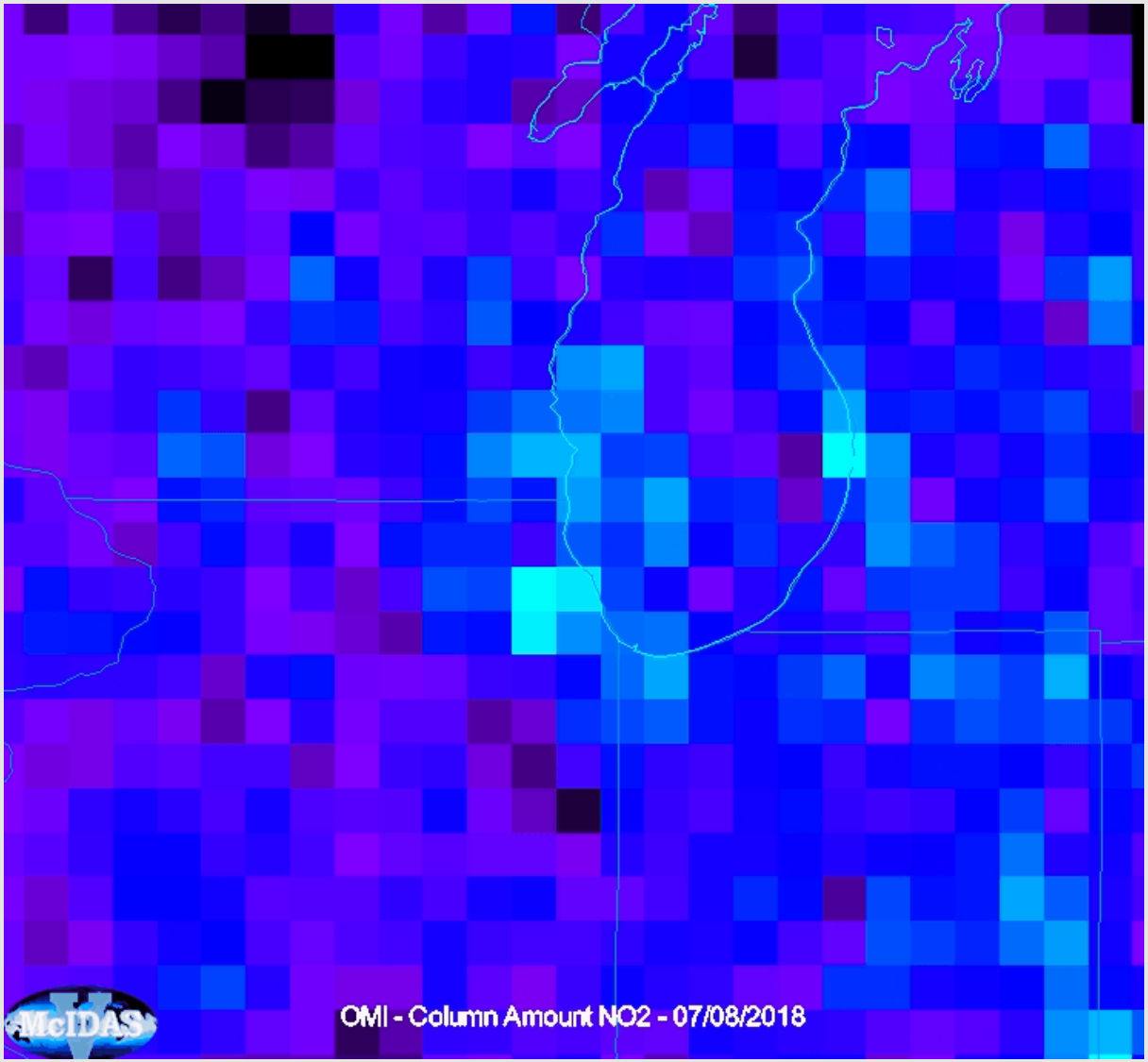
If one sensor produces a product the other can leverage to great advantage.

If the data products of one sensor can validate data products from the other.

Potential for “fusion” products.

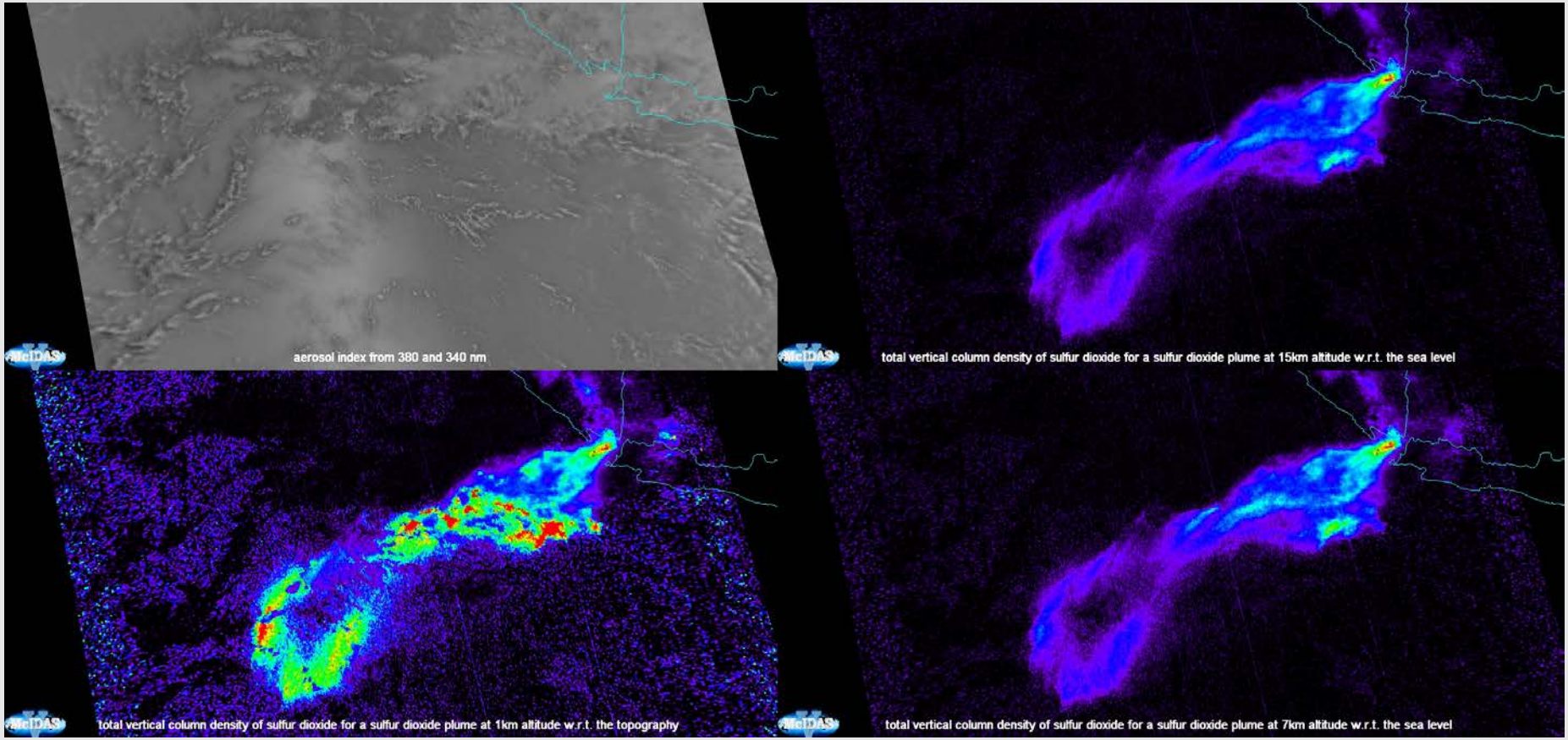
Sample McIDAS-V Visualizations #1

OMI vs. TROPOMI vs. DNB – Chicago area



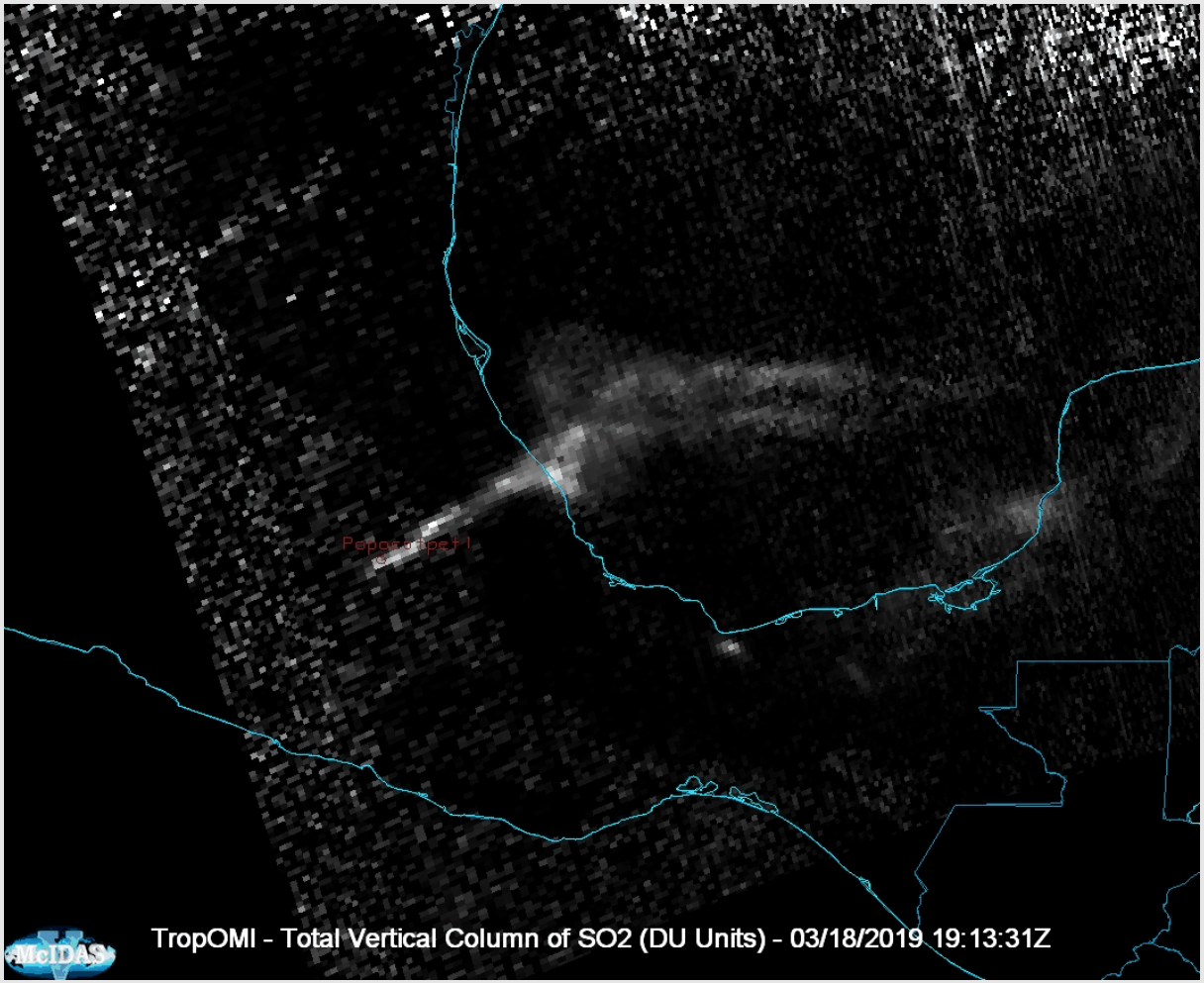
Sample McIDAS-V Visualizations #2

22-23 Dec 2018 Eruption of Krakatoa

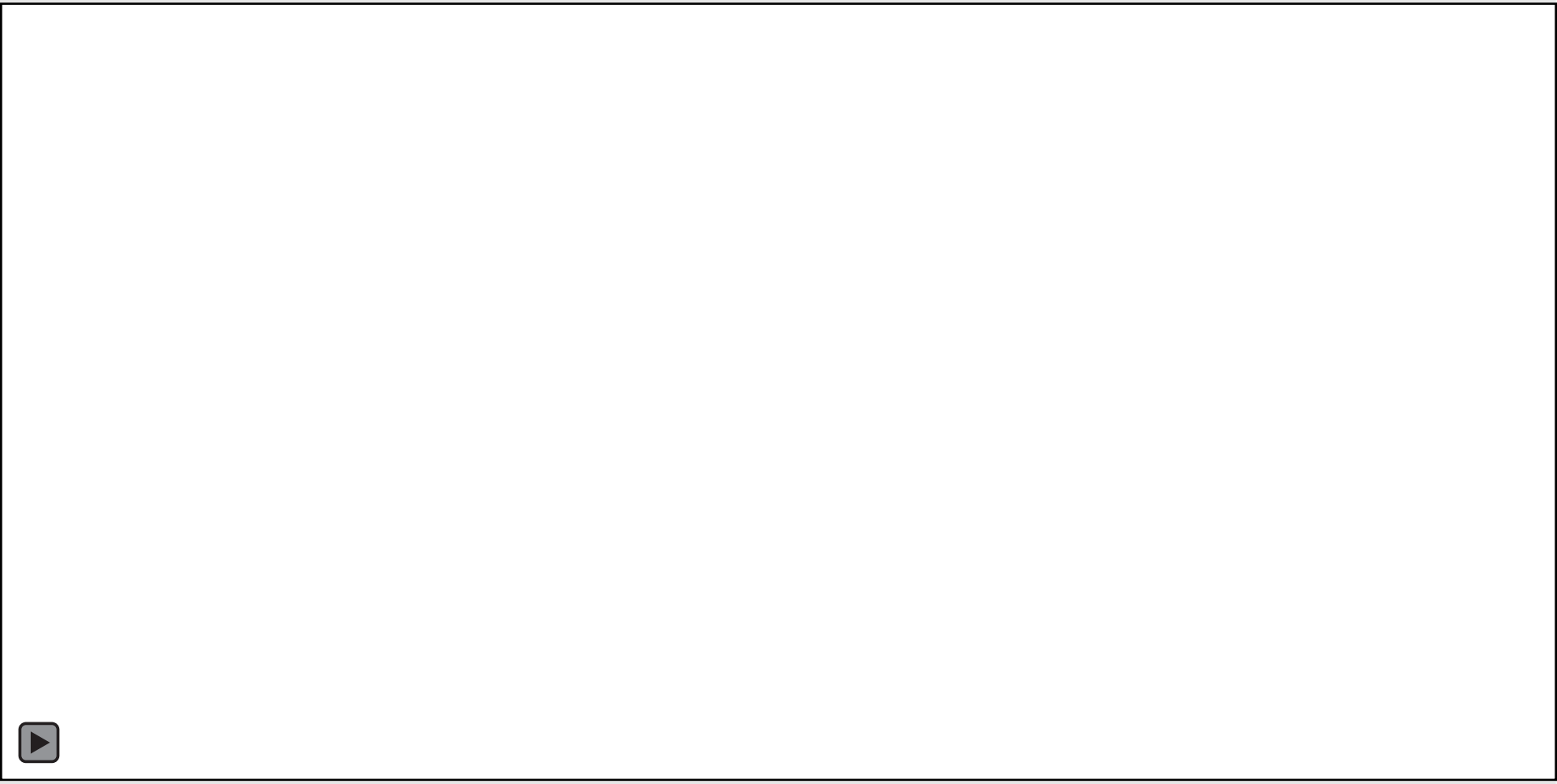


Sample McIDAS-V Visualizations #3

TROMPOMI vs. OMI – Popocatpetl eruption, March 2019



Global NO_2 Animation

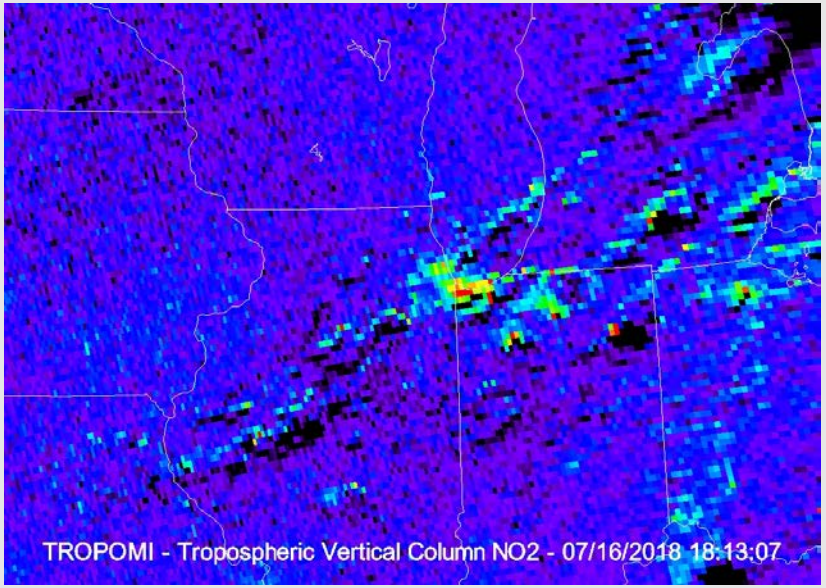


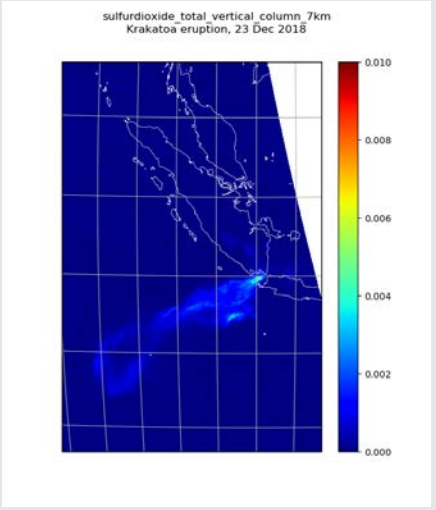
Takeaways

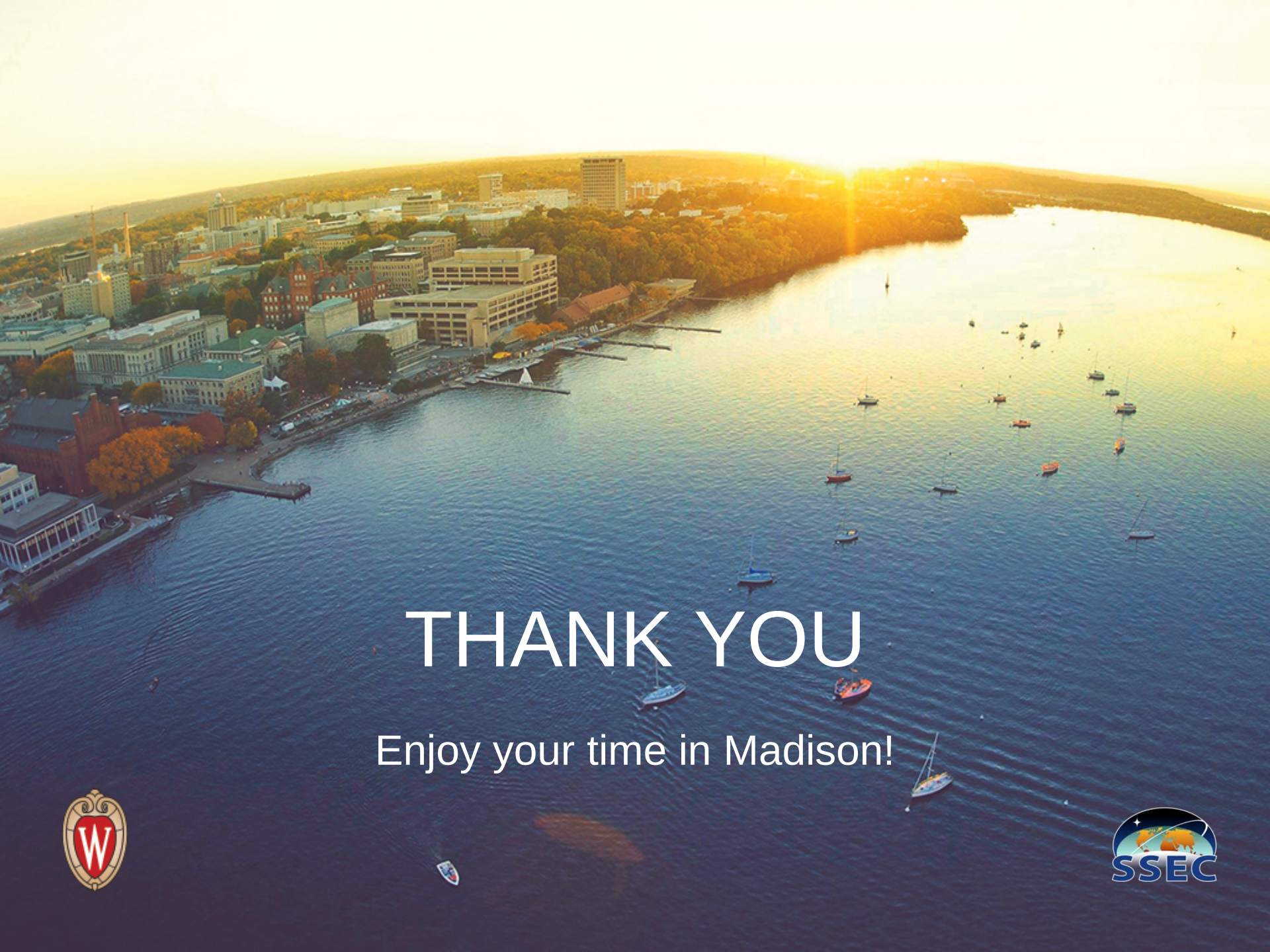
New sensors are going up all the time.

Data interoperability in analysis/visualization packages is becoming increasingly vital.

McIDAS-X/V : are already workhorses supporting a multitude of data types, and are extensible to new data types with modest effort if conventions are followed.






THANK YOU
Enjoy your time in Madison!
SSEC