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.





0.45

0.4

0.35

0.3

0.25

0.2

0.15

0.1

0.05

0 ^L 0

Reflectance













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





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\\w\\w\\w\\w\ // 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\\d" + TROPOMI_FIELD_SEPARATOR + // Collection Number "\\d\\d" + TROPOMI_FIELD_SEPARATOR + // Processor Version Number : MMmmpp (Major - Minor - Patch) "\\d\\d\\d\\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";

f Data is Geolocated, Let User See It!



•	McIDAS-V - Da		
ata Sources:	Fields show variables	G Displays	
Formulas	v 2D grid	▶ Imagery	
S5P_OFFL_L2NO2	2 ► PRODUCT	▼ Plan Views	
	PRODUCT_SUPPORT_DATA_DETAILED_RESULTS	Contour Plan View	
	Chi squared of fit	Color-Filled Contour Plan View	
	Cloud fraction at 439 nm for NO2 retrieval	Color–Shaded Plan View	
	Cloud radiance fraction at 440 nm for NO2 retr		
	Degrees of freedom from slant column fit	▶ 3D Surface	
	Fit coefficient of the Ring effect	▶ General	
	Ghost column NO2: modelled NO2 column belo		
	Liquid water column	Region Data Sampling	
	NO2 slant column density	✓ Use Default	
	NO2 slant column density precision		
	anumber of iterations	Total grid size: x: 450 y: 3246	
	Number of spectral points used in the retrieval	X: Undefined 🗢 🚥	
	O3 slant column density	McIDAS-V	
	O3 slant column density precision	File Edit Display Tools History Bundles Window Help	
	Precision of fit coefficient of the Ring effect	🍯 🚍 💽 👽 😵 🔞 😡 😮 🕥 💭 🖼 🖤 🖨 Current WX	
	Precision of liquid water column		
	Precision of stratospheric vertical column of nitro Precision of the slant column density of oxygen		
	Precision of the sum of the tropospheric and str	standarda 🖉	gend
	Precision of the sum of the dopospheric and sum Precision of the total vertical column of nitrogen	View Projections Dend 1 99 9 00	-
	Precision of the total vertical column of nitrogen	dioxide derived	
	Precision of water vapor slant column density	North & Centr	ral America
	Processing quality flags	World Political	
	Root mean square residual of the fit		
	Slant column density of oxygen collision induced	absorption	51 - 62 / 12 - 14
	Stratospheric air mass factor		JITL LZ
	Stratospheric vertical column of nitrogen dioxide	e, derived from the second secon	
	Sum of the tropospheric and stratospheric vertice	al columns	
	Total vertical column of nitrogen dioxide derived	d from the total s	
	Water vapor slant column density		
	A wavelangth calibration chi causes		
		Create Display *	

Memory: 653/1074/5462 MB Latitude: -18.2 Longitude: -26.7 Altitude: 2776.2 m

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.





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













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!



