PA54A-04: Lessons and Challenges for New User Development for NASA Earth Observation Data

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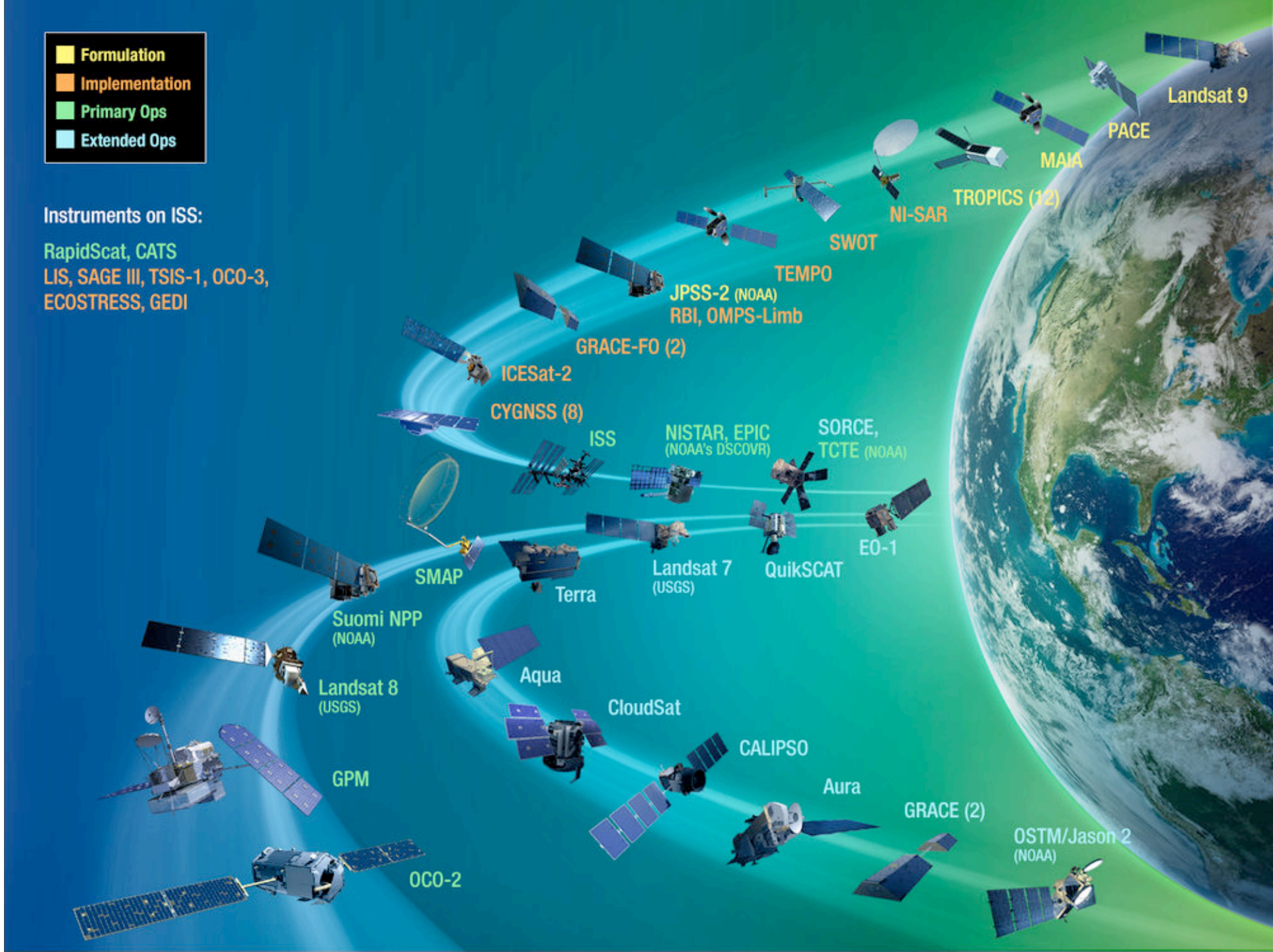
Landscape of the Earth Observation data available now and in the future

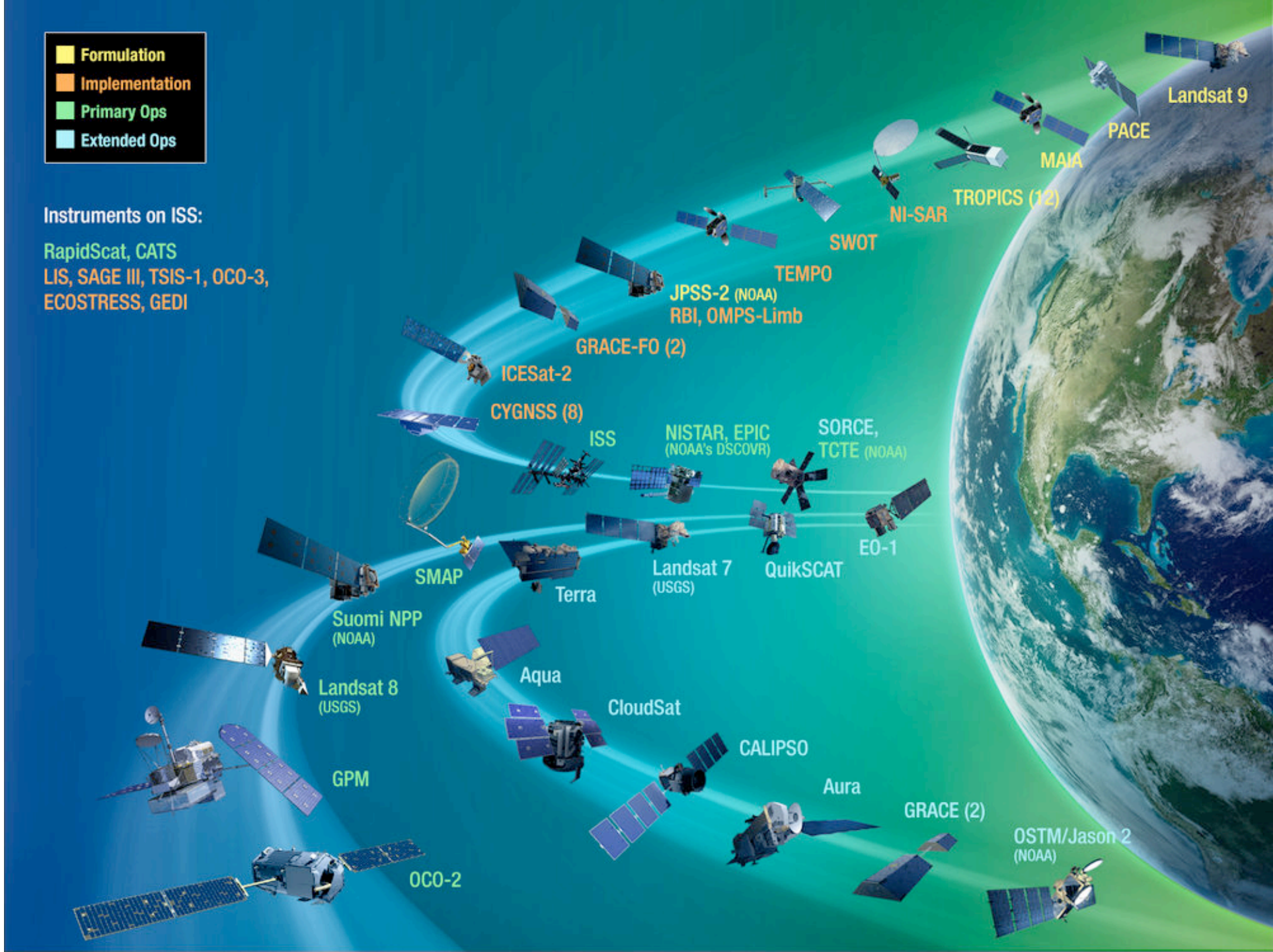


Q : How do we get more users for our data?

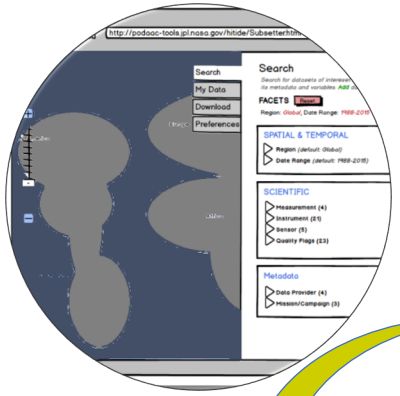
Translation:
How can we get more publications?

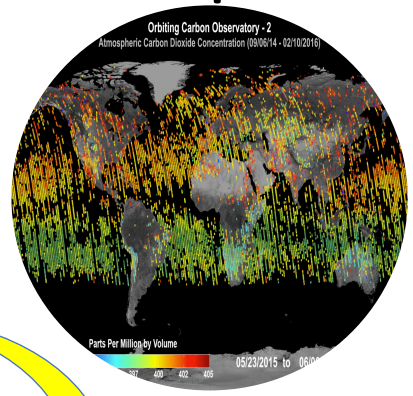
Translation:
How can we get other agencies to say they value NASA data?

Reality:
Much more complicated to answer!



First, A System Engineering Approach to User Assessment & Development





User Assessment
- Identification
- Requirements
- Process
- Compatibility

Product Development
- Data
- Tool
- Interface
- Test

Implementation
- Schedule
- Adoption
- Evaluation
- Operation

DESIGN → DEVELOP → DELIVER

However, one of the unique components in system engineering is how to address the human component of the system.

"Systems engineering focuses on analyzing and eliciting customer needs and required functionality early in the development cycle, documenting requirements, then proceeding with design synthesis and system validation while considering the complete problem, the system lifecycle. "

So the solicitation, understanding, and gathering of customer needs and requirements, as a part of the planning and design process, will improve the overall feasibility of the mission.

Oliver, David W.; Timothy P. Kelliher, James G. Keegan, Jr. (1997). Engineering Complex Systems with Models and Objects. McGraw-Hill. pp. 85–94. ISBN 0-07-048188-1.

User Assessment: Identify and Get to Know your User

DESIGN PHASE

User Assessment
Identification
Requirements
Process
Compatibility

USDA United States Department of Agriculture
Agricultural Research Service

USDA United States Department of Agriculture
National Agricultural Statistics Service

USDA U.S. FOREST SERVICE
Caring for the land and serving people
United States Department of Agriculture

Some Questions:

Who will use and or need remote sensing data?

What is remote sensing data to *them*?

Do they know how to work with the data?

What do they need the data for?

What do they think they would get?

How would they use the data?

What are their goals for using the data?

How do they think the data will help their goals?

How does their work feed into the next step? Does it?

User Assessment: Learn about Requirements and Processes

DESIGN PHASE

User Assessment
Identification
Requirements
Process
Compatibility

Some questions:

What are your products?

What are your deliverables?

What are your needs?

What are your wants?

What are your concerns?

How do you work?

How do you want to work?

NASS Annual Product Summary

Products				
Name	**Time Frame**	**Information**	**Source**	**Users**
Census survey	1X/5 years	Complete summary	All Producers earning over $1K/year	Producers, Wall Street, US government
Quarterly survey	Every 3 months	Acreage, crop variety	Voluntary producer participation	Producers, Wall Street, USDA
Intentions survey	1X/year, March	What will be planted	Voluntary producer participation	Producers, Wall Street, USDA
Assessment survey	1X/year, August	Yield	Voluntary producer participation	Producers, Wall Street, USDA
Crop Progress and Condition Survey	Weekly	Commodity assessment and soil moisture	Voluntary producer participation	Participant List and NASS
Crop Data Layer Maps (CDL)	1X/year February	Map with what and where commodities are planted	FSA, Unit analysis of producer data	Publicly available

Must Have Regular Engagement and Feedback

DESIGN PHASE

User Assessment
Identification
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Process
Compatibility

- 1st workshop (before launch)- Discussion focus was for the XCO_2 products and its use (and limitations) for policy. Take away was OCO-2 would be good proof of concept and baseline data that will pave the way for OCO-3 data. Application possibilities would be limited.
- 2nd workshop (NLAE) – Discussion focused more on Interest in SIF products and how that can used to "replace" or be used in conjunction with NDVI for agricultural applications.
  - Deliverable: MOU with NLAE, Joint SMAP-Ex campaign in IA, NE, and IL flying CFIS, published paper Wood et al. SIF as a proxy for GPP.
- 3rd workshop (USDA) – Discussion focused on developing traceability matrix and next steps for working with different agencies within USDA.
  - Deliverable: Traceability Matrix and strategic partners.
- 4th workshop (JPL) - Dual goal workshop for OCO-2 and OCO-3, users presented on their current work incorporating OCO-2 data and future direction. Interest was expressed in combining work with ECOSTRESS or other ISS capabilities.
  - Deliverable: Working groups and targeted studies
- 5th workshop (AGU) - SIF Technical Workshop for existing and future satellite. Participants will meet the leading SIF researchers and learn more about how to work with SIF data including caveats and how to do data fusion
  - Deliverable: Working groups and workshop report

User Assessment and Product Development Example

DEVELOP PHASE

Product Development

Data

Tool

Interface

Test

Orbiting Carbon Observatory-2 (OCO-2) Application Traceability Matrix

Application Area	Branch	Fundamental Questions	Current Measurements & Approach	Planned Measurements	Measurement Needs*	OCO-2 Data Product Available	Instrument Performance	Complementary Data	Study Priority	Readiness Level (ARL)
Agriculture	ARS	How can we use SIF to study plant stress and productivity?	FluxTower and aircraft data along with LandSat Data, looking at NDVI, EVI and models.	OCO-3, ECOSTRESS	Small spatial resoluion e.g., 1 pixel=1 degree	L2 SIF	1.3 × 2.25 km2	ET and ambient T	1	4
Agriculture	ARS	How can we combine SIF data with existing data to better gauge ET?	Flux Tower and aircraft data along with LandSat Data, looking at NDVI, EVI and models.	OCO-3, ECOSTRESS	better than 16 day repeat of LandSat	L2 SIF	1.3 × 2.25 km2	ET and ambient T	2	4
Agriculture	ARS	How can we use SIF as a complement to NDVI for studying land change?	Small Scale studies comparing NDVI over a given area to SIF maps of photosynthetic activity.	OCO-3	better than 16 day repeat of LandSat	L2 SIF	1.3 × 2.25 km2	NDVI	3	3
Agriculture	ARS, NASS	What impact does [CO2] have crop productivity?	Models and yield estimates	OCO-3	Small spatial resoluion e.g., 1 pixel=1 degree	L2 or L3 XCO2	2.9 X 10.3 km2	ArcGIS data	5	3
Agriculture	ARS, NRCS, NAS	What impact does [CO2] have on invasive species and crop protection?	Models and surveys	OCO-3	N/A	L2 or L3 XCO2, L2 SIF	2.9 X 10.3 km2	Data from Plant Materials Centers	7	3
Agriculture/Forest Service	ARS, USFS	How can we improve from the the scaling up and down of CO2 to capture regional needs?	Combining tower data across LTAR network and the model, SMAP	OCO-3	Better spatial and temporal resolutions, as well as uncertainty quantification	L2 XCO2	OCO-2 footprint surface is 1 sq mile	Flux tower data	6	3
Forest Service	USFS	How can we use averaged CO2 values from space to support survey work in our forest systems?	Sampling and building models for CONUS.	OCO-3, GEDI	N/A	L2 or L3 XCO2	400 foot prints/deg latitude	Surveys	4	3

Assessment for Tool Development

DEVELOP PHASE

Product Development
Data
Tool
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Visualizing Data						
Service	**Contact**	**Tool**	**End User**	**Can use OCO-2 data directly from DAAC**	**Description**	**Reference**
Common Mapping Client	George Chang	Global Imagery Browse Service (GIBS)	Scientist	no	Clioent service which requires a backend service such as GIBS. Interactive tool that provide plots and timed series for study	http://marstrek.jpl.nasa.gov https://sealevel.nasa.gov/data/data-analysis-tool
Eyes on the Earth	Jason Craig	Elumanati Software	Public	no	User friendly interace to play with NASA data from different satellites. Display static low res images that can move like short movie from software	http://eye.jpl.nasa.gov/eyes-on-the-earth.html
World View	Charles Thompson	Globla Imagery Browse Sevice (GIBS)	Scientist	no	Interactive customizable browsing tool that uses the GIBS backend to serve up different data sets. Can set layers and create maps	https://worldview.earthdata.nasa.gov
Hyperwall	Jeff Hall/John Howard	Rendered jpegs or PPT	Public	no	Multi screen, high resolution display of static images or movie files. Data or images used can all be different and shown on available screens.	https://svs.gsfc.nasa.gov
JERI	PODAAC	GIRI	Scientist	no	Use data files to create large mosaics that can be ingested into GIBS and then displayed in web based browser	
X-GLOBE	Zhangfan Xing	Webification	Scientist	no	Access of various data files for web based applications and adaptable for web based tool API. Interactive user interface can pull their data from widget and see their data on the globe.	http://xglobe.jpl.nasa.gov
DISCOVR	KY and Manasa Ashok	Java based search/query tool	Scientist or data seeker	yes	Intuitive query tool that allows user to serach y region/area to pull just the files they need on the dates they need. User can interact with data display on Xglobe	only internal so far

Summary of Process and Lessons

- Have a plan (what do you want to achieve and have steps to help you get there) and be prepare to revisit and revise.
- Do you homework (Don't make assumptions)
- Take time with users (relationships are cultivated and not just a business card exchange. Listen and don't assume you understand)
- Make sure you have common goals and deliverables
- This will take longer than you expect. Be prepare to scale back due to time or budget.
- Communicate and share

Thank you!