



AIRS Applications

Status, Applications vs. Traditional Science

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March 2016

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Session Objectives

educate and inspire

- program** NASA Applied Sciences
- definition** applications, different from traditional science
- exposure** examples of how science is being applied
- support** services, tools
- feedback**

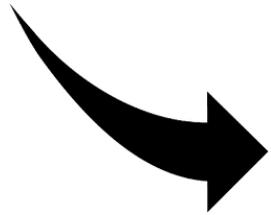
AIRS Applications: where we're at

Level 4 Products	<ul style="list-style-type: none">• Drought Indicator, JPL• Drought Indicator, UCI• Vector Borne Disease• SO2 concentration• Volcanic Ash Burden/Ash, Dust Height• Volcanic, Algorithm comparisons• Temperature Inversions
Tools	<ul style="list-style-type: none">• Applications Browse Tool• AIRS Data Explorer (local GIBS instance)
Map-making infrastructure	<ul style="list-style-type: none">• L3 map prototyping• L2 maps, GIBS format• Operational production: LANCE (NRT) & GES DAAC, both send to GIBS (DAAC supports Big Earth Data Initiative)
Internships	<ul style="list-style-type: none">• NASA Applied Sciences DEVELOP program• summer intern
Partners	<ul style="list-style-type: none">• NASA Applied Sciences, LANCE, GES DAAC, SPoRT• SCAQMD, NOAA Oxnard Field Office
Conferences	<ul style="list-style-type: none">• AGU, AMS

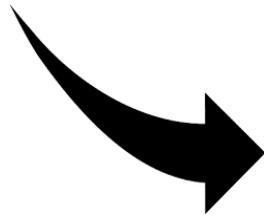
AIRS Imagery

BEDI Big Earth Data Initiative

- Obama Admin effort to make earth data and applications accessible
- improve discoverability, accessibility, usability
- open access and machine readable
- support societal benefit areas



NASA's role:
provide accessibility, tools



EOSDIS approach:

- enhance Global Imagery Browse Services (GIBS) capability to provide pre-generated full resolution browse imagery with links to the underlying data
- greatly expand number of data sets & usability of data by making it compatible with commercial GIS software
- access NASA browse imagery & data through earthdata.nasa.gov (earthdata pulls imagery from GIBS)



AIRS imagery, operational production

BEDI → NASA → EOSDIS → **GIBS**

AIRS near real time L2 images

LANCE to GIBS

- Land, Atmosphere Near real-time Capability for EOS
- AIRS project supplies new visualization algorithm
- algorithm inserted into existing LANCE-to-GIBS pipeline

AIRS standard product L3 images

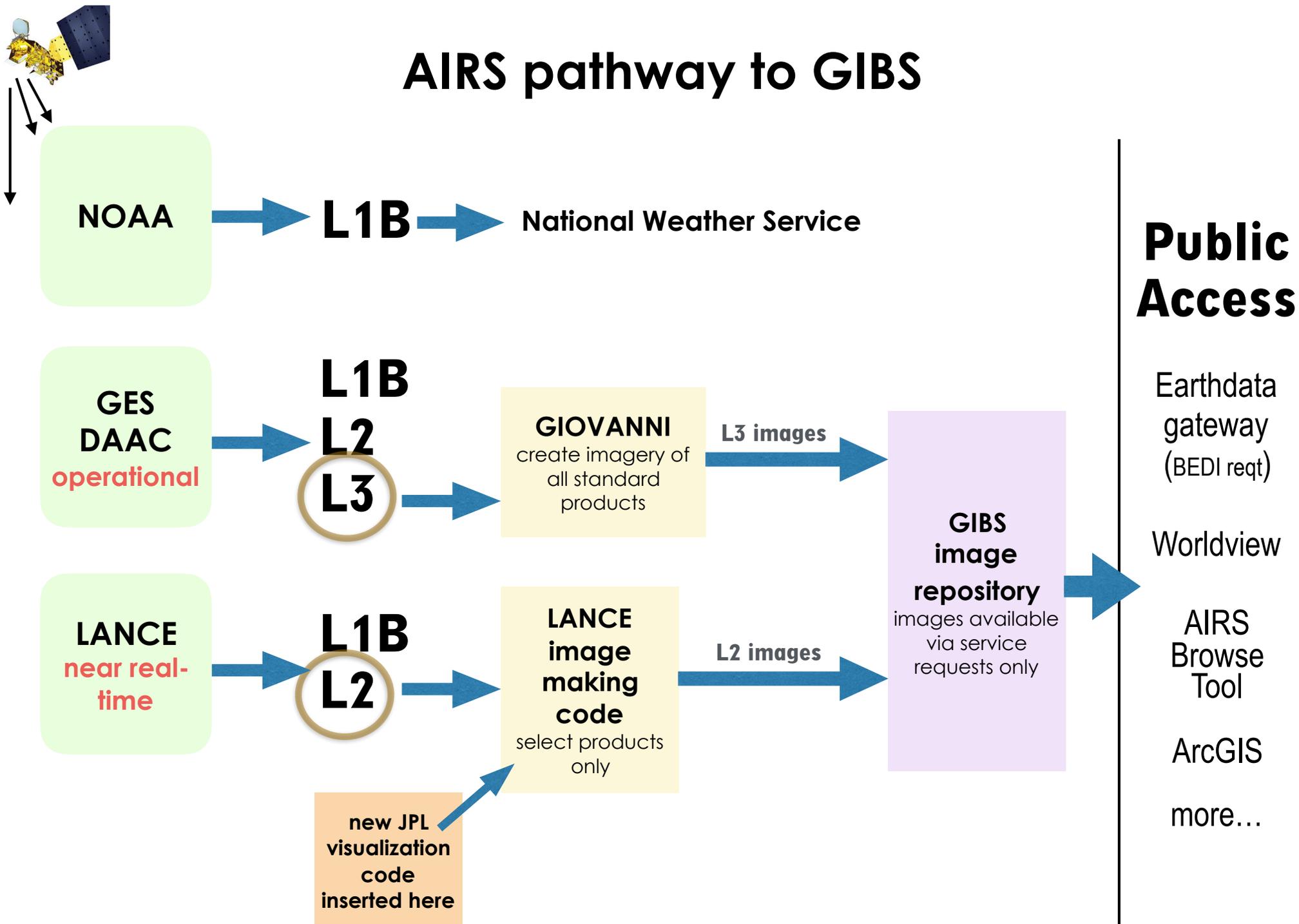
Goddard DAAC to GIBS

- imagery operationally created in GIOVANNI
- GIOVANNI-to-GIBS pipeline

Due by end of FY16,
EOSDIS deliverable for BEDI

- **AIRS Project supplies colorbar, mins, maxes**
- **Coordination, so AIRS imagery in GIBS has consistent colorbar and scaling whether image is from LANCE or DAAC**

AIRS pathway to GIBS



Defining “Applications”

it's not research

“our data could be used in a model that shows...”

it's not PR

“NASA Earth scientists gave a hyperwall presentation to members of the World Bank Agricultural delegation to inform them that NASA has several data products that can be used to determine agricultural yields...”

NASA Applied Sciences Program

“Welcome to the NASA Applied Sciences Program. The Program *funds projects that enable innovative uses of NASA Earth science data in organizations' policy, business, and management decisions.* The project results and enhanced decision making improve the quality of life and strengthen the economy.”

“Discovering innovative and practical uses of Earth observations”

Applications



Science products that are
used by decision makers
or are in a
decision making pipeline

**Converting science information
into products for use by
decision makers**

decision-making pipeline

the path that starts at data and ends with a decision-maker

the task is to identify those steps in between

Why know the pipeline?

We can identify where our product would have relevancy and who might be interested in it. *Discuss product concept with this group, get feedback, guidance*

We can ask people in the know about the M.O. of decision makers—d.m. needs may be less refined than what we assume

Can determine if we're going to step on toes
see the conduits to the appropriate organizations

benefits

save time and money

make a better product

cultivate partners, advocates

improve chance of successful outcome

Applications

(it ain't traditional science)

When it comes to applications,
“The perfect is the enemy of the good”

Mike Wimberly and EPIDEMIA

An applications development model



South Dakota State
University

EPIDEMIA

integrated system for surveillance and forecasting of malaria epidemics

system includes:

public health interface

uploading and querying weekly
surveillance reports

algorithms

automatically validate incoming
environmental and epidemiological
data and update database

surveillance database

First

Saw the need and had the contacts

(Ethiopia)

Second

Talked about idea with Ethiopian contacts
determine if they were interested

Third

Requirements workshop

Ethiopia collaborators and scientists

- Nonprofit executive director helped identify key players
- Participants: scientists, programmers, Ethiopian university collaborators, doctors, and health workers

Hashed out requirements/needs/issues

- Ignorance from both sides
- **Ethiopians didn't know what was possible**
- **scientists didn't know what was needed**

**Michael Wimberly,
Michael Devos, Geoffrey
Henebry, Yi Liu, Chris
Merkord**

**South Dakota State
University**

Gabriel Senay

**USGS Earth Resources
Observation and Science
Center, Sioux Falls SD**

**Estifanos Bayabil,
Mekonnen Bishaw,
Alemayehu Lemma,
Abere Mihretie**

**Health, Development,
and Anti-Malaria
Association, Addis
Ababa Ethiopia**

Belay Beyenne

**Amhara Regional Health
Bureau, Bahir Dar
Ethiopia**

Worku Yalew

**College of Medical and
Health Sciences, Bahir
Dar University Ethiopia**

Post workshop

- “kept in touch all the time”
- first year, live forecasting
- Chris Merkord (SDSU) sent messages about epidemiological data, then sent reports every week during malaria season

Validation data

- get data directly from regional health bureau (weekly data at the district level)
- Health bureau uploads data into their outbreak prediction system
- “It aint perfect, there are time lags (1 week latency), and problems with spatial points

How do we deal with uncertainty?

- Don't give error estimates. "We don't give error estimates with weather forecasts, but people are comfortable with that"
- Pushed out the forecast. "We knew it wasn't good but we linked it to validation"
- Every week model was validated

Product refinement

- Misinterpretations with the forecast reports
- Solicited feedback—it turned out reports were confusing to end users
- Worked with end users to hone forecast reports so text and graphics made sense to recipients

Transition Plan

- Ultimately the idea is to transfer the technique to Ethiopia.
- This needs capacity building, (example: they need a statistician in Addis Ababa)
- Possible that NIH continues research and USAID does the execution
- "My thought in our own planning, we need to brainstorm what the transition plan is"

Labor

- 1 PI and 2 Co-I's, 1FTE programmer, 1FTE post-doc analyst
- Paid colleagues in Ethiopia via NGO Health, Development, and Anti-Malaria Association, Addis Ababa Ethiopia
- Funding from NIH (5 years), currently at start of year 2

“Ultimately you just gotta start doing something. At a certain point you just have to blunder in and do this. If you wait until you have a perfected model, you end up not doing anything. The perfect being the enemy of the good. Look at the history of weather forecasting, they just jumped in and did it.”

— Mike Wimberly

A chat with David Green, Program Manager, NASA Applied Sciences Natural Hazards

rethink “end user”

intermediary groups or brokers often better suited to reach decision makers
NGOs, commercial companies...

new types of partners

think about non-traditional partners that deal with economic impacts, social impacts, or 2nd or 3rd order effects that result from the actual environmental event

collaborate from the get-go

stressed the importance of including brokers or end users at the beginning of the process to inform how the application is developed

ROSES

Working on a ROSES call that will require a broker or end-user be a partner
that doesn't mean just having a letter of partnership

good enough is ok

Applications do not need perfect products. Make a messy demonstration product and get in the dirt with it. This is where the fun is.

RELATIONSHIPS MATTER

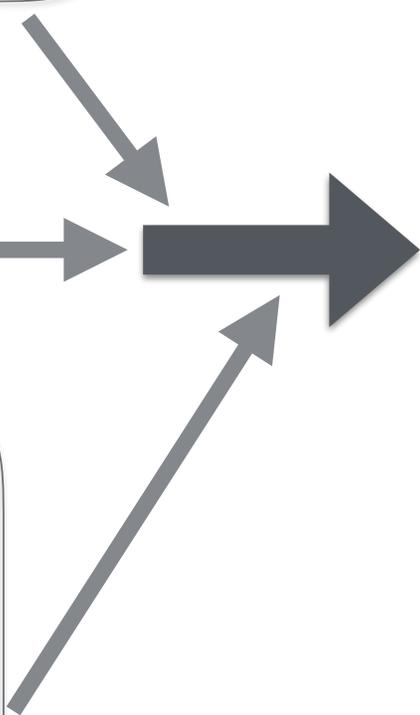
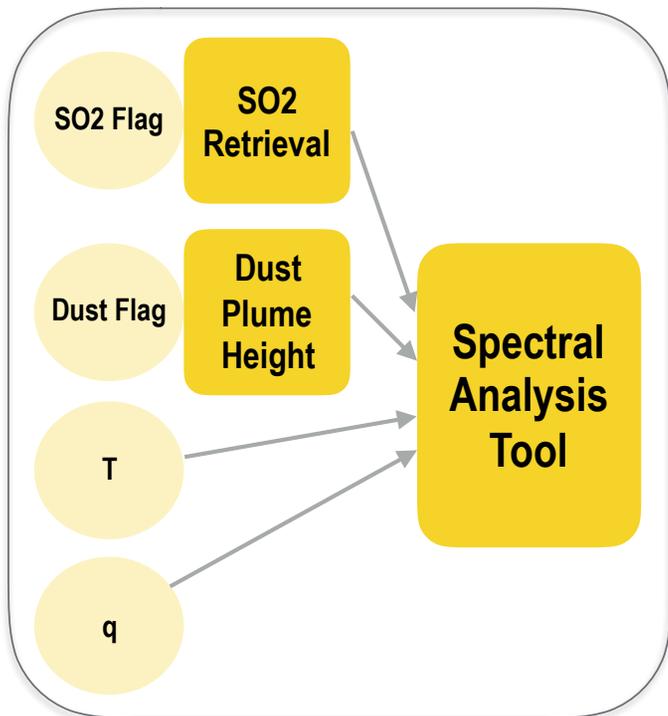
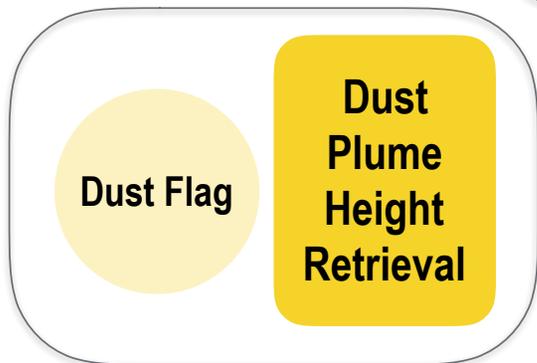
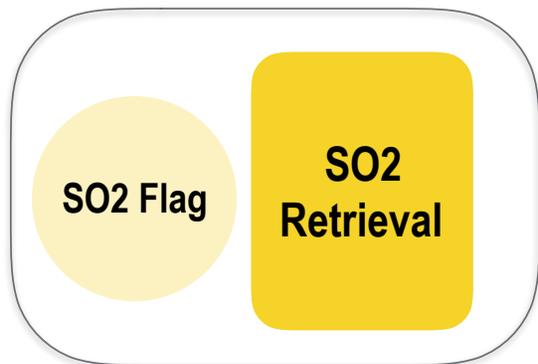
and they must be cultivated

- **organization/groups along a decision pipeline are often a tight knit community**
- **people know each other, trust is key**
- **trusted workflow and network**
they won't necessarily use a product that appears on the scene
(if you build it, it's likely to be ignored)



Decision Pipeline Examples

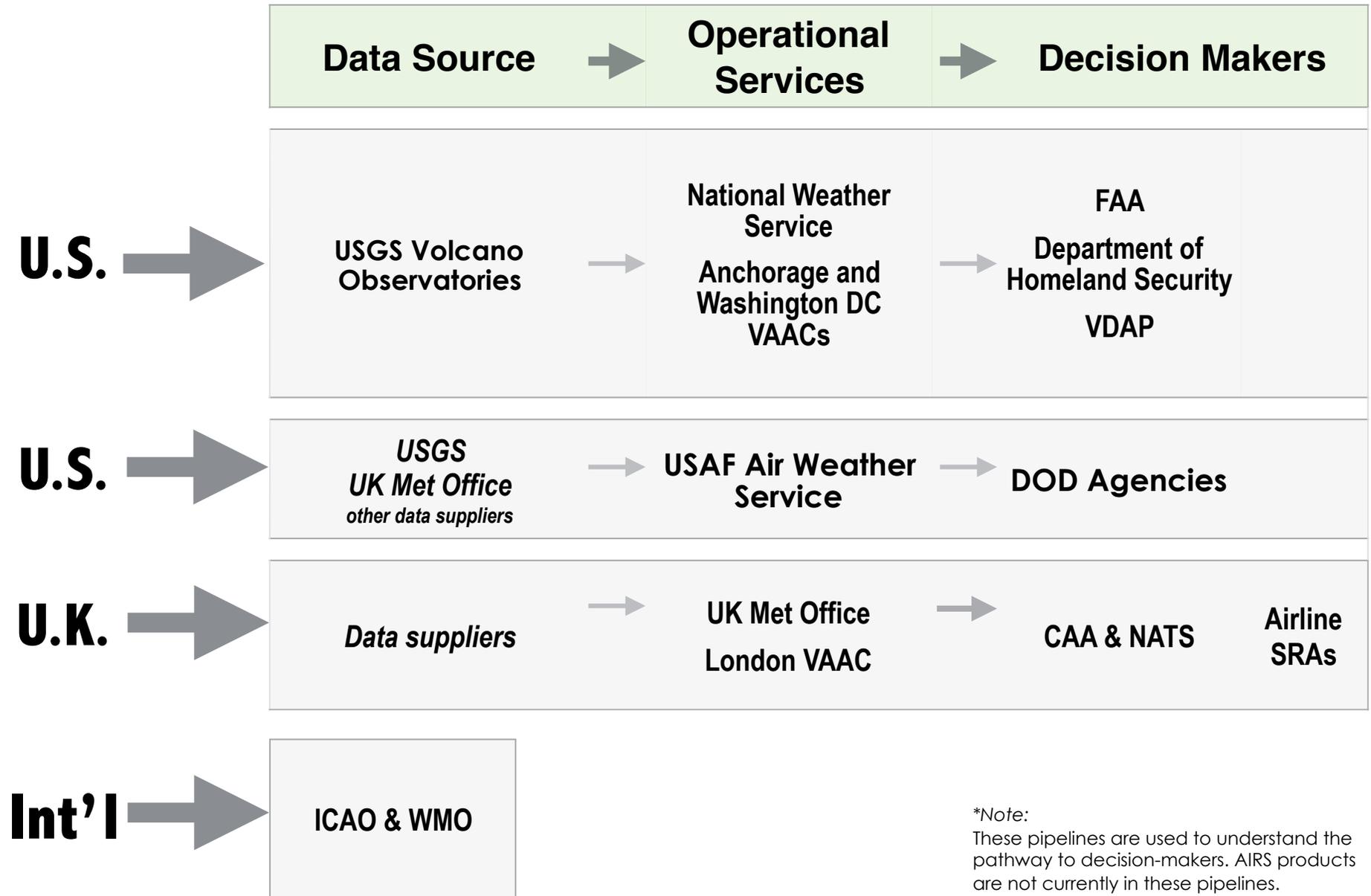
Potential AIRS Volcano Products



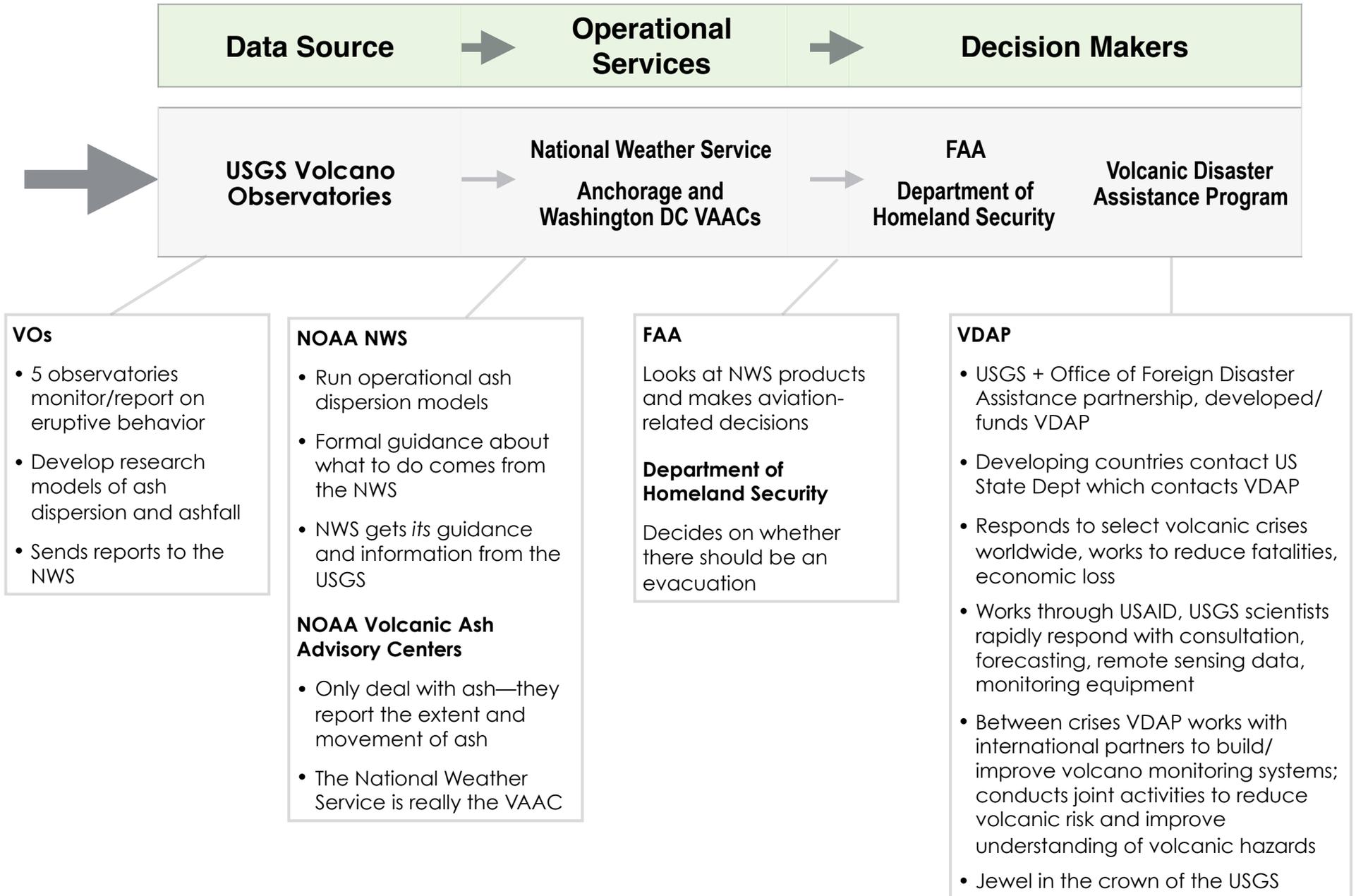
Volcano Decision Pipelines

 standard product  L4 product or tool

Multiple **Volcano** Decision Pipelines*



U.S. Volcanic Emissions Decision Pipeline



U.S. Volcanic Emissions Decision Pipeline - Military



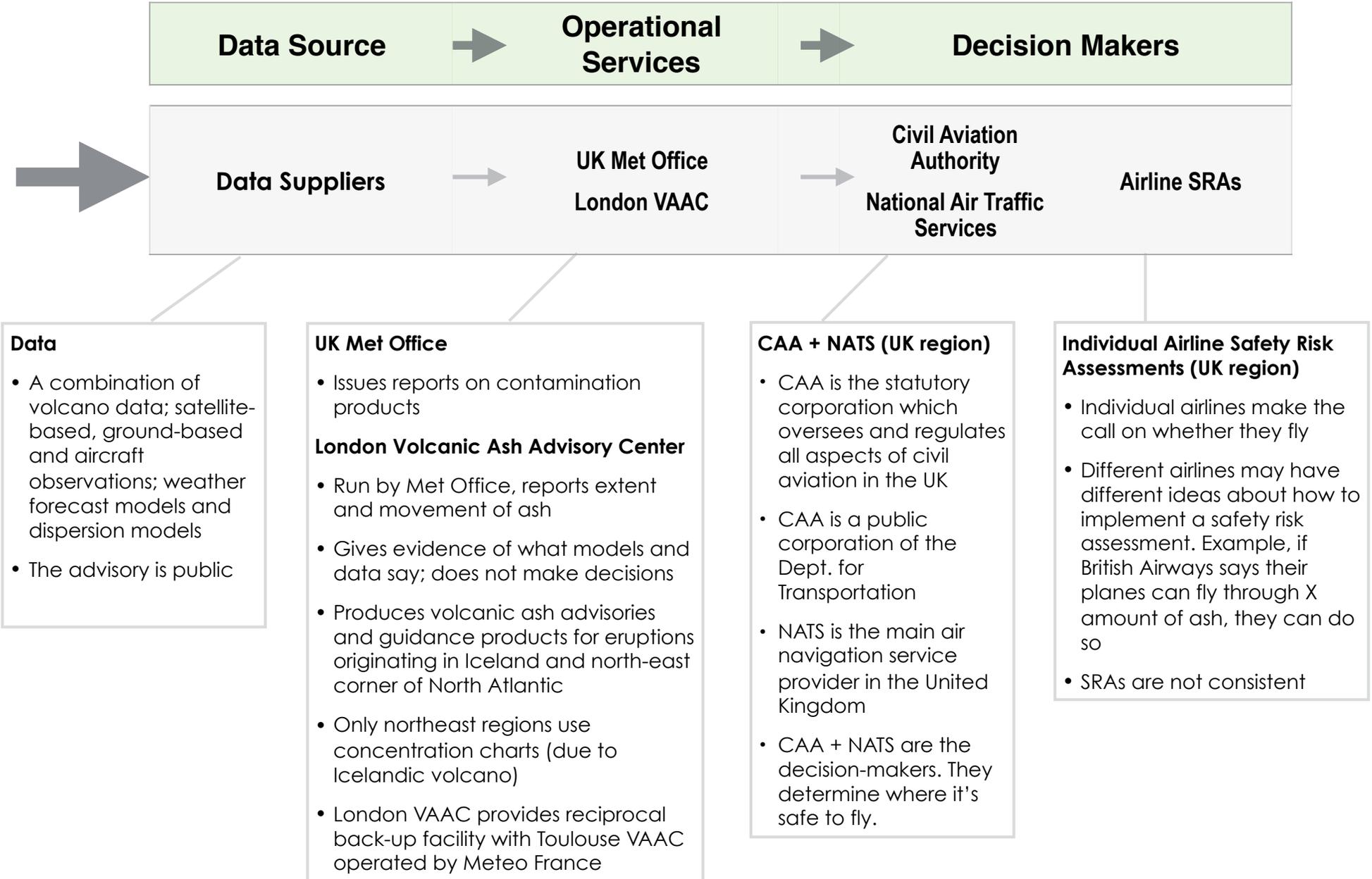
Collaboration in the U.S. for volcanic emissions

- USGS, NOAA, FAA, and Air Force Weather Agency collaborate according to International Civil Aviation Organization (ICAO) guidelines
- Share data and refine communication protocols so that necessary information reaches commercial and military pilots, dispatchers, and air-traffic controllers quickly

AFWA at Offut AFB, Nebraska

- provides terrestrial and space weather products necessary to effectively plan and conduct military operations at all levels of war.
- operates satellite data processing center and centralized climatology center with largest military archive of meteorological data in the world
- AFWA's meteorological satellite applications branch generates volcano summaries and monitors volcanic emissions for Department of Defense agencies
- operational backup for Washington VAAC

U.K. Volcanic Emissions Decision Pipeline



Aviation and Weather World Governance: *The ICAO and the WMO*

- ICAO and WMO maintain close and constant cooperation
- review requirements of meteorological services for aviation and oversee adoption of procedures for the provision of these services

ICAO

International Civil Aviation Organization

- United Nations specialized agency
- Manages the administration and governance of the Convention on International Civil Aviation
- Is the governing body over the WMO
- The ICAO is very strong now because of the Icelandic volcano

WMO

World Meteorological Association

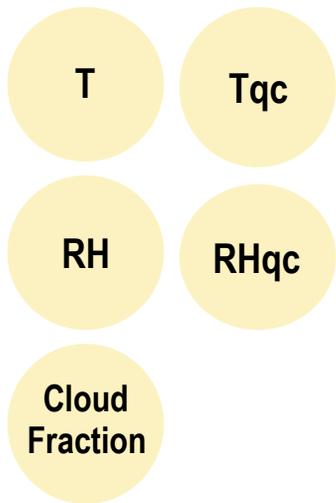
- The WMO includes all the VAACS in the world, 9 VAACS meet once a year
- Kristi Wallace USGS suggested WMO would be interested in any products we have

Volcanic Ash Scientific Advisory Group

- Organized by WMO in cooperation with ICAO, created in 2011 after Icelandic volcano with goal of defining levels of ash concentration that are dangerous to aircraft
- Emphasis both on meteorological (remote sensing and in-situ observations, transport and dispersion modeling) & geophysical/volcanological such as eruption source parameters, ash characteristics, ash fallout and aggregation

AIRS Path to a Drought Application

AIRS standard products



AIRS Level 4 products

JPL

Dewpoint
Temperature

Standardized
Vapor
Pressure
Deficit

Standardized
Relative
Humidity

UCI

Standardized
Relative
Humidity

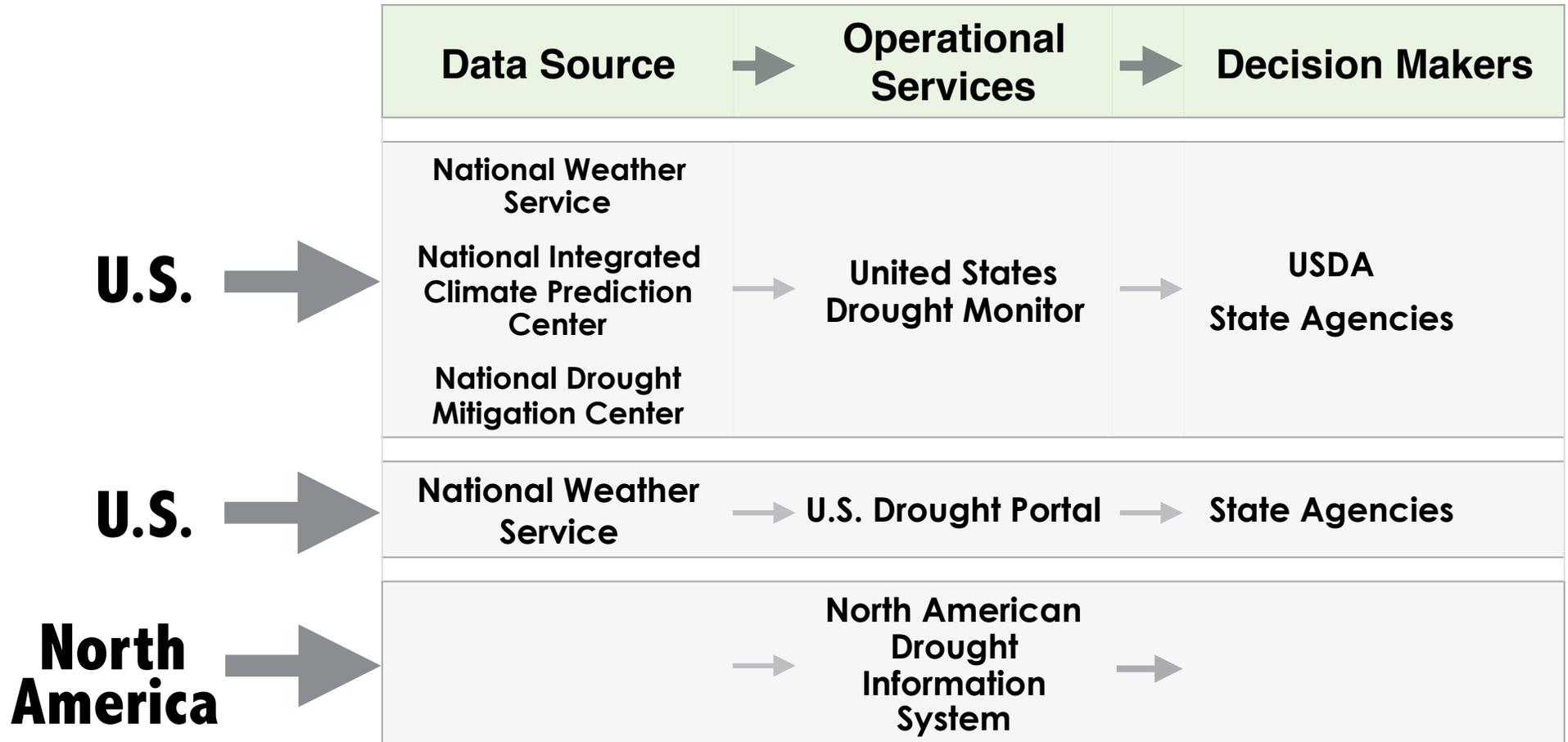
another
algorithm

validate,
make
connection to
drought

Drought Decision Pipelines

DRAFT

U.S. and North America Drought Decision Pipelines*



**Note:*
These pipelines are used to understand the pathway to decision-makers. AIRS products are not currently in these pipelines.



ELSEVIER

Remote Sensing Applications: Society and Environment

M.E. Brown

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University of Maryland, College Park, Maryland, USA

The journal '*Remote Sensing Applications: Society and Environment*' (RSASE) focuses on remote sensing studies that address specific topics with an emphasis on environmental and societal issues - regional / local studies with global significance.

<http://www.journals.elsevier.com/remote-sensing-applications-society-and-environment/>