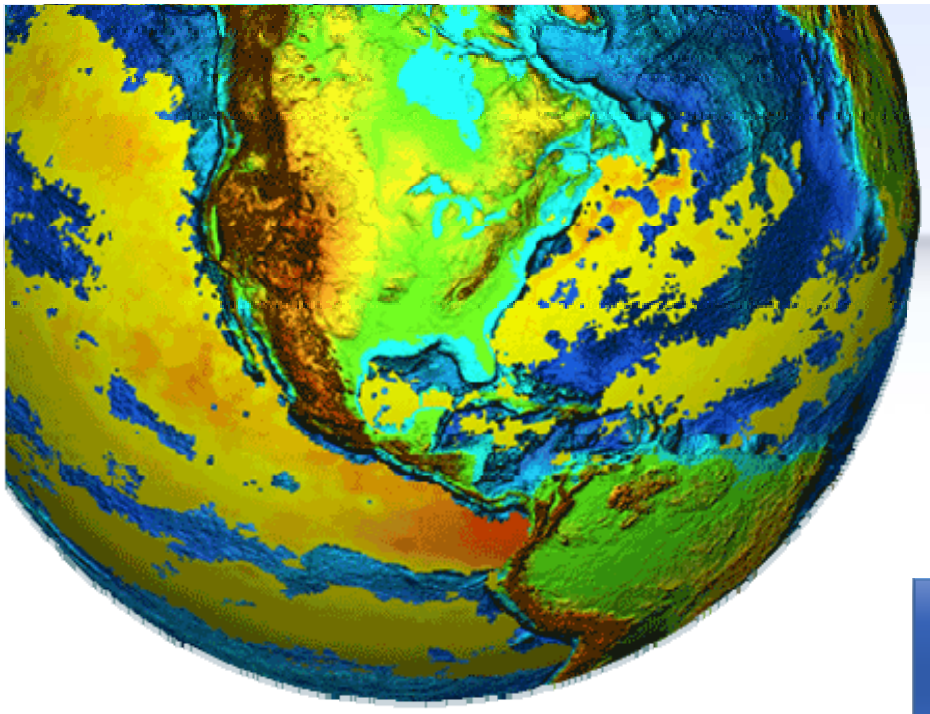

Assessing Climate Data Record Transparency and Maturity

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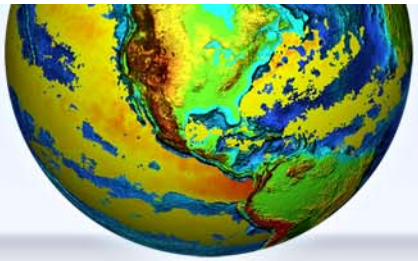
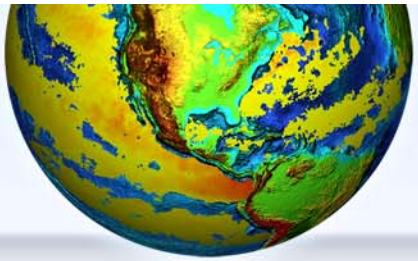
April, 2011



Overview

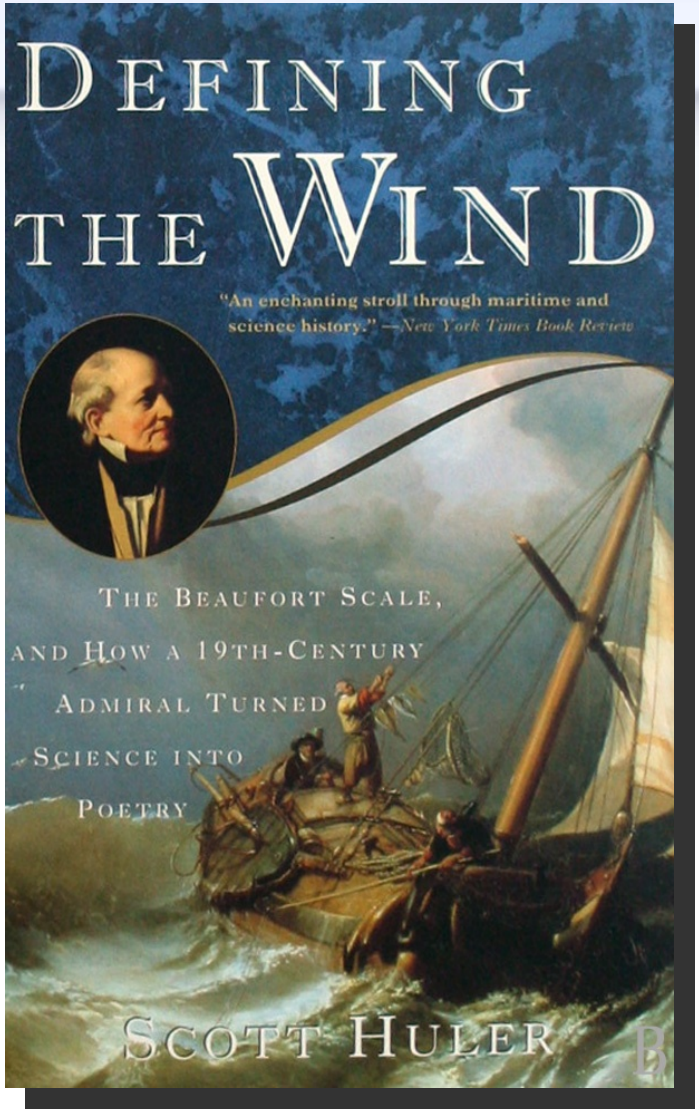
- Climate variability and change are having profound effects on society
- Society deserves full and open access to the data and methods used to produce climate products
- Scientists often use nomenclature and methods that are difficult for non-specialists, and sometimes even specialists, to understand
- Scientists must do a better job in standardizing their nomenclature and methods, and more clearly communicate with the public

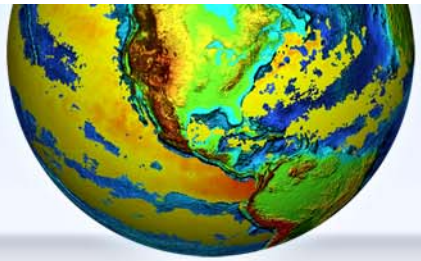


Motivation

What is at stake?

- History shows that weather observations did not become useful for society until a lexicon was agreed to
  - ✓The Beaufort scale did this for wind climatology and maritime commerce in the 19th century
- For The Climate Service to benefit society, it must adopt a lexicon that sets expectations for openness, process and transparency that are accessible to the public
  - ✓How might we define a climate record lexicon useful to both scientists and the general public in the 21st century?



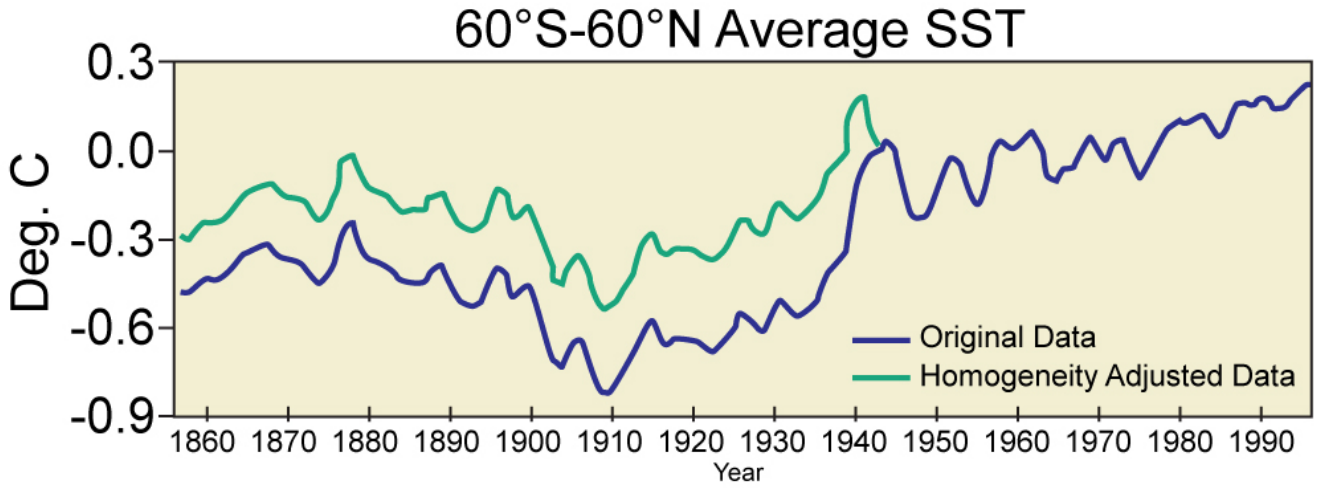


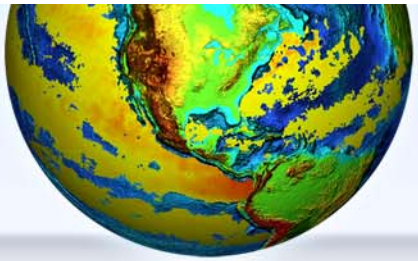
Common Climate Observations
Business Practices

Steps to long-term monitoring

- Over the last 20-30 years many investigators have developed methods for seaming together observations with evolving coverage and accuracies
- From these experiences, common elements are emerging on how climate scientists do business

How do we capture and make available these business practices?

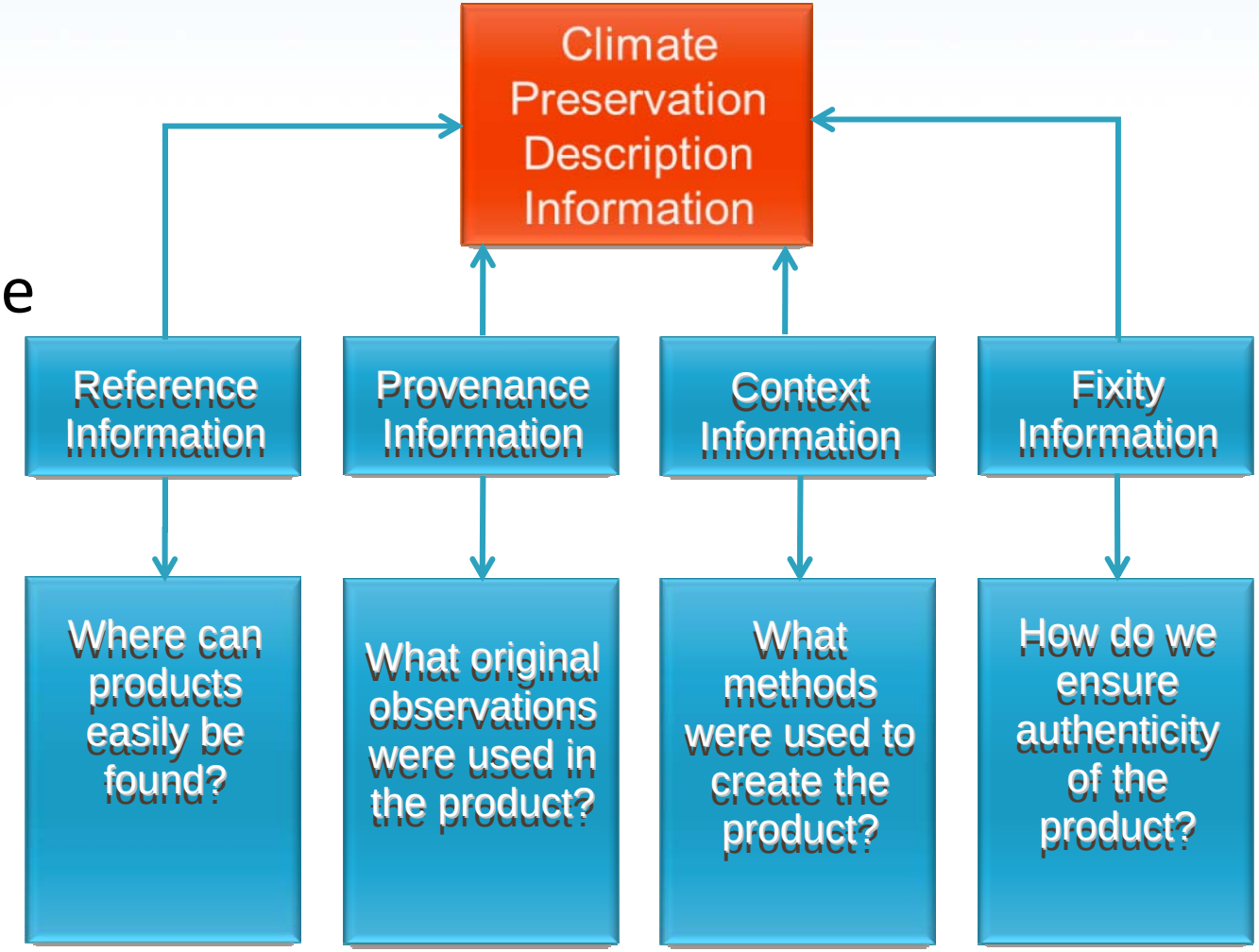


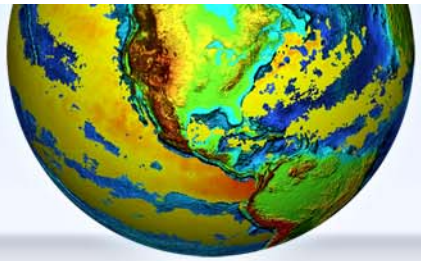


Common Climate Observations

Business Practices

What common preservation information do we need and how do we capture and communicate this?





Do We Need Observation Ingredients and Nutritional Labels?

Ingredients: Tapioca Syrup*, Dark Chocolate Flavored Coating (sugar*, palm kernel oil, cocoa powder*, cocoa butter*, soy lecithin*, nonfat milk*, vanilla*), Peanuts*, Granola* (rolled oats*, brown rice syrup*, sugar*, sunflower oil*, sea salt, baking soda, vanilla*), Crisp Rice* (rice flour*, sugar*, sea salt, malt extract*, annatto color), Cashews*, Almonds*, Rice Maltodextrin*, Sea Salt, Sunflower Oil*, Soy Lecithin*, Natural Flavor. *Organic CONTAINS PEANUT, CASHEW, ALMOND, SOY, MILK; MAY CONTAIN WALNUT, PISTACHIO, PINE NUT, PECAN, MACADAMIA, HAZELNUT AND BRAZIL NUT INGREDIENTS.

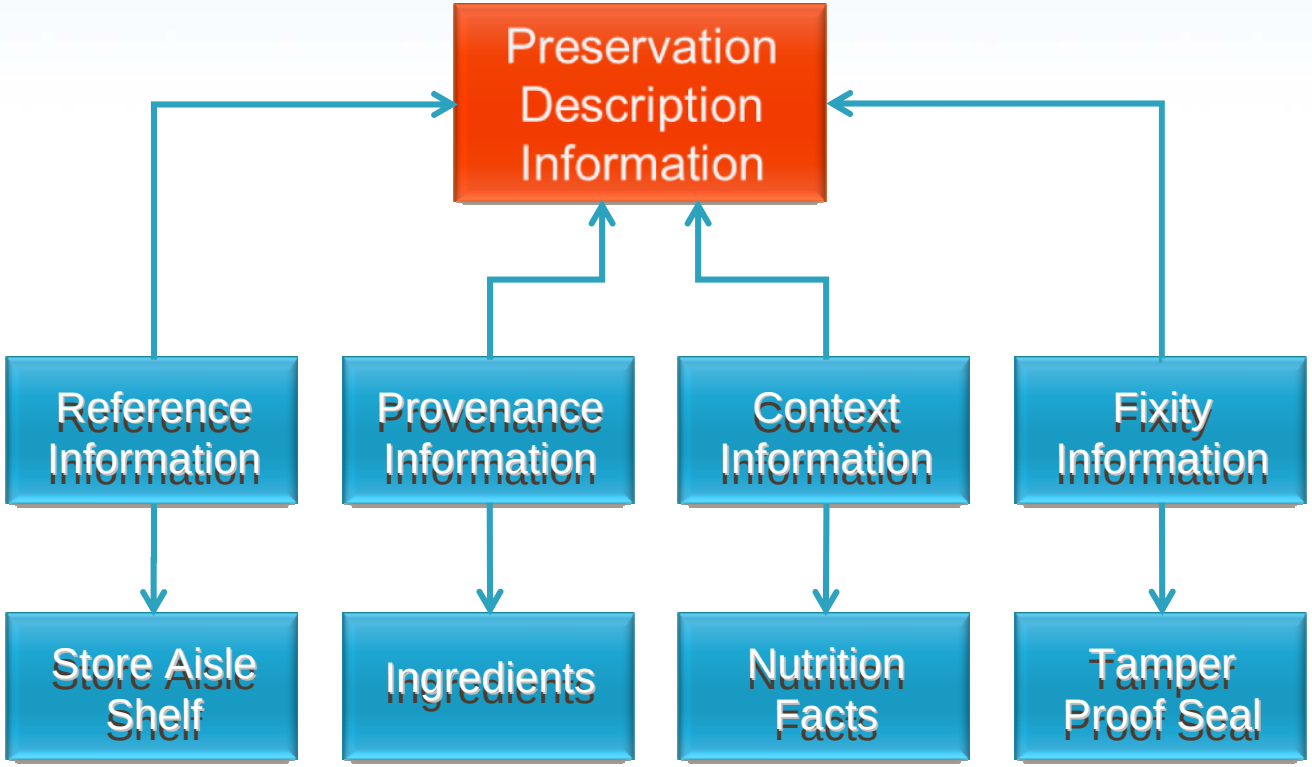
CERTIFIED ORGANIC
CERTIFIED ORGANIC BY THE WASHINGTON STATE DEPARTMENT OF AGRICULTURE IN ACCORDANCE WITH THE ORGANIC STANDARDS OF THE U.S. DEPARTMENT OF AGRICULTURE.

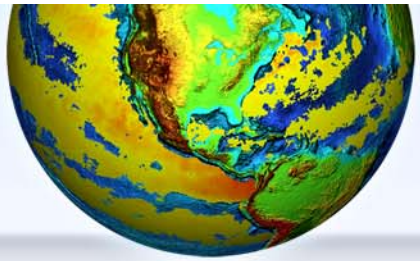
Nutrition Facts

Serving Size (35g)

Amount Per Serving	
Calories	160
Calories from Fat	70
	% Daily Value*
Total Fat 8g	13%
Saturated Fat 3g	14%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 130mg	5%
Total Carbohydrate 20g	7%
Dietary Fiber 2g	7%
Sugars 10g	
Protein 3g	
Iron	2%

Not a significant source of vitamin A, vitamin C and calcium.
*Percent Daily Values are based on a 2,000 calorie diet.





Maturity Matrix

Where can products easily be found?

What original observations were used in the product?

What methods were used to create the product?

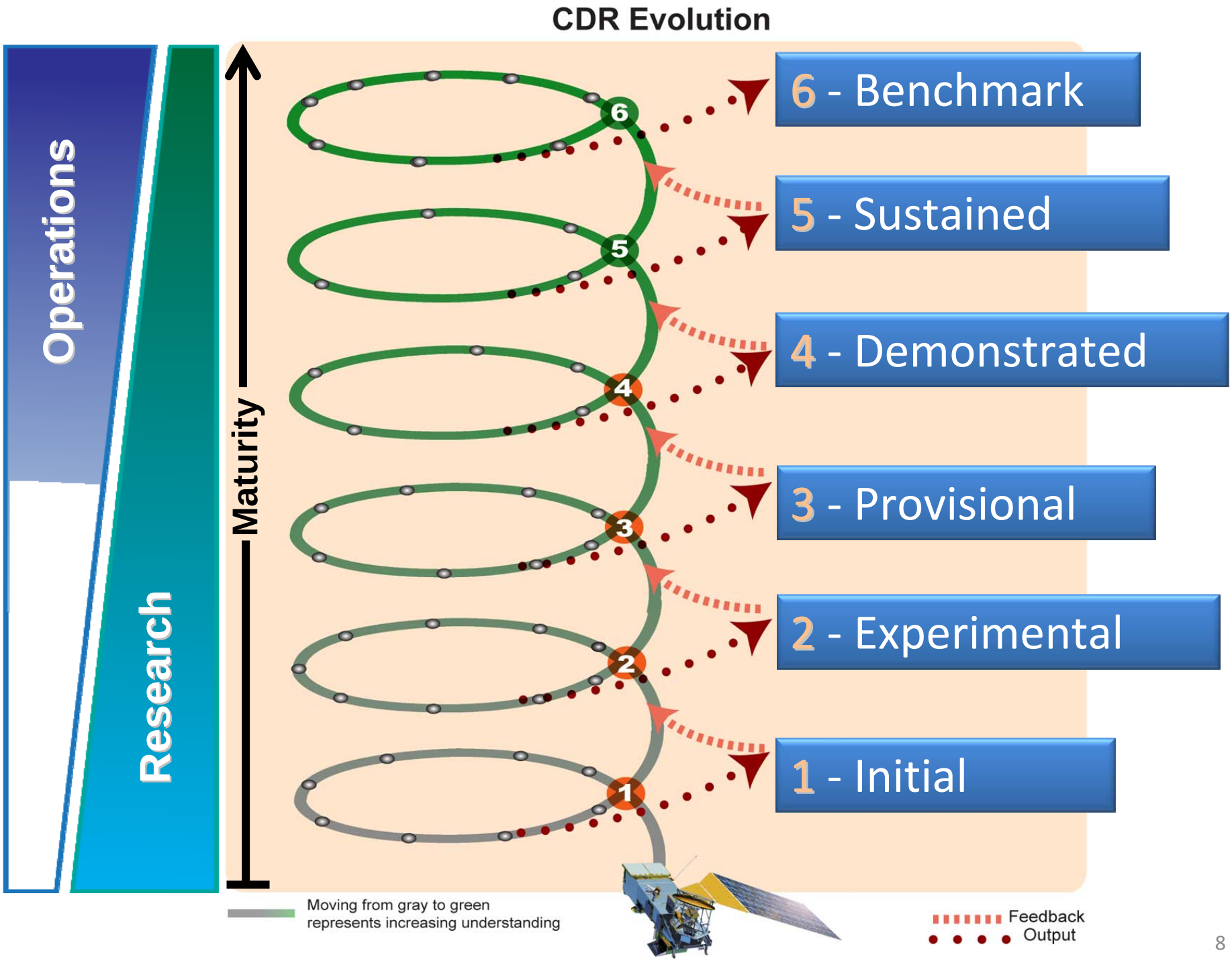
How do we ensure authenticity of the product?

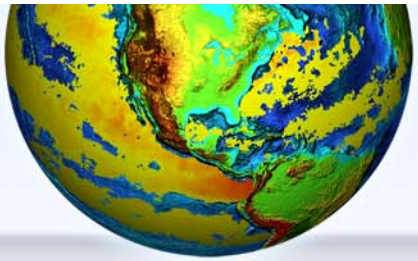
Climate Portal www.climate.go

Digital Signature

Let's define a Maturity Matrix (1=low; 6=high) that sets expectations and assesses progress

Collection Methods	Algorithm stability	Metadata & QA	Documentation	Validation	Public Release	Science & Applications
How was the data collected, sensors, surveys, etc.?	Are algorithms under configuration management and how mature?	How full and complete are the metadata and quality assessment?	Is the Operational Algorithm Description full, complete, and peer reviewed?	How complete is the validation?	Are the data, algorithms and software open and available to the Public?	How extensive is the peer reviewed literature and how varied are the applications?

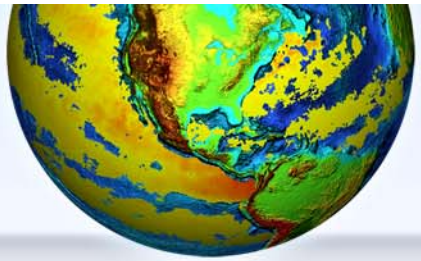

CDR Evolution
Operations
Research
Maturity
6
5
4
3
2
1
6 - Benchmark
5 - Sustained
4 - Demonstrated
3 - Provisional
2 - Experimental
1 - Initial
Moving from gray to green
represents increasing understanding
Feedback
Output



How Do We Prioritize Climate Record Work?

- We can group by cycles –
  Water Cycle, Carbon Cycle, etc.
- We can group by forcing and feedbacks
- We can group by Societal Benefit Areas

- Regardless of the approach, we need some way to assess and communicate easily our progress towards maturity

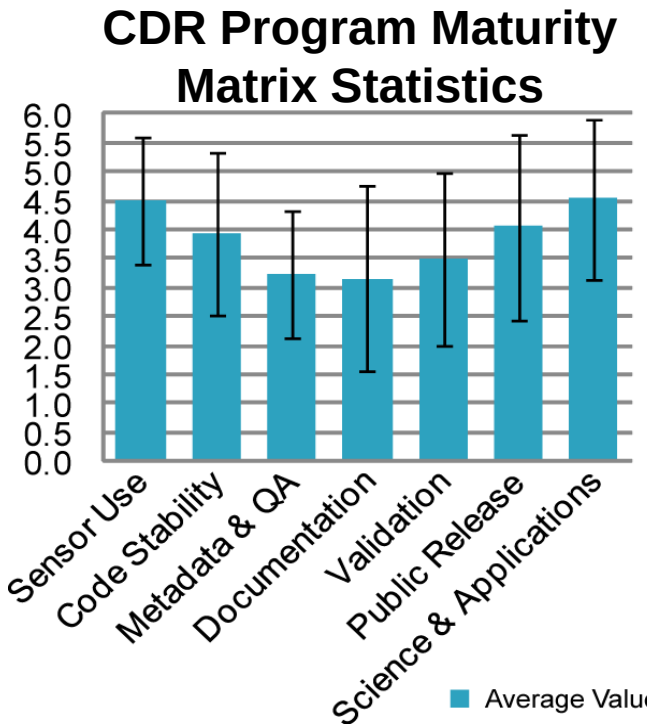


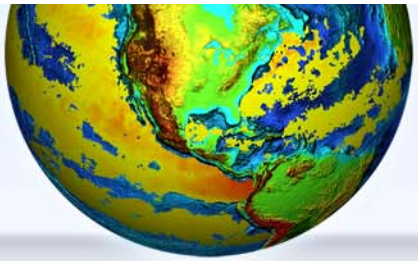
Using the Maturity Matrix to Assess Progress

- NOAA's Climate Data Record (CDR) Program is working with scientists on the routine production of climate information
- A self assessment by those scientists provides a first measure of how the climate community is doing in meeting criteria for openness, process and transparency
- Results show moderate levels of maturity and more work needed in particular on metadata and documentation

Maturity	Sensor Use	Algorithm stability	Metadata & QA	Documentation	Validation	Public Release	Science & Applications
1	Research Mission with limited period of record	Significant changes likely	Incomplete	Draft Operational Algorithm Description (OAD)	Minimal	Limited data availability to develop familiarity	Little or none
2	Research Mission with limited period of record	Some changes expected	Research grade (extensive)	OAD Version 1+	Uncertainty estimated for select locations/times	Data available but of unknown accuracy; caveats required for use.	Limited or ongoing
3	Research Mission with sufficient period of record	Minimal changes expected	Research grade (extensive); Meets international standards	Peer-reviewed OAD and product descriptions	Uncertainty estimated over widely distribute times/locations by multiple investigators; Differences understood.	Data available but of unknown accuracy; caveats required for use.	Provisionally used in applications and assessments demonstrating positive value.
4	Operational Mission with sufficient period of record	Minimal changes expected	Stable, Allows provenance tracking and reproducibility; Meets international standards	Public Operational Algorithm Description (OAD), Peer-reviewed product descriptions	Uncertainty estimated over widely distribute times/locations by multiple investigators; Differences understood.	Data archived and available but of unknown accuracy; caveats required for use.	Operationally used in applications and assessments demonstrating positive value.
5	All relevant research and operational missions; unified and coherent record demonstrated across different sensors	Stable and reproducible	Stable, Allows provenance tracking and reproducibility; Meets international standards	Public OAD and Validation Plan; Peer-reviewed product and validation articles	Consistent uncertainties estimated over most environmental conditions by multiple investigators	Multi-mission record is archived and publicly available with associated uncertainty estimate	Used in published applications and assessments by different investigators
6	All relevant research and operational missions; unified and coherent record over complete series; record is considered scientifically irrefutable following extensive scrutiny	Stable and reproducible; homogeneous and published error budget	Stable, Allows provenance tracking and reproducibility; Meets international standards	Product, algorithm, validation, processing and metadata described in peer-reviewed literature	Observation strategy designed to reveal systematic errors through independent cross-checks, open inspection, and continuous interrogation	Multi-mission record is publicly available from Long-Term archive	Used in multiple published applications and assessments by different investigators
Comments for Maturity rating Avg rating = 3.9	POR 1854 to present ship and buoy data consists of (ICOADS2.4 + marine obs after 2006) NOTE: pseudo calibration uses average statistical adjustment factors not instrumental Historical data has large uncertainty	Code documented throughout Multiple papers published Source code is packaged and deployable	FGDC compliant User Manual available	Algorithm techniques published in multiple papers Internal wiki page with overview, flow chart, white papers, and code descriptions Source code is packaged and deployable	comparisons made with equivalent products e.g., HadSST and GSST comparisons with simulations (e.g.,GFDL CM2.1 but need others) comparisons among previous versions	Data archived and available on ftp server Product updated monthly	Well published and referenced research Most recent version will need a paper after testing MetOffice adjustment factors and new ICOADS release

Self-assessment of a single CDR

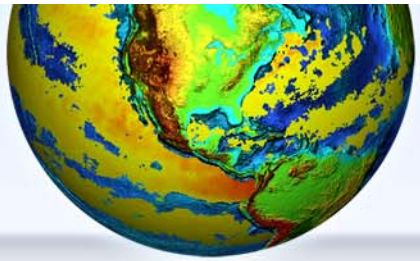




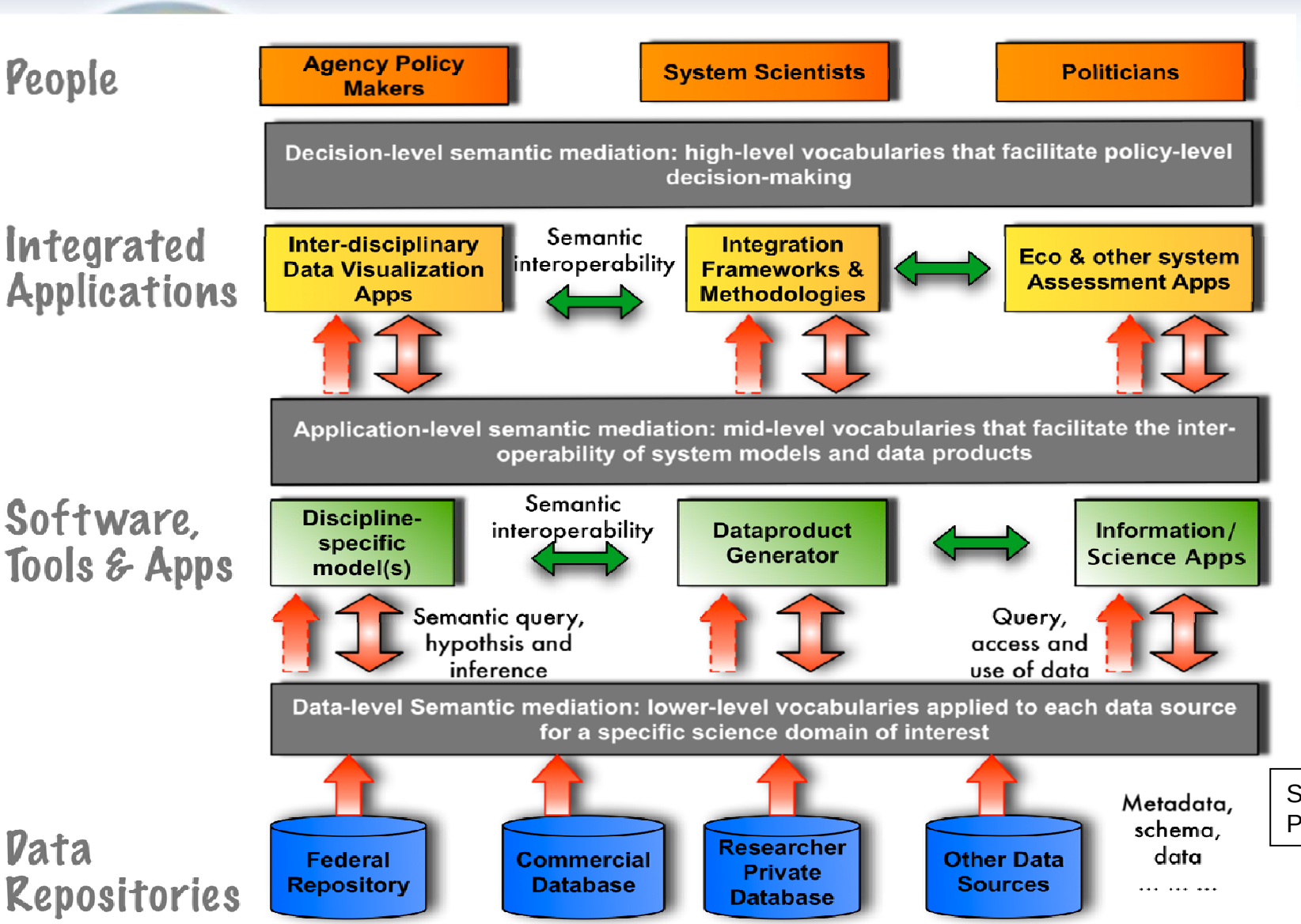
What is the Role of IT in Enabling Transparency and More Widespread Use of Climate Data?

- The Maturity Matrix sets expectations, but needs enabling information technology to be broadly useful
- Climate Services, to be relevant to society, needs to be accessible to both expert and non-expert communities
- We need what has been dubbed *'Knowledge provenance'** - that is, for the content of the Maturity Matrix to be truly useful it must be enriched with semantics and semantically-aware tools

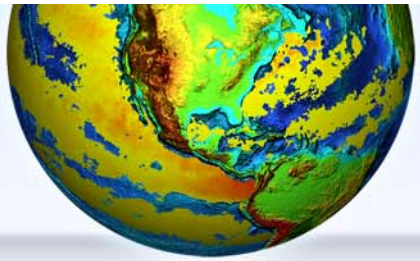
* The term 'knowledge provenance' was coined by Peter Fox Rensselaer Polytechnic Institute



Semantics – Enabling Data Transparency

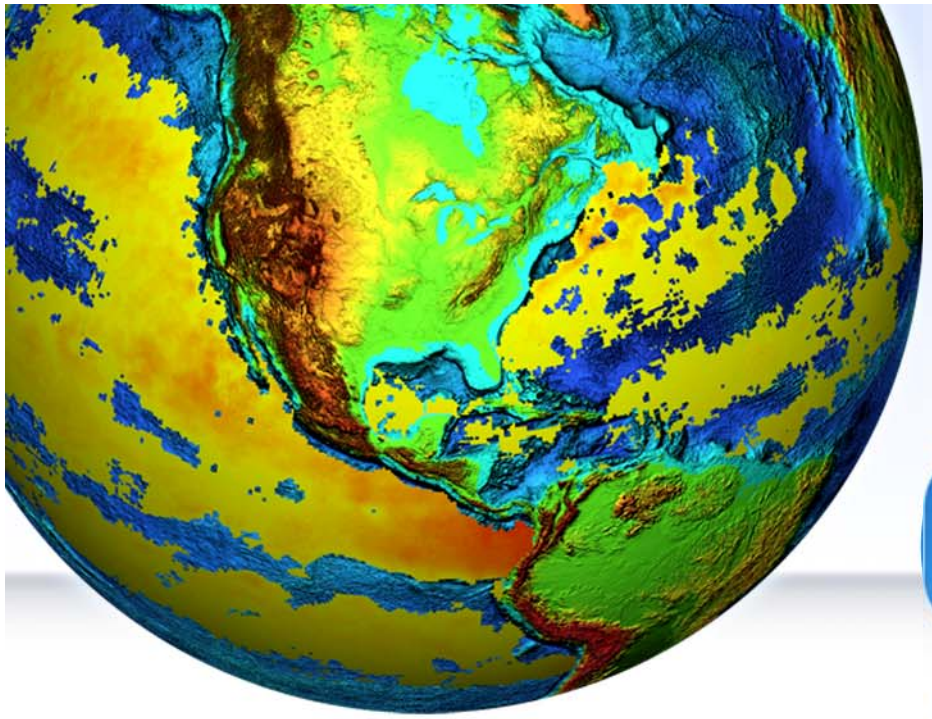


Slide Courtesy Peter Fox RPI



Conclusions

- Climate Scientists must adopt a common vocabulary and lexicon
- The Maturity Matrix provides a basis for information preservation, expectations, and a metric for progress to completeness
- The Maturity Matrix concept needs to be enabled through the use of semantics to be useful to a broad range of interdisciplinary scientists and policy makers



THE CLIMATE SERVICE

Thank You…

Questions?