



Environmental Informatorium: The one stop and multi-faceted observation data service

Apivadee Piyatumrong

(presenter)



GEO Grid Workshop, Sapporo, Japan
Monday, October 17, 2011

Plan



- [Brief introduction of myself
- [Motivation
- [Facts + Concern Issues
- [Challenges
- [Environmental Informatorium

Me

Apivadee Piyatumrong

2007 - 2010

— Université du Luxembourg (UL), LUXEMBOURG

2011 - present

— Large Scale simulation Research Lab (LSR),

— National Electronics and Computer Technology Center (NECTEC),
THAILAND

Apivadee Piyatumrong

Research topics

- Distributed and scalable system
- Dynamic and Multi-Objective Optimization

Applications

- Environment
- Healthcare system
- Mobile ad hoc network

Motivation

Environmental data

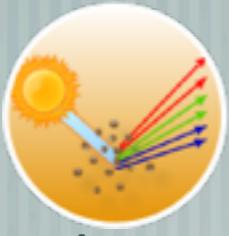
[Natural disaster



[Lots of environmental data type



Surface wind



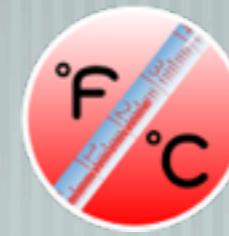
Sun photometer



Pollution



Rain



Temperature



Tidal height

...

[Connecting two main stakeholders

— Data consumers

— Data providers

Facts

Facts of data consumer

[3 simple processes

- Accessing data
- Utilizing data
- Interpreting data

[Different types of consumer

- Civilian
- Administrator
- Scientist



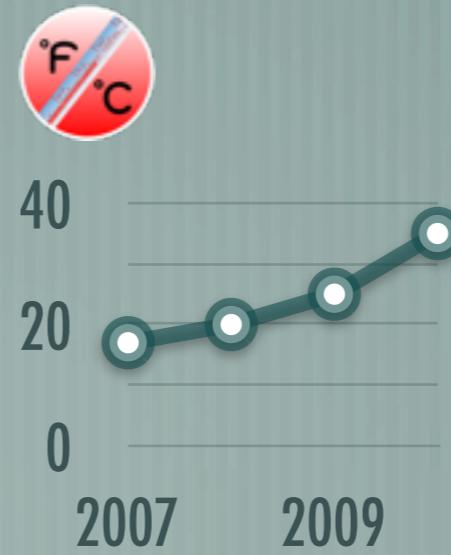
Differentiate those simple processes!

Civilian

Examples

- A family with a good area for life
- A farmer with the right decision for planting & harvesting

Access one-domain
Utilize simple visualization

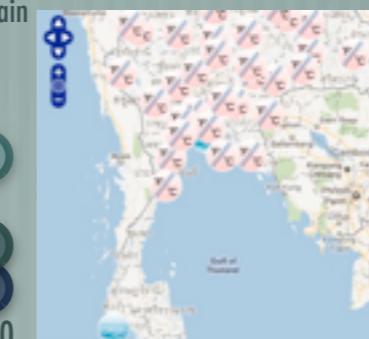
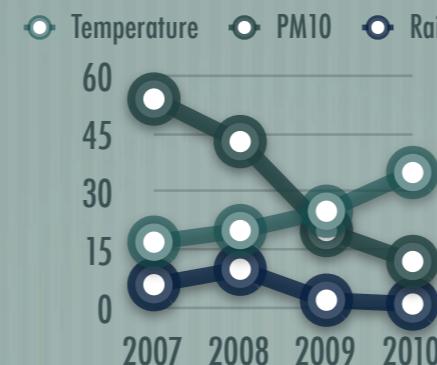


Administrator

Examples

— Provides a consultancy to civilian

Access multi-domain
Utilize integration & visualization tool



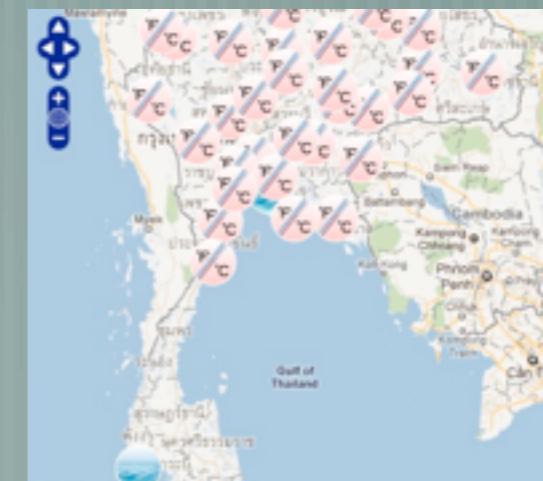
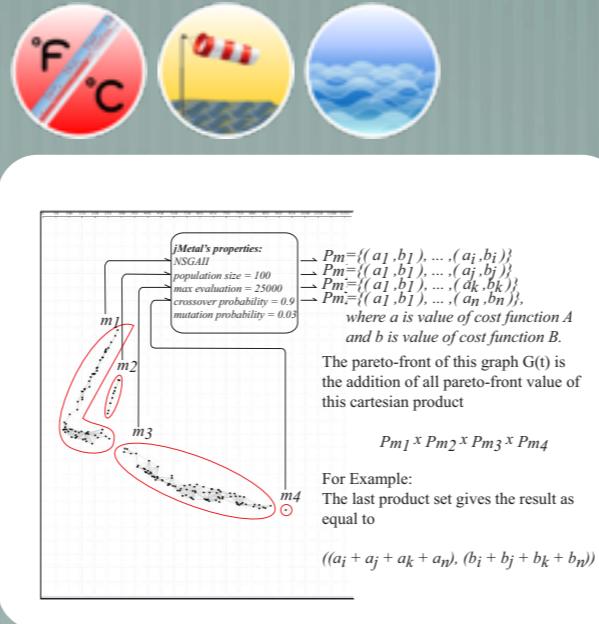
Time	Min	Max

Scientist

Examples

— Studying storm surge at a specific area

Access multi-domain
Utilize scientific models

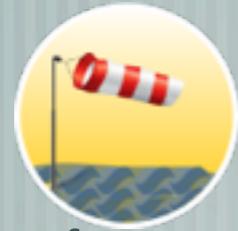


Facts of data provider

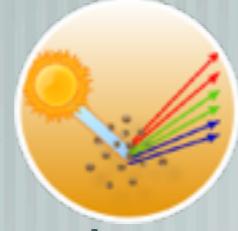
- [**Collect and share observation data**
 - by proprietary means (request, publicity)
 - by proprietary data formats (units/granularity)
 - by different data patterns (.pdf, .txt, netcdf, .html, ...)

Concern Issues

Connecting consumers & providers



Surface wind



Sun photometer



Pollution



Rain



Temperature



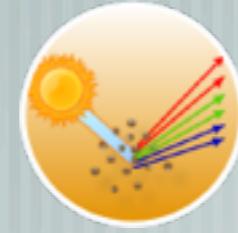
Tidal height

...

Connecting consumers & providers



Surface wind



Sun photometer



Pollution



Rain



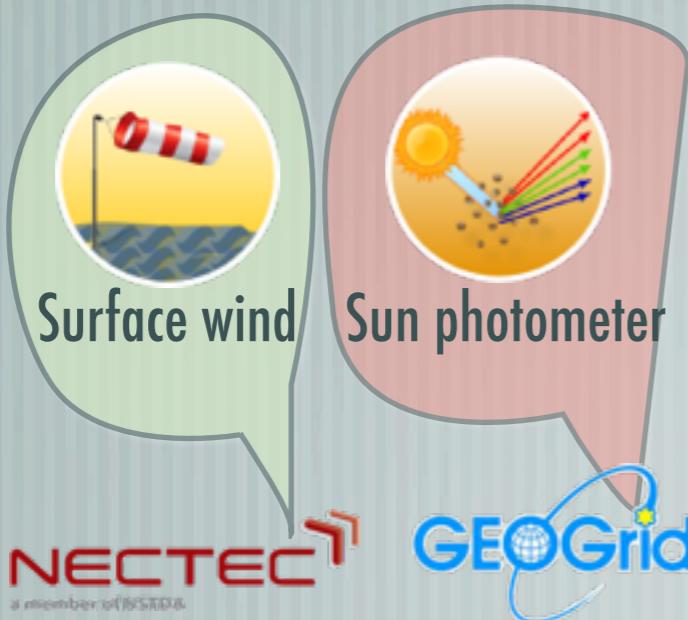
Temperature



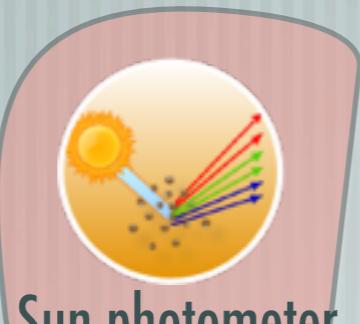
Tidal height

...

Connecting consumers & providers



Surface wind



Sun photometer



Pollution



Rain



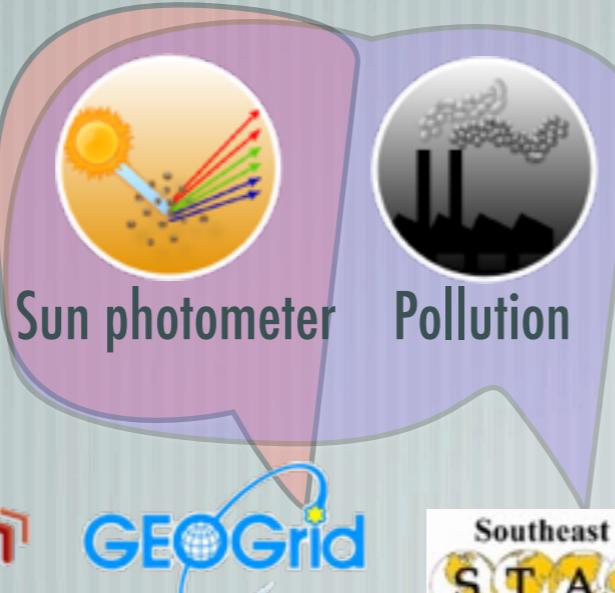
Temperature



Tidal height

...

Connecting consumers & providers



...

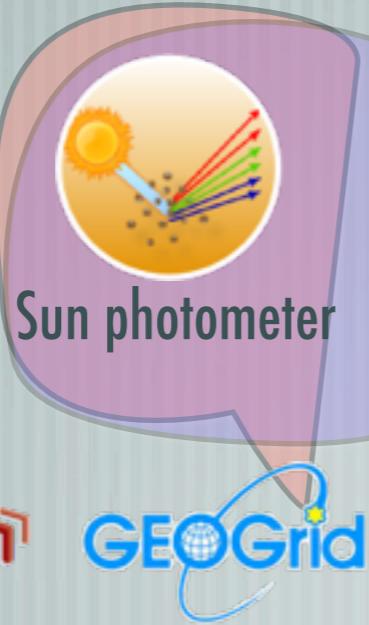
NECTEC
a member of NSCISD

GEOGrid

**Southeast Asia
START**
IHDP · IGBP · WCRP
Regional Center

**Southeast Asia
START**
IHDP · IGBP · WCRP
Regional Center

Connecting consumers & providers



...

NECTEC
a member of NSCI

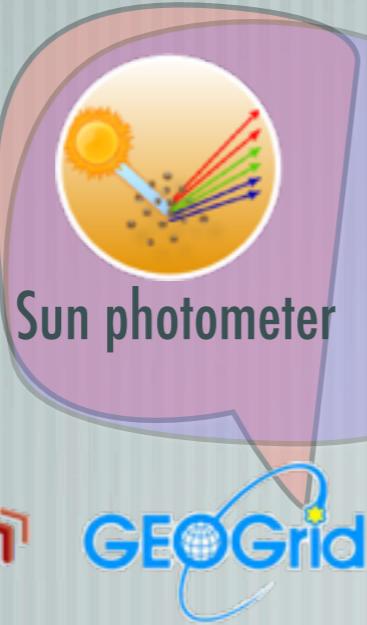
GEOGrid

**Southeast Asia
START**
IHDP - IGBP - WCRP
Regional Center

**Southeast Asia
START**
IHDP - IGBP - WCRP
Regional Center



Connecting consumers & providers



Surface wind

Sun photometer

Pollution

Rain

Temperature

Tidal height

...



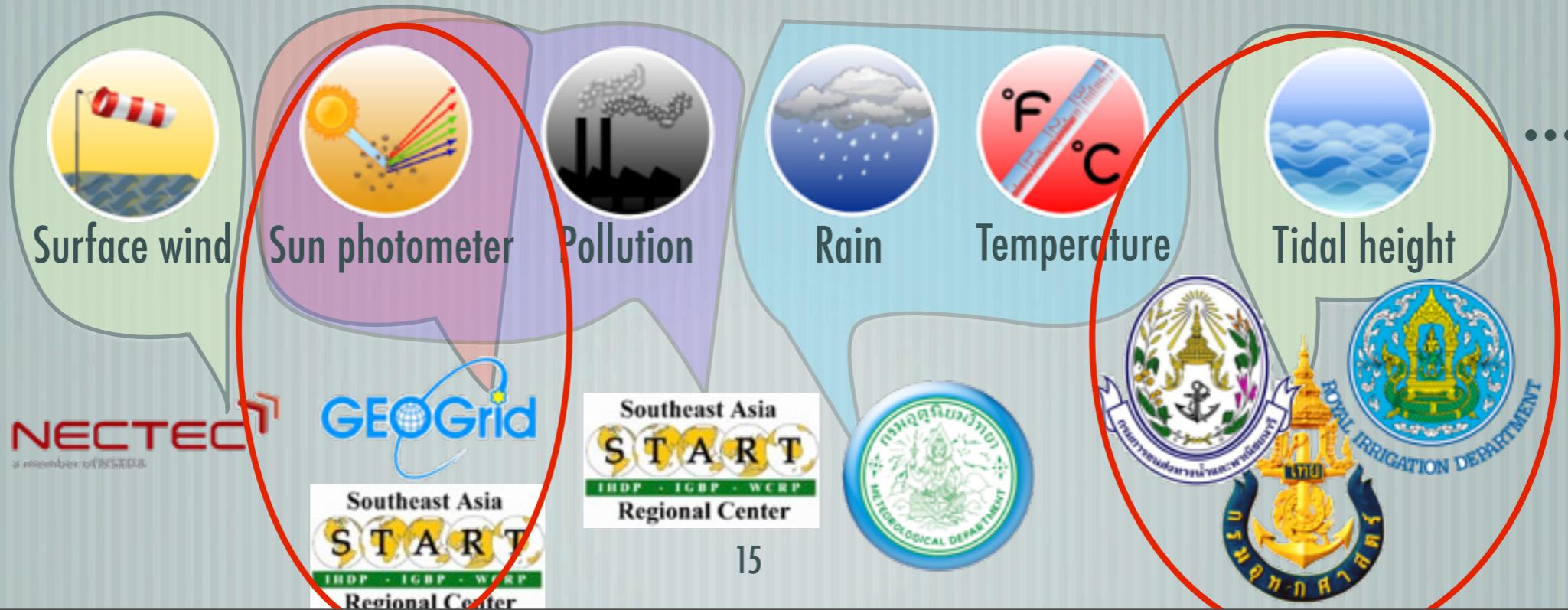
Connecting consumers & providers

→ Individually access data from each provider



Connecting consumers & providers

- Individually access data from each provider
- Manually integrate same data type from different providers



Connecting consumers & providers

- Individually access data from each provider
- Manually integrate same data type from different providers
- Manually solves heterogeneity of data



Connecting consumers & providers

- Individually access data from each provider
- Manually integrate same data type from different providers
- Manually solves heterogeneity of data
- Manually do data visualization



Connecting consumers & providers

- Individually access data from each provider
- Manually integrate same data type from different providers
- Manually solves heterogeneity of data
- Manually do data visualization

Time consuming
Loss of man power
EXPENSIVE!!!



Challenges

Desire situation



1. Easy data access across repositories
2. On-the-fly data integration
3. User-oriented data visualization

Multi-disciplined Technique

The virtualization of repositories

— to enable one-stop data access

The data standardization

— to enable data interoperability & integration within single domain

The harmonization of two given standards

— to enable data interoperability & integration across multiple domain

The visualization of any data in a user-oriented manner

— to welcome any data consumers to explore the data on demand

The honor of data providers (ownership)

— to promote collaboration by publishing the data

E-Rium

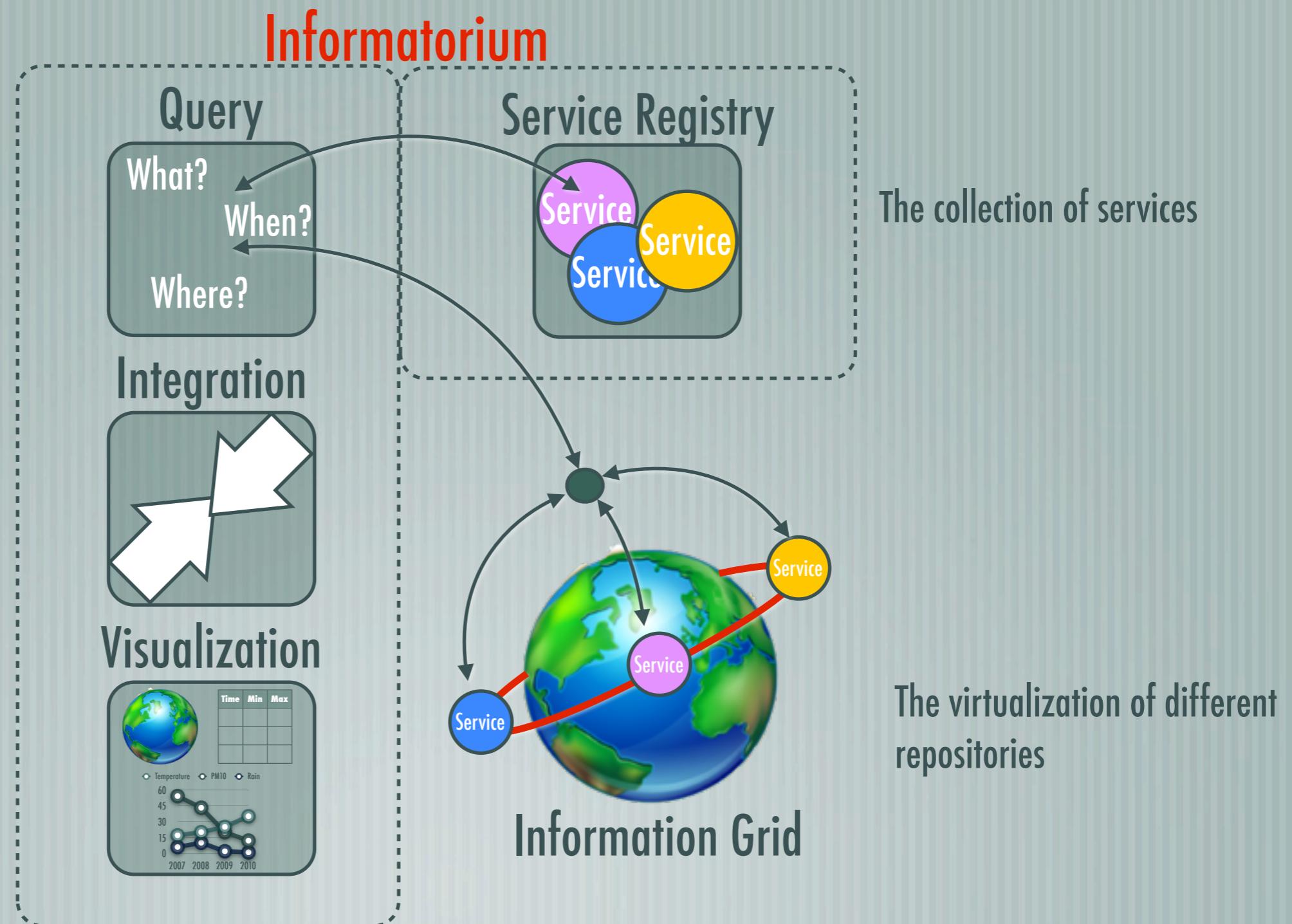
(Environmental Informatory)

Overview of E-Rium

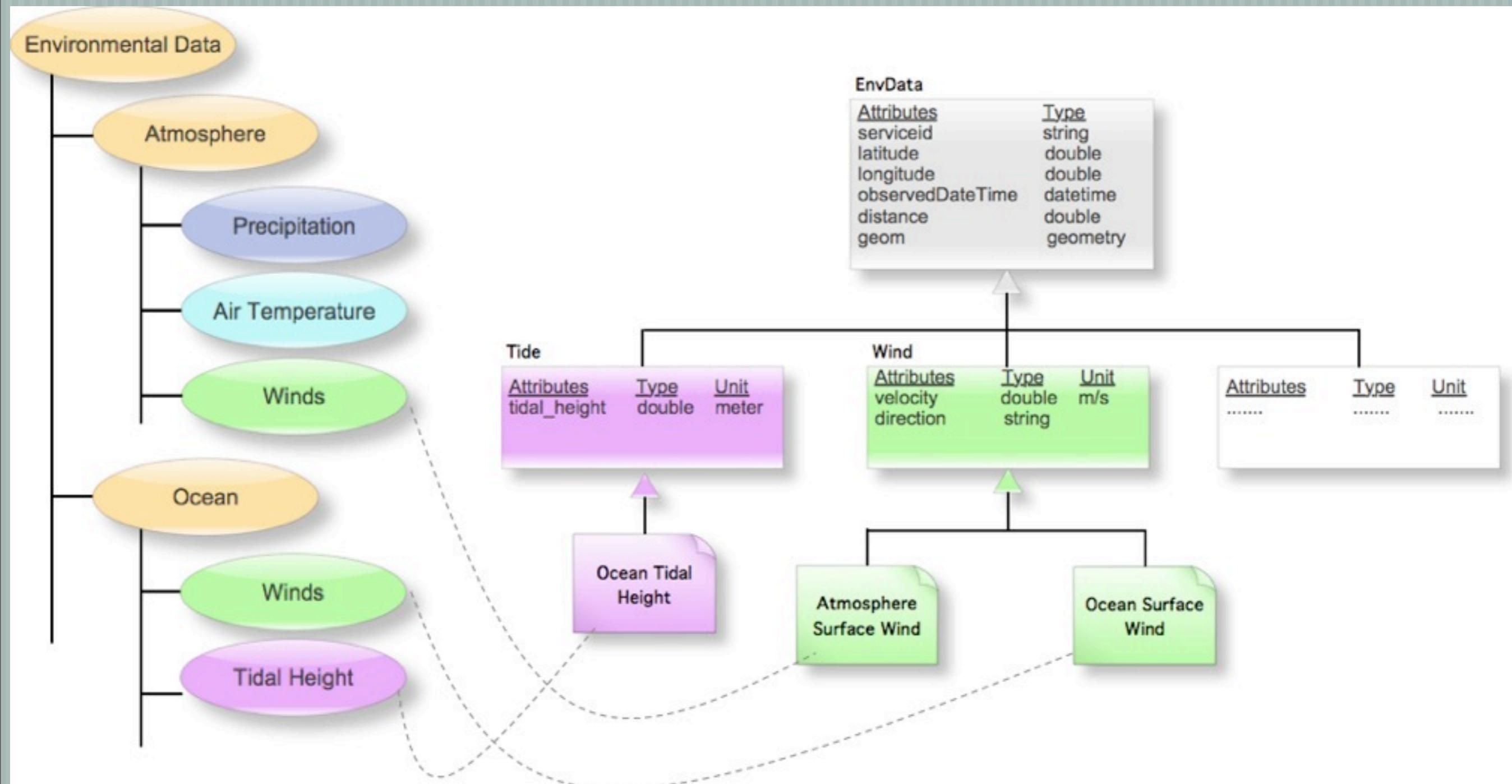
Access data across repositories
Emphasize the ownership

Harmonize two given standard

Visualize data in a user-oriented manner
Provide 'Data Exploration'



Environmental data types & standard



Service Registry

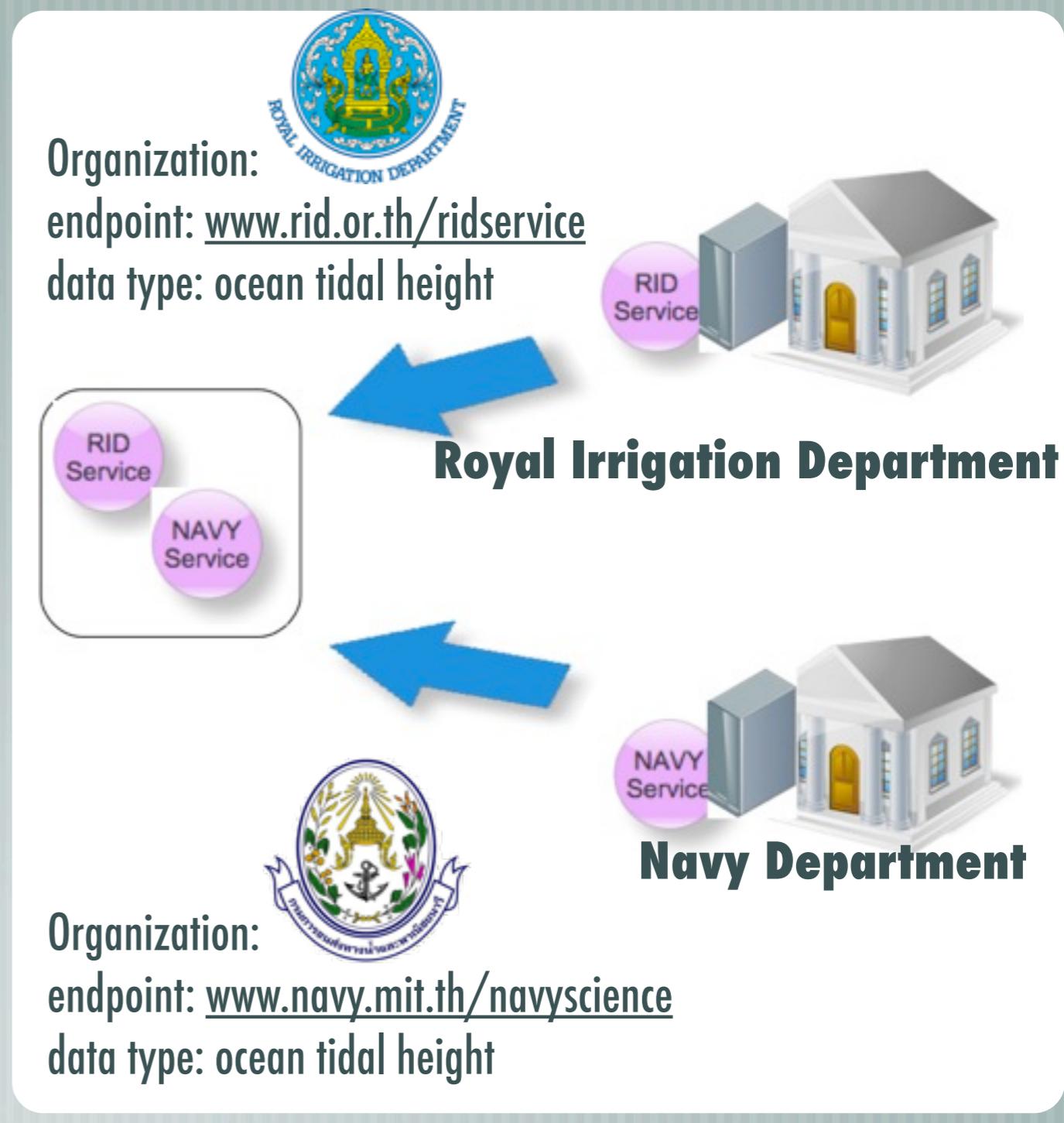


[Simple steps to register service

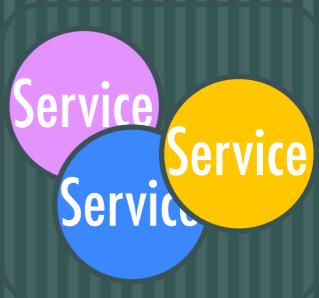
logon E-Rium

specify service endpoint

specify the data types



Service Registry



Simple steps to register service

logon E-Rium

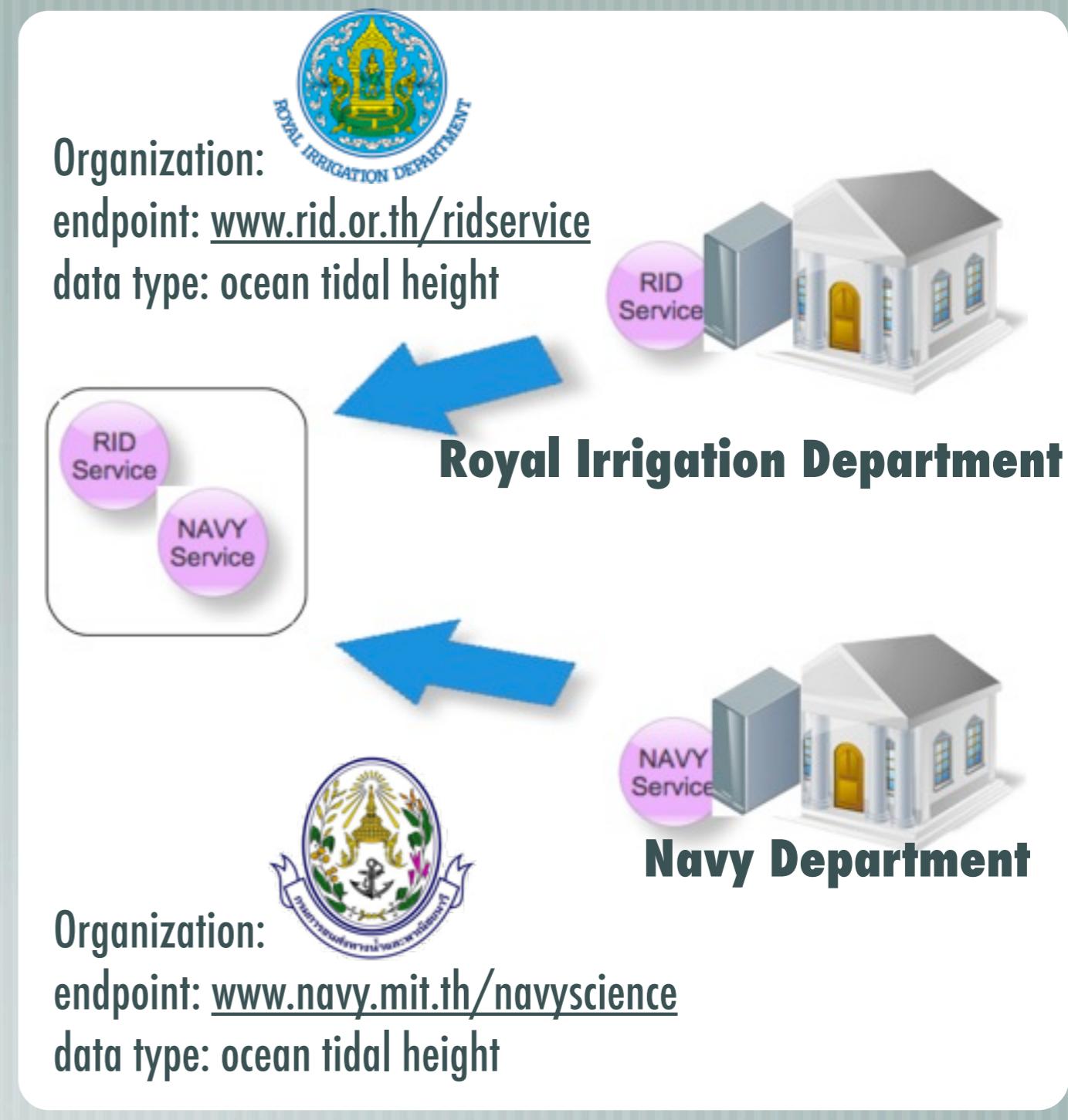
specify service endpoint

specify the data types



Sun photometer

Pollution



Service Registry

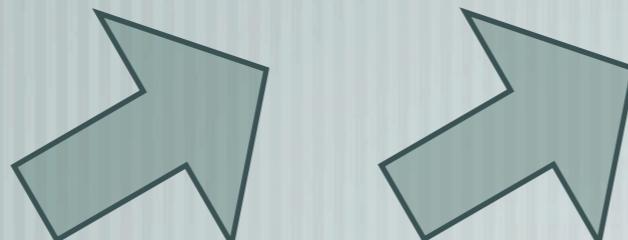


[Simple steps to register service]

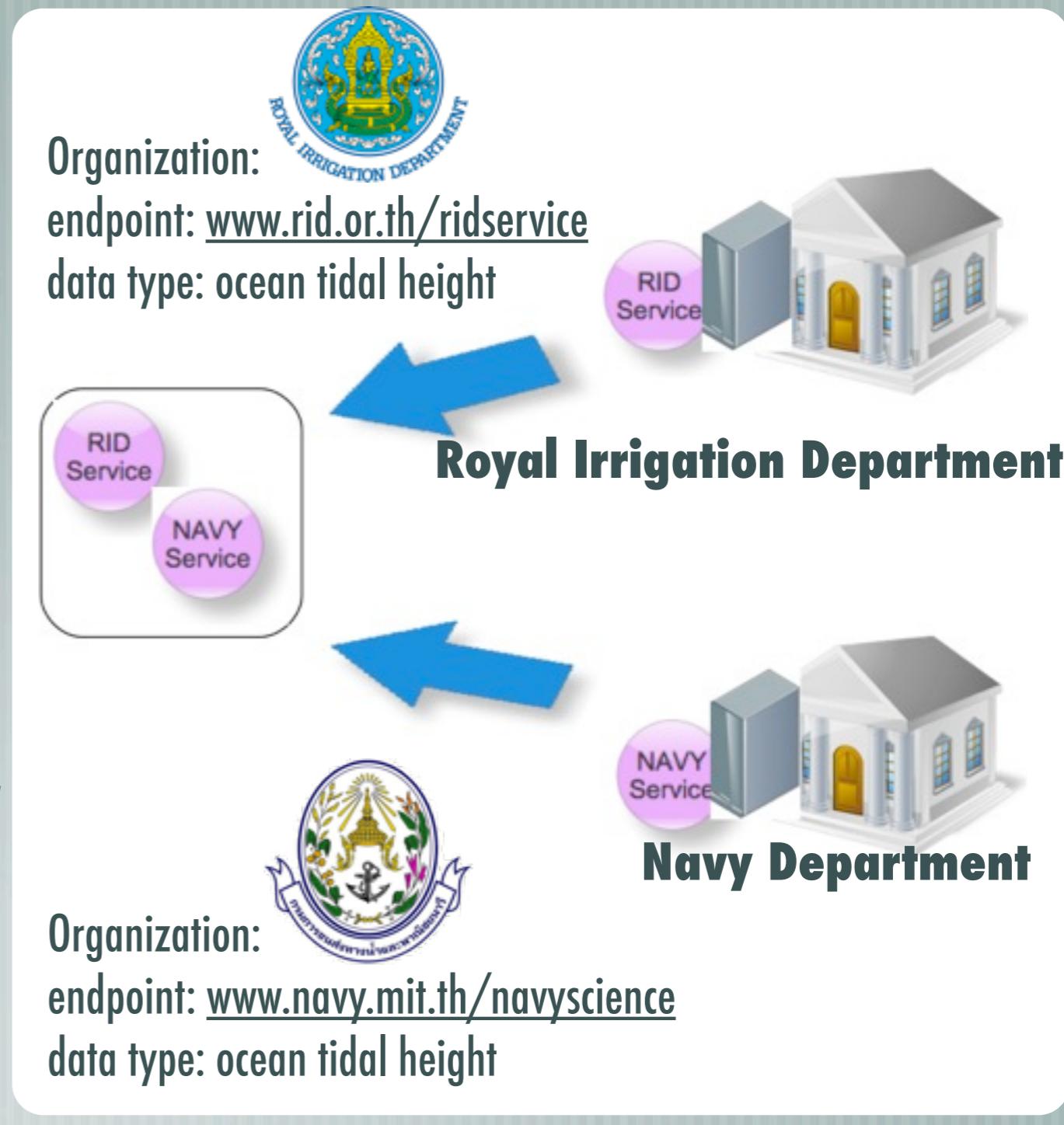
logon E-Rium

specify service endpoint

specify the data types



Sun photometer Pollution



Query

What?
When?
Where?

Create New Project

New MyInformatorium Name

Data Categories

- ocean
 - ocean winds
 - tides
 - tidal height
- atmosphere
 - atmospheric winds
 - precipitation
 - aerosol
 - atmospheric temperature
 - air temperature
 - atmospheric pressure
 - atmospheric water vapor

Geographical Coverage

North

West

East

South

Temporal Coverage

Begin Date

End Date

yy-mm-dd Example 2011-06-30

What?
When?
Where?

Query

Create New Project

New MyInformatorm Name

Data Categories

- ocean
 - ocean winds
 - tides
 - tidal height
- atmosphere
 - atmospheric winds
 - precipitation
 - aerosol
 - atmospheric temperature
 - air temperature
 - atmospheric pressure
 - atmospheric water vapor

Geographical Coverage

West	<input type="text" value="96.2476"/>	North	<input type="text" value="20.1646"/>	East	<input type="text" value="106.5308"/>
South					<input type="text" value="8.2608"/>

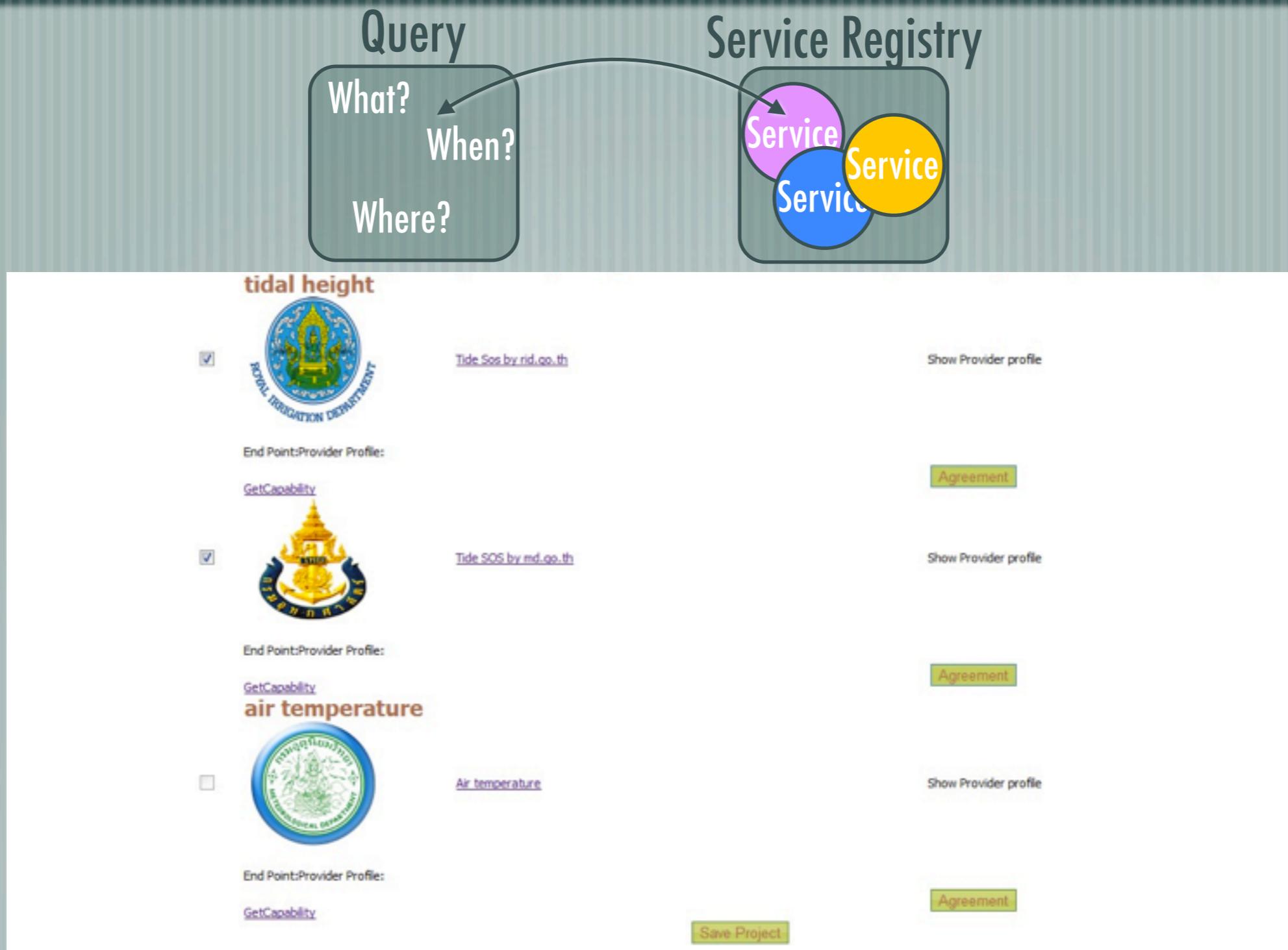


Temporal Coverage

Begin Date	<input type="text" value="2006-01-01"/>	<input type="button" value="..."/>					
End Date	<input type="text" value=""/>	<input type="button" value="..."/>					
yy-mm-dd	<input type="text" value="Dec 2006"/>						
	Su	Mo	Tu	We	Th	Fr	Sa
	1	2					
	3	4	5	6	7	8	9
	10	11	12	13	14	15	16
	17	18	19	20	21	22	23
	24	25	26	27	28	29	30
	31						

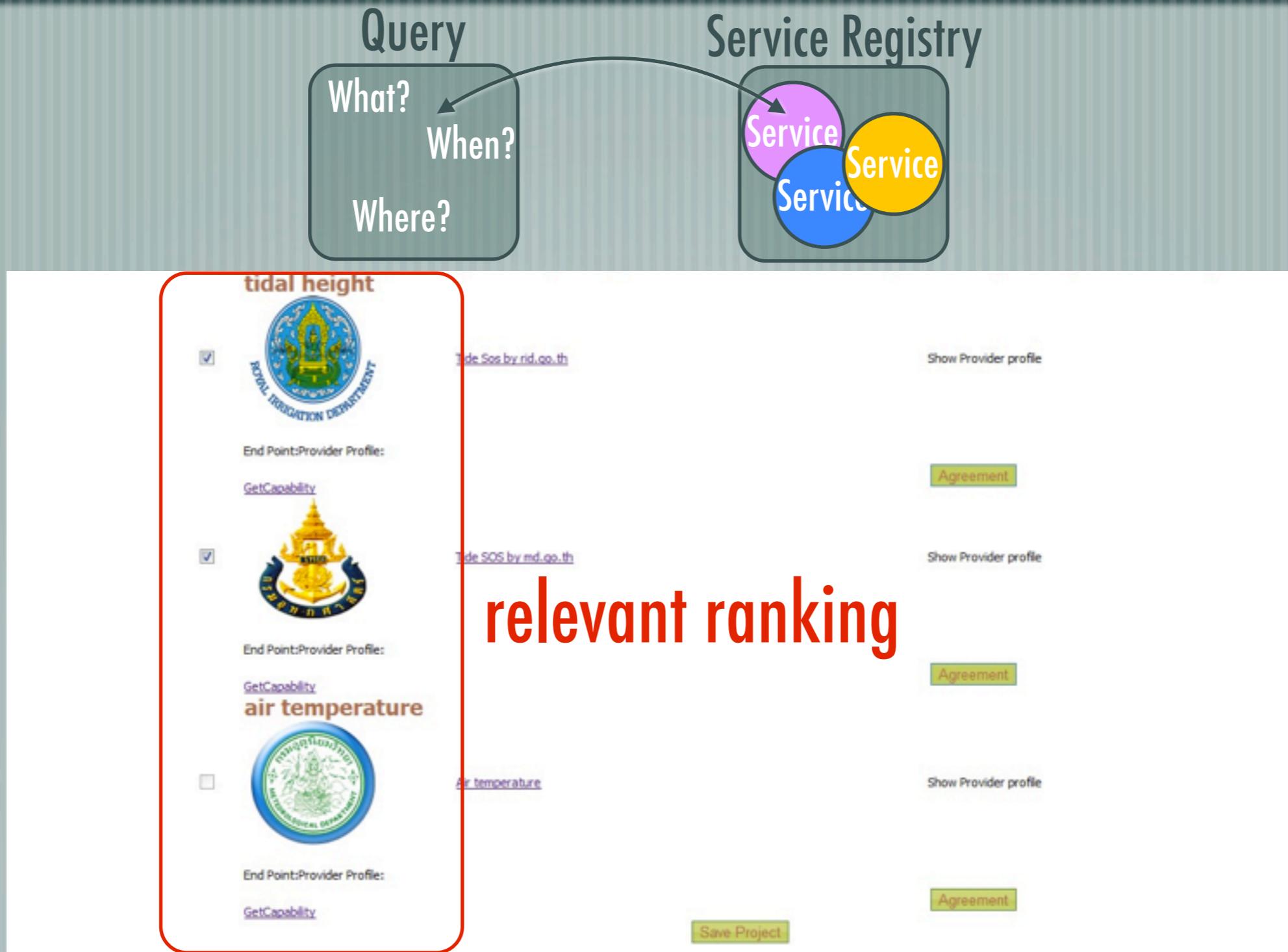
Ownership of data

What?
When?
Where?



Ownership of data

What?
When?
Where?



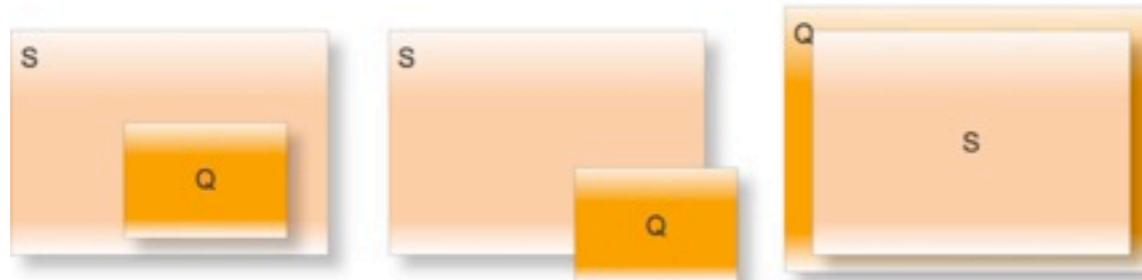
Service Ranking

Given that

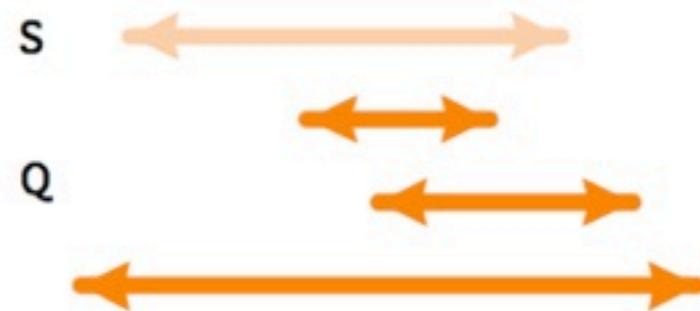
S: Service, Q: Query

$$\text{Similarity}(\mathbf{S}, \mathbf{Q}) = w_{gs}GS(\mathbf{S}, \mathbf{Q}) + w_{ts}TS(\mathbf{S}, \mathbf{Q})$$

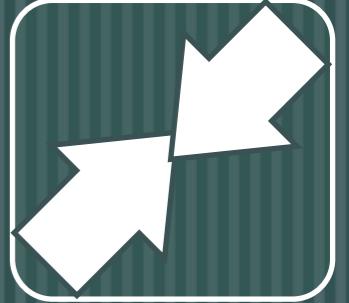
$$w_{gs} + w_{ts} = 1$$



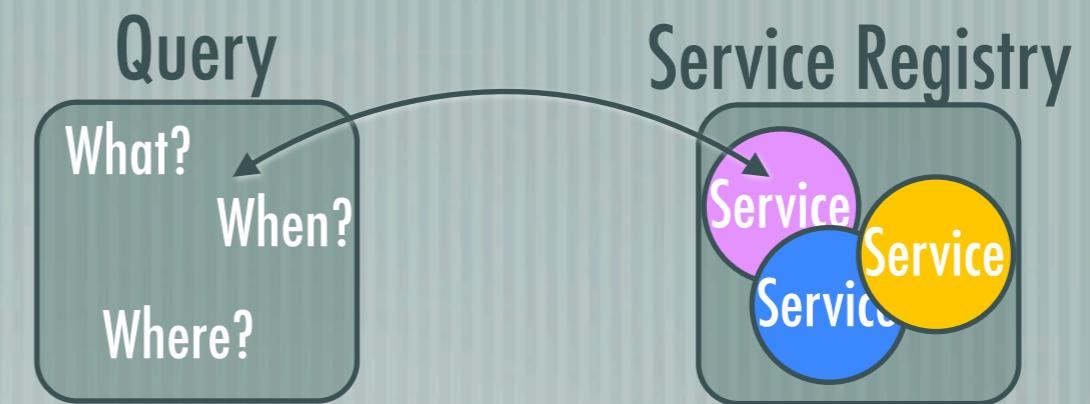
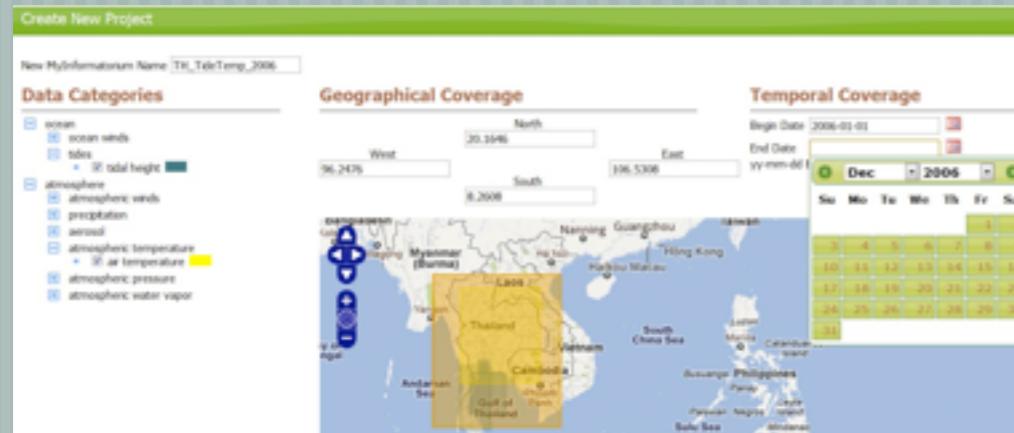
$$GS(\mathbf{S}, \mathbf{Q}) = \frac{|S \cap Q|_{area}}{|Q|_{area}}$$



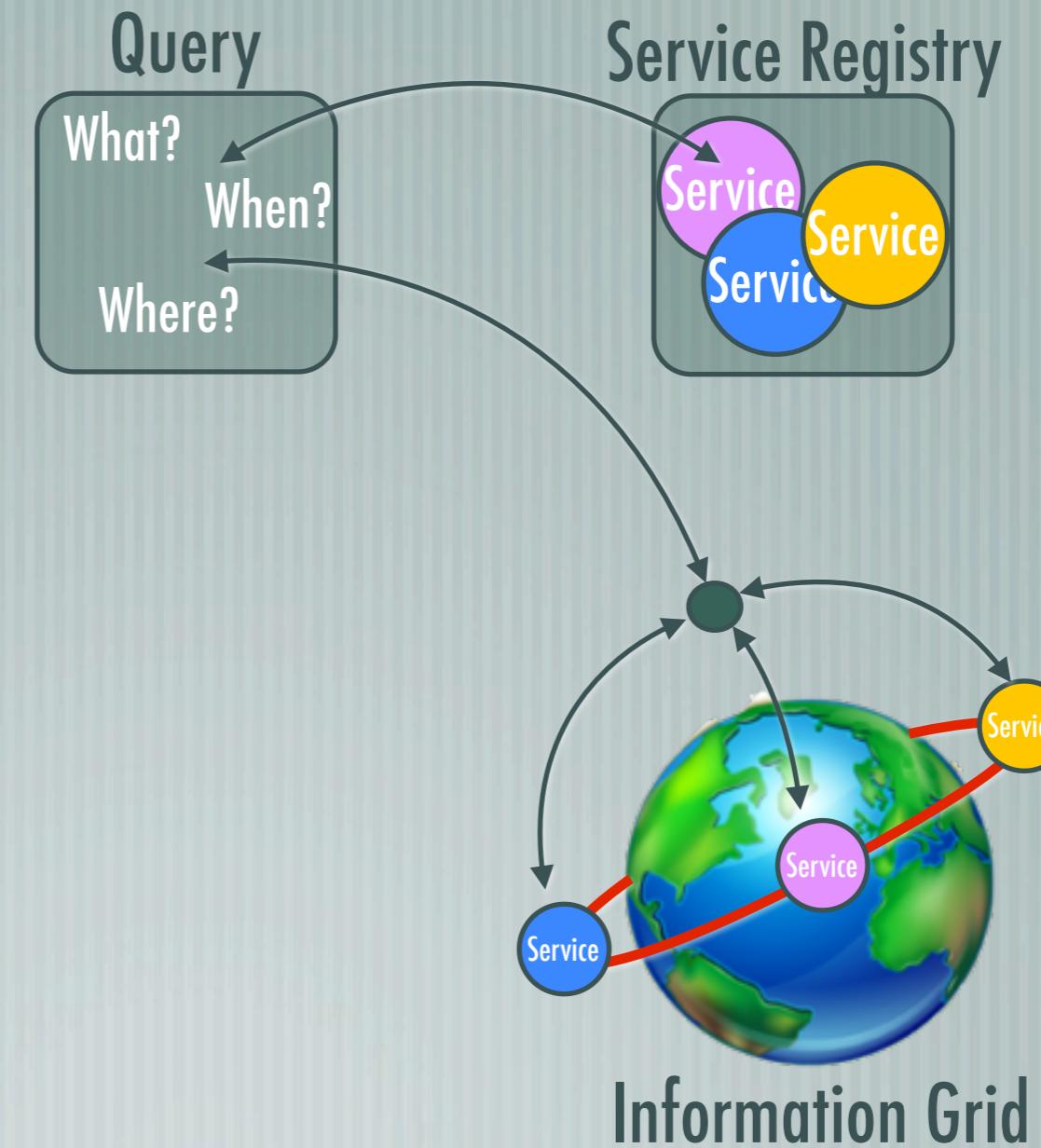
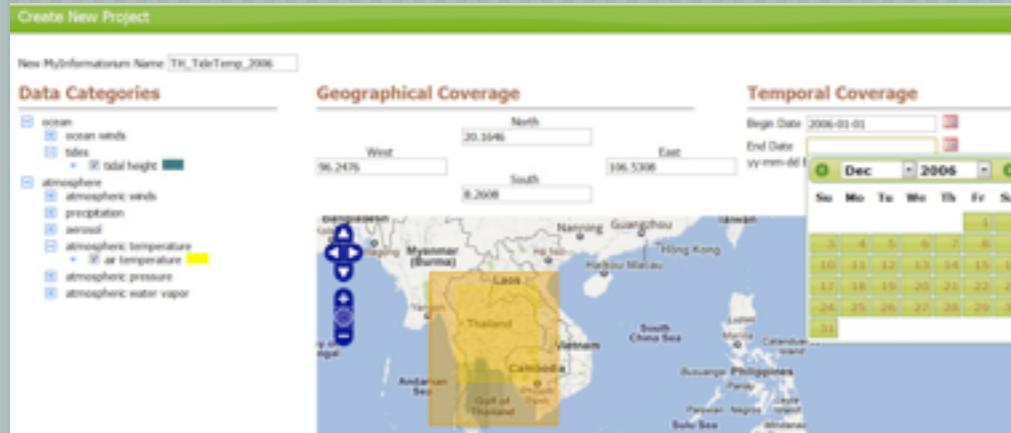
$$TS(\mathbf{S}, \mathbf{Q}) = \frac{|S \cap Q|_{time}}{|Q|_{time}}$$



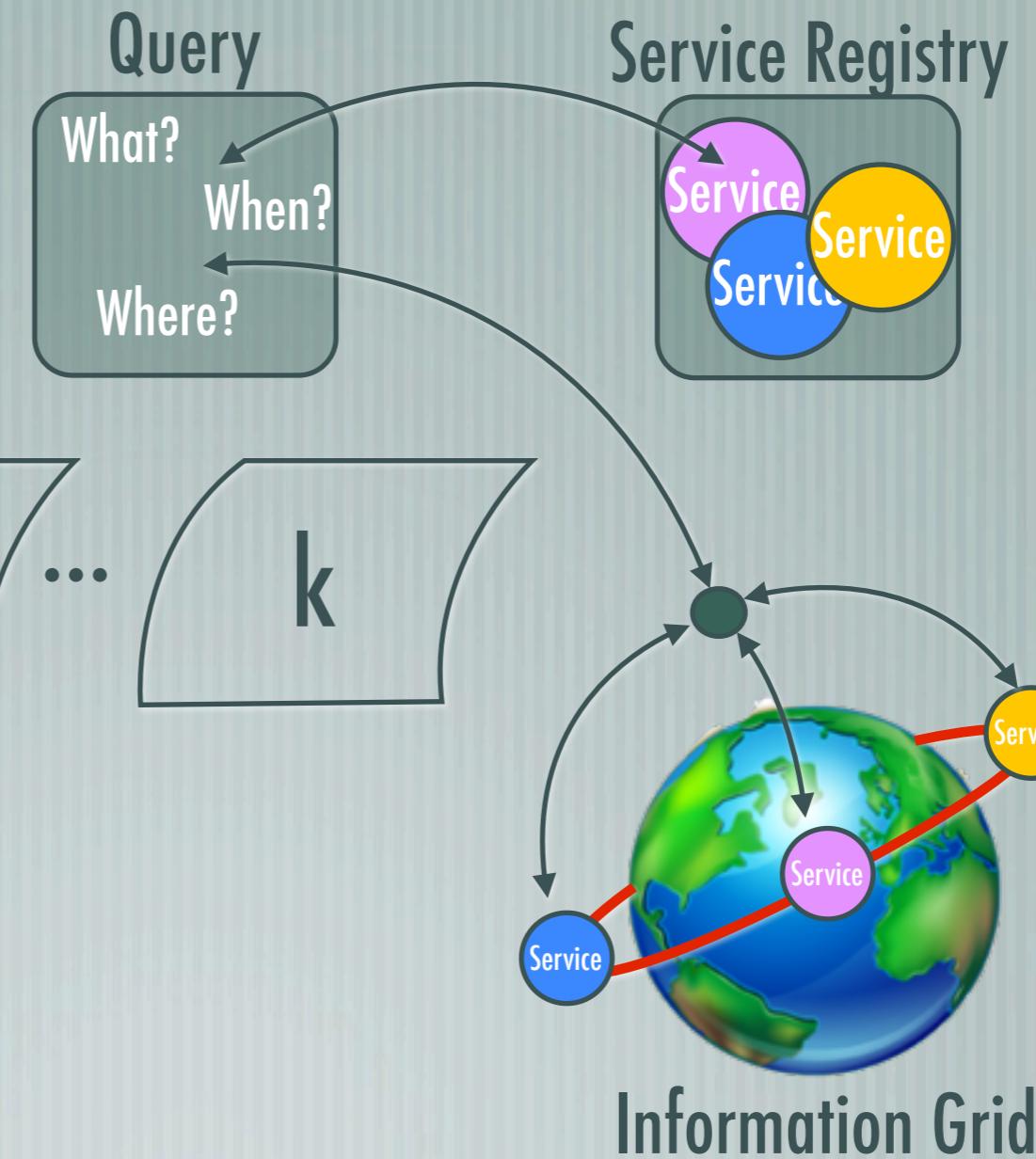
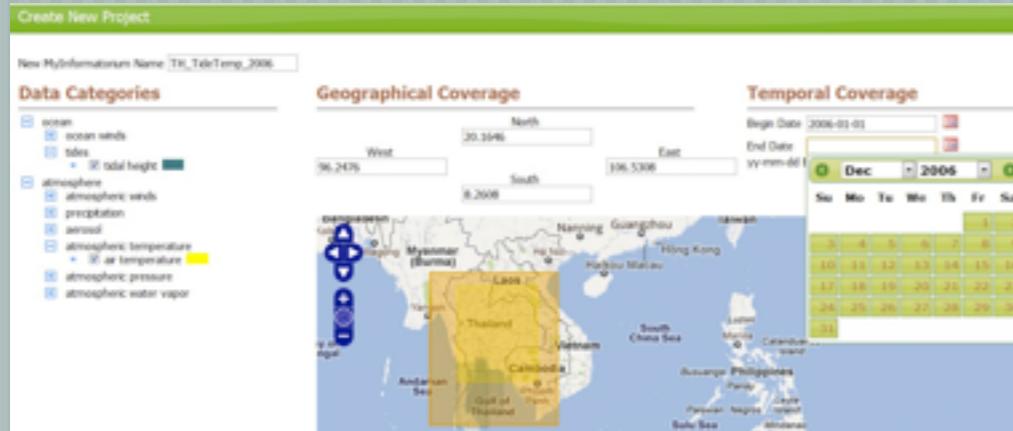
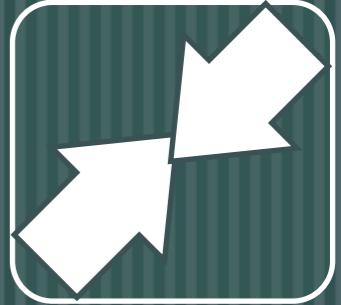
Data integration



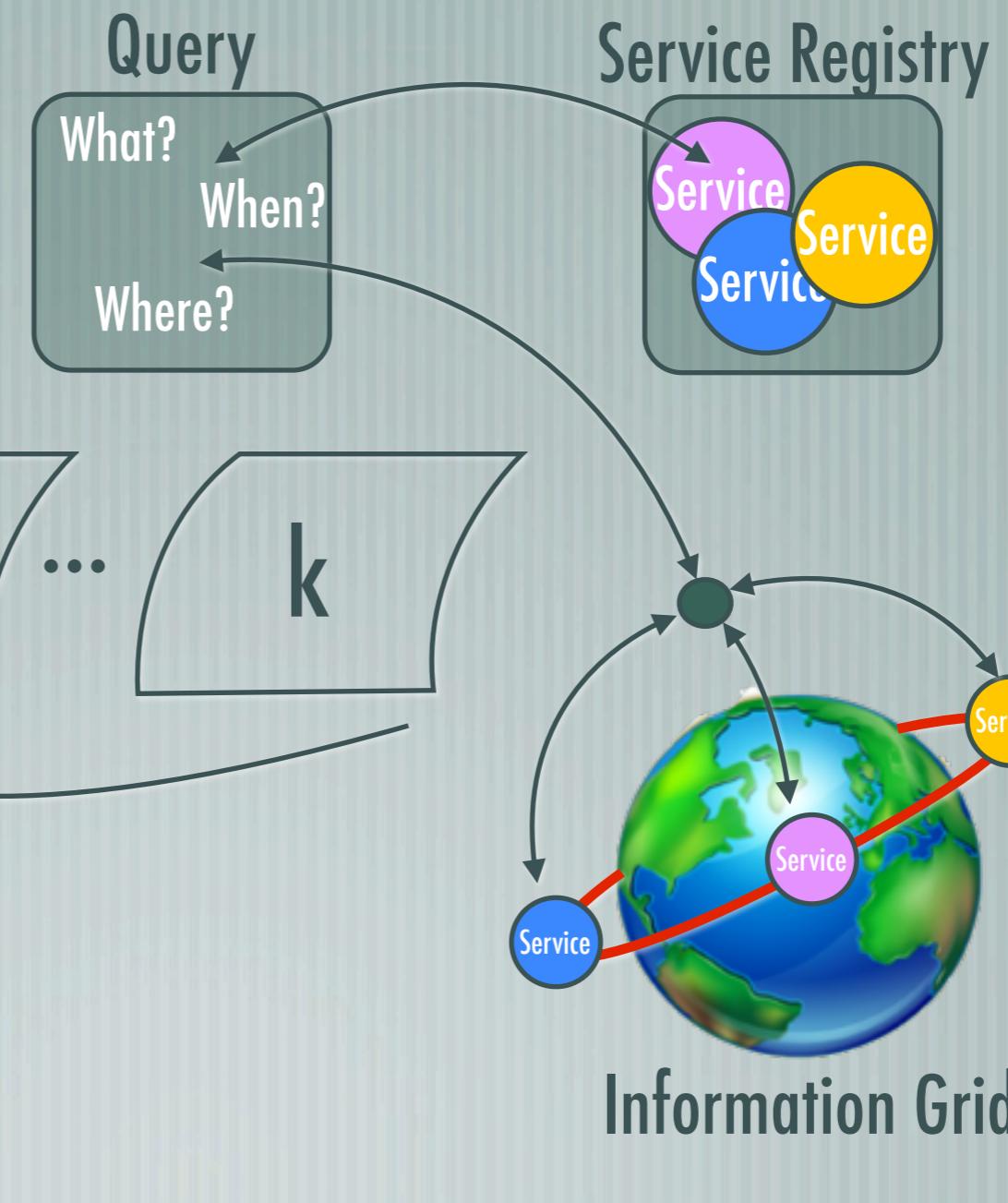
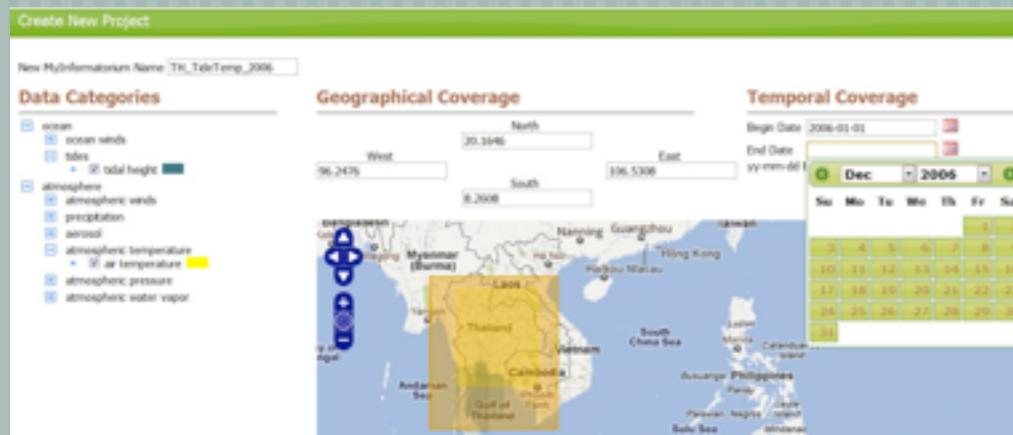
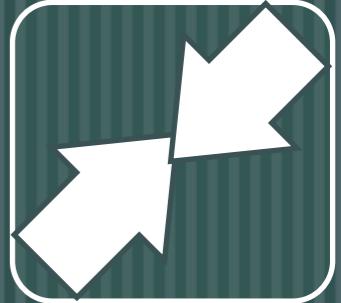
Data integration



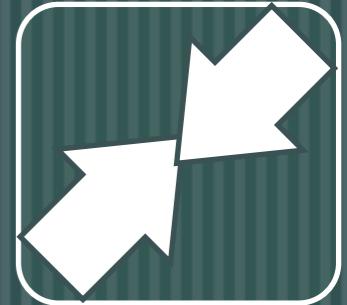
Data integration



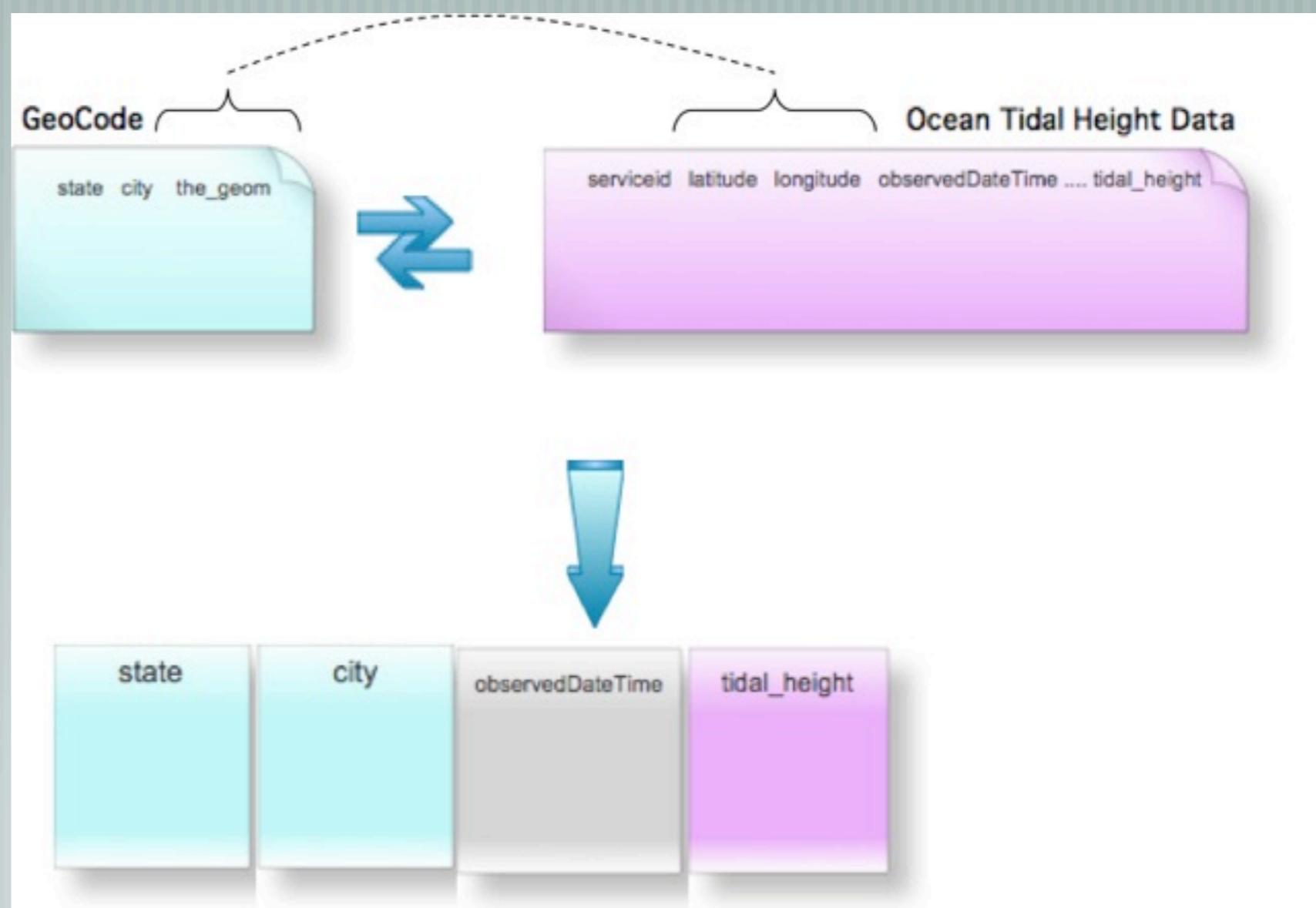
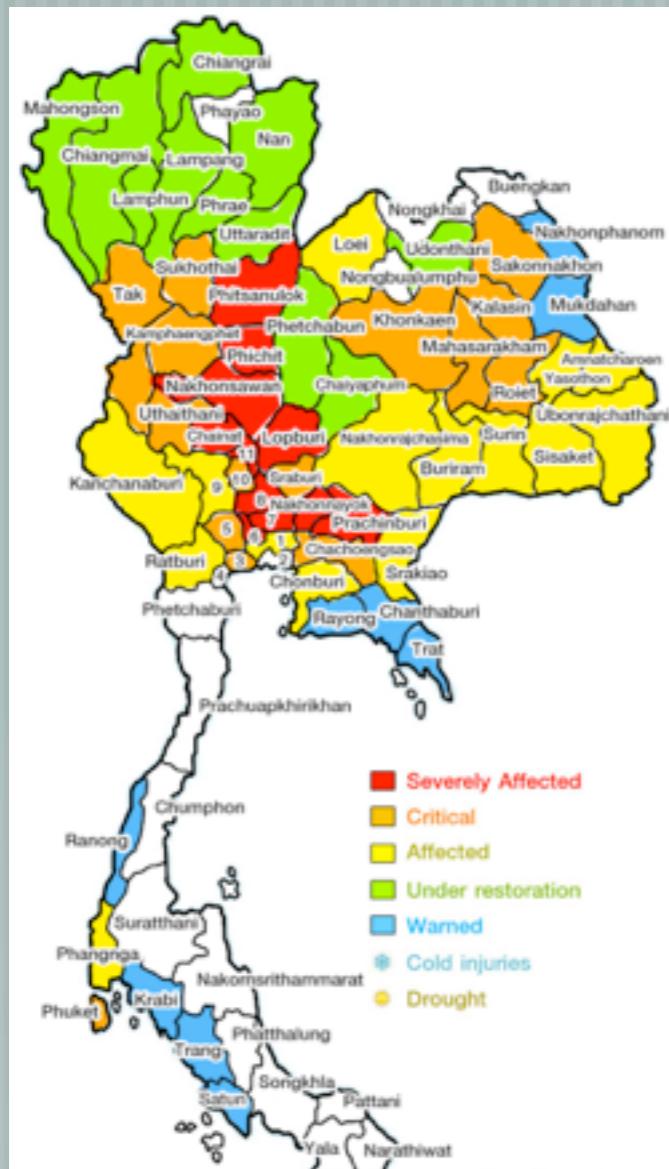
Data integration



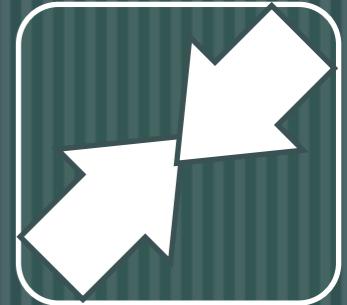
Data Integration



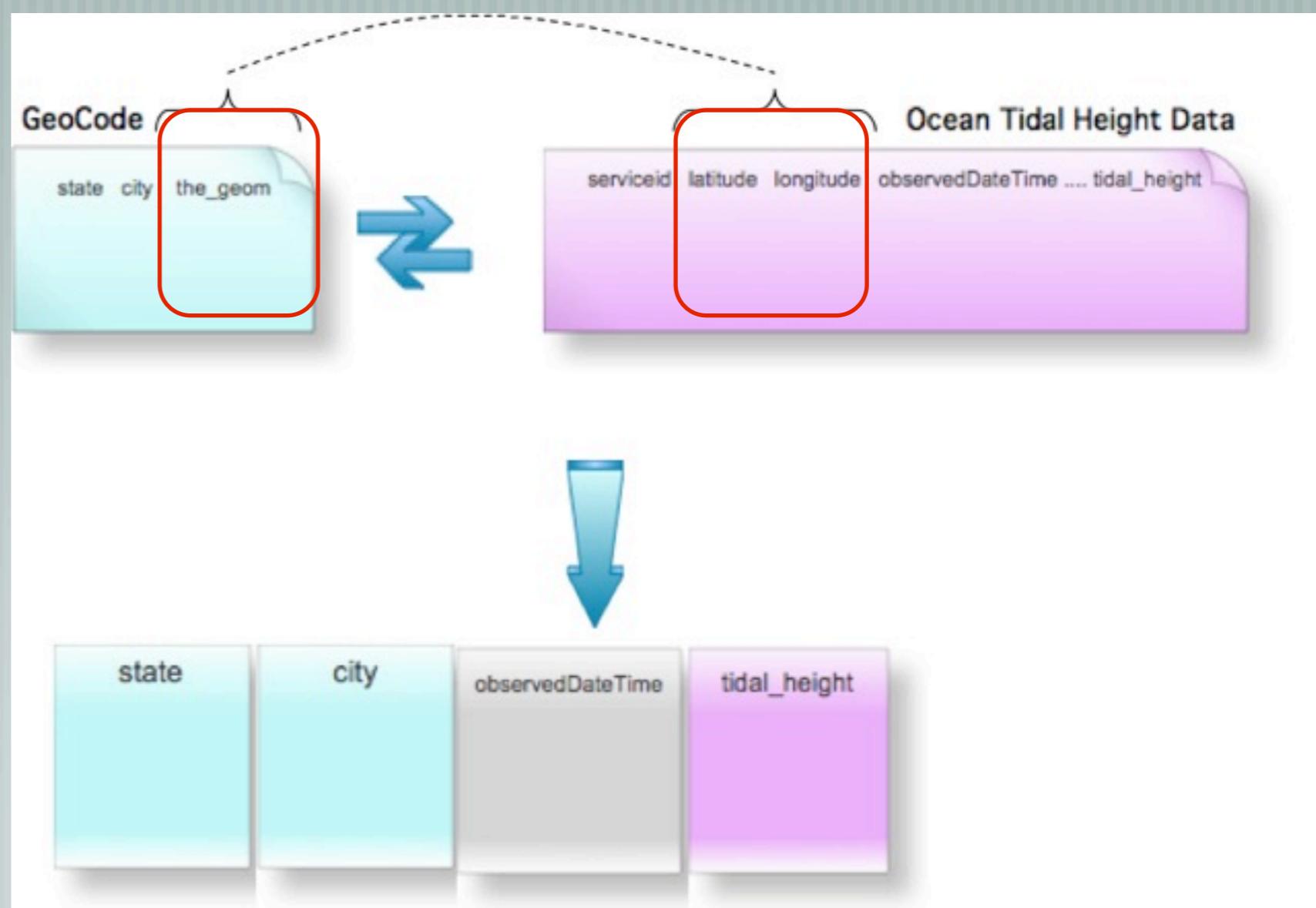
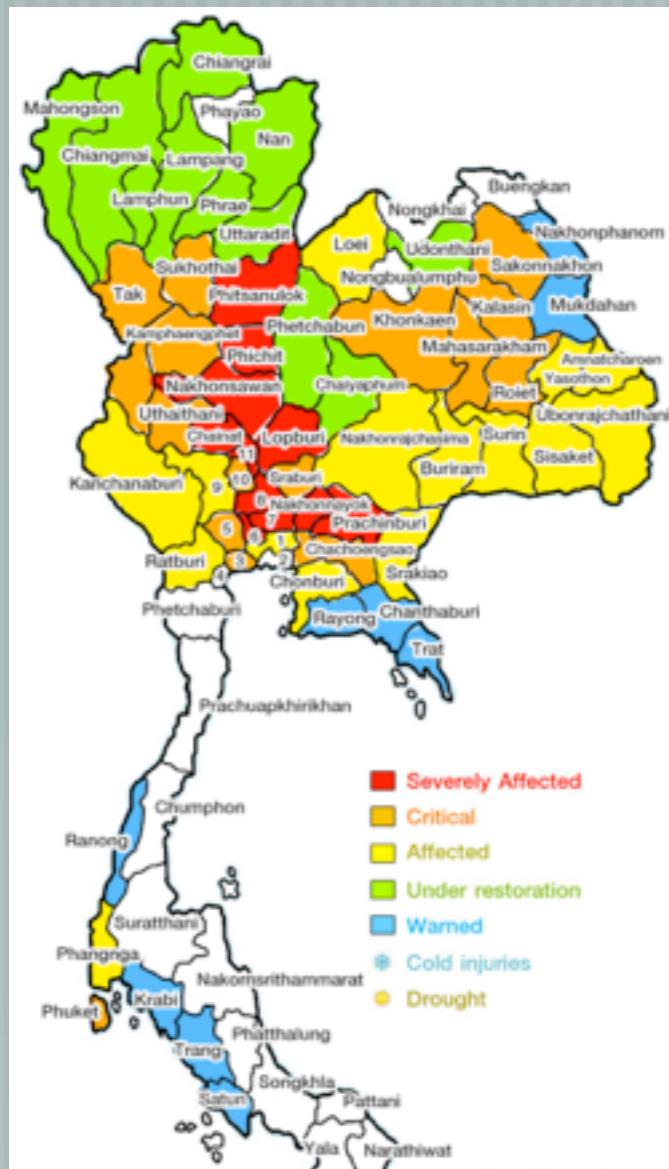
Single integration with GeoCode



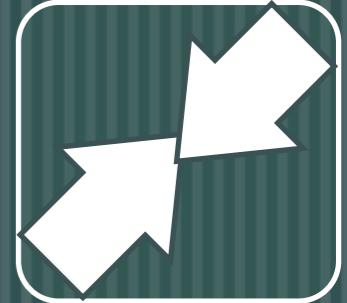
Data Integration



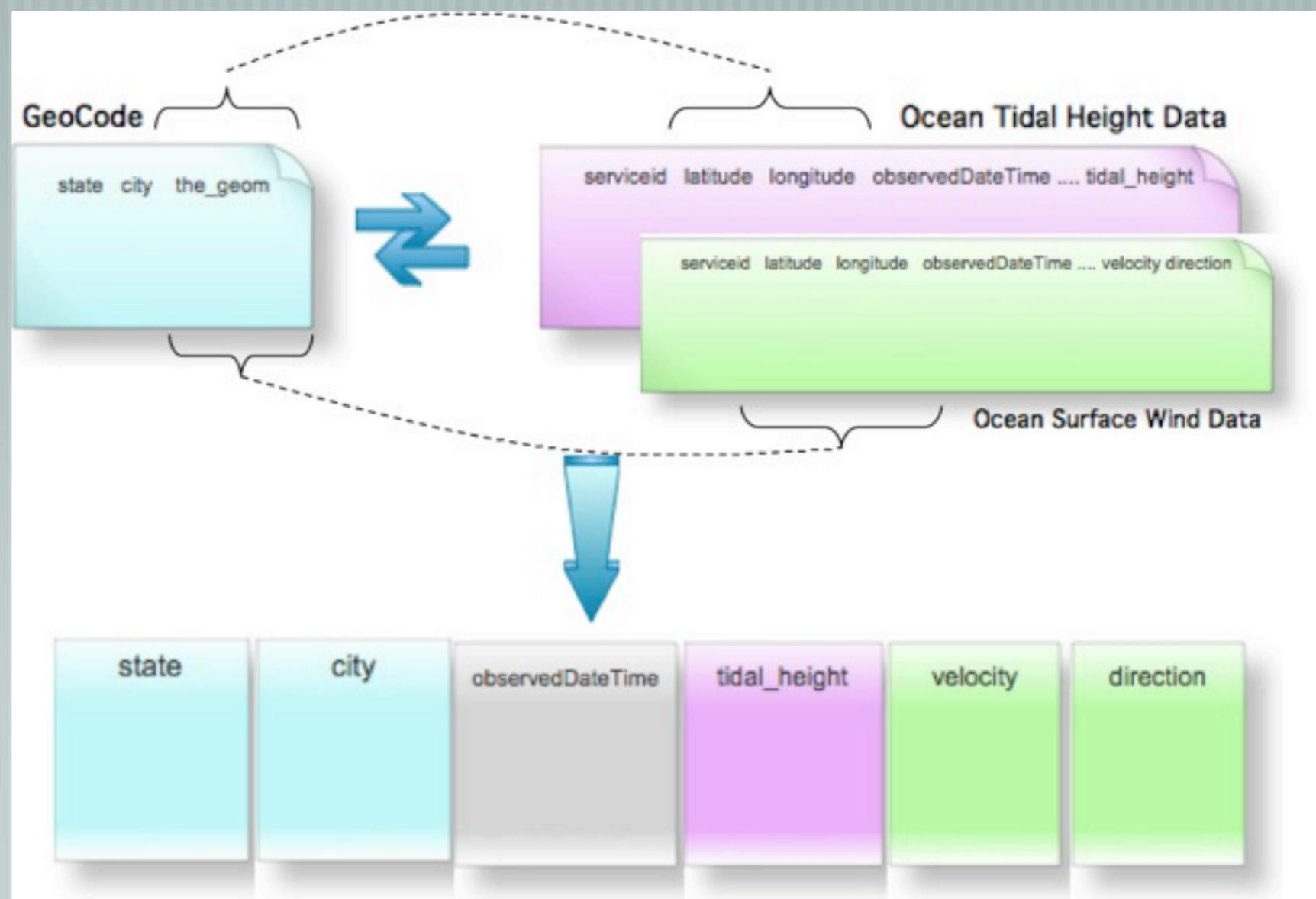
Single integration with GeoCode



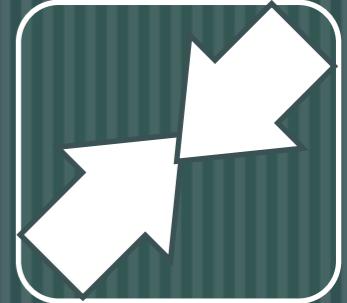
Data Integration



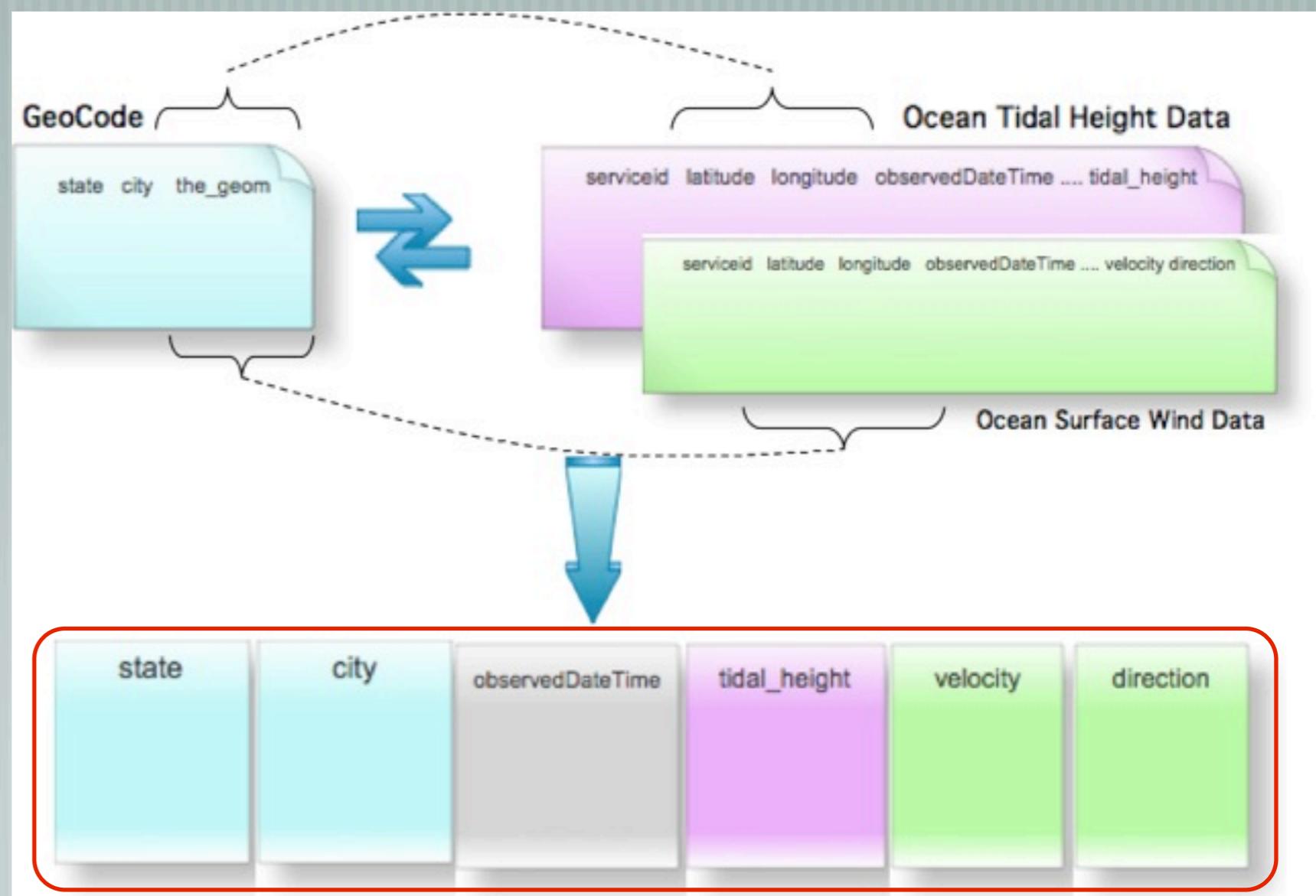
Multi-integration with GeoCode



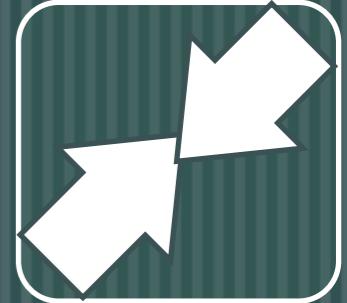
Data Integration



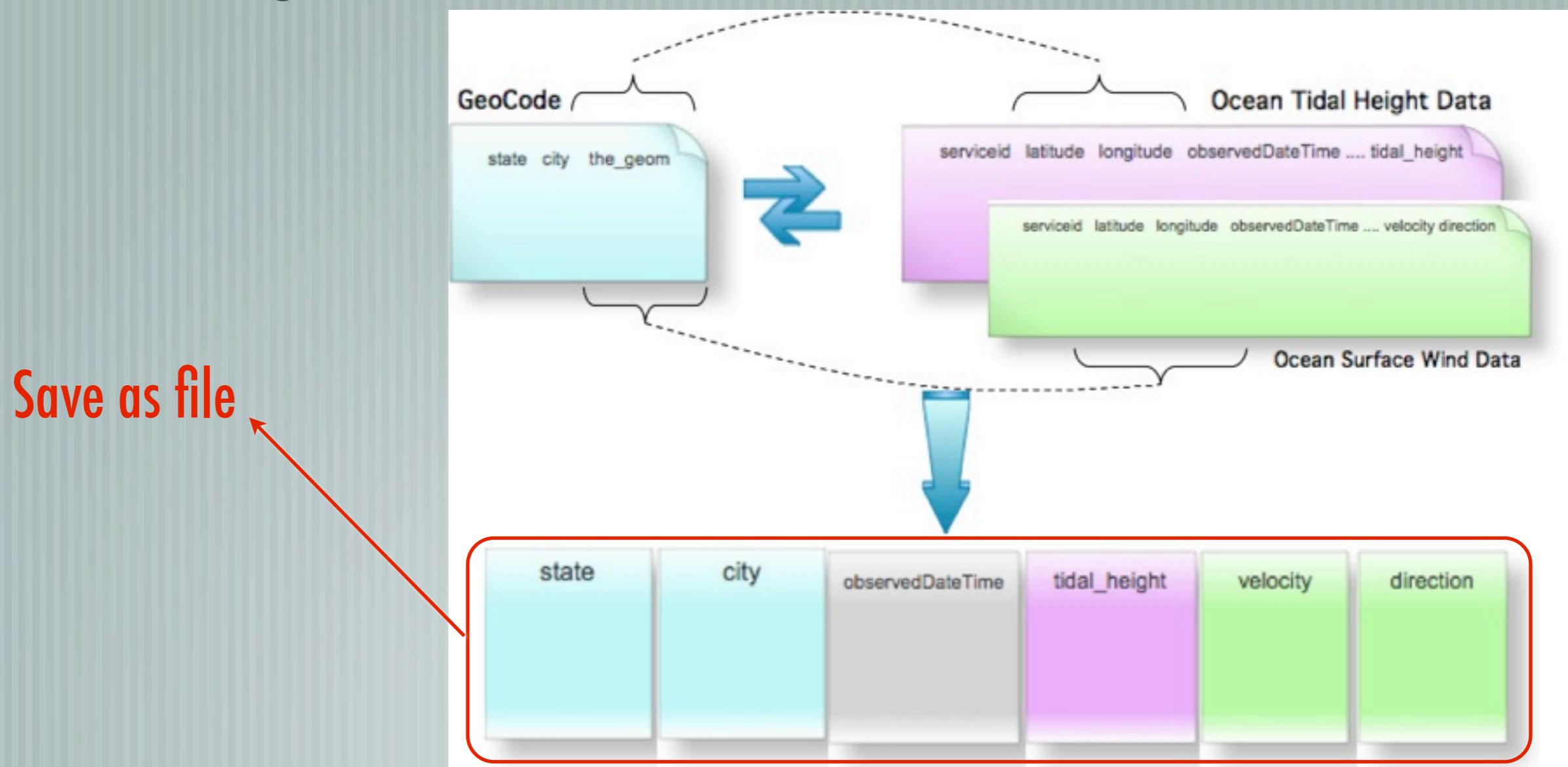
Multi-integration with GeoCode



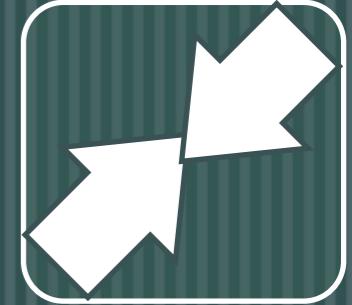
Data Integration



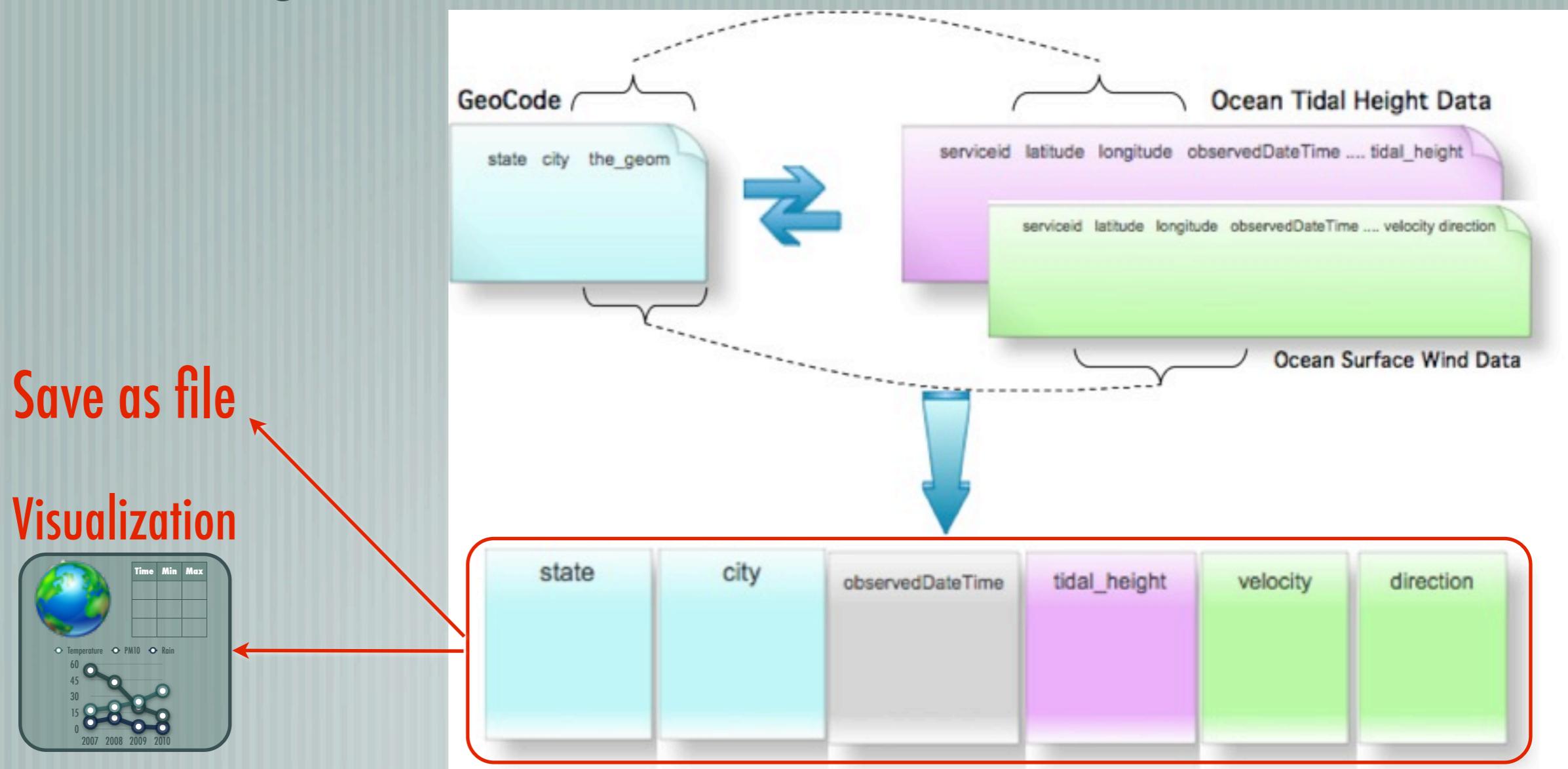
Multi-integration with GeoCode



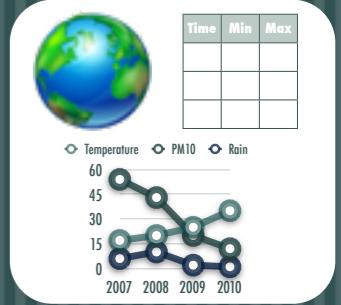
Data Integration



Multi-integration with GeoCode

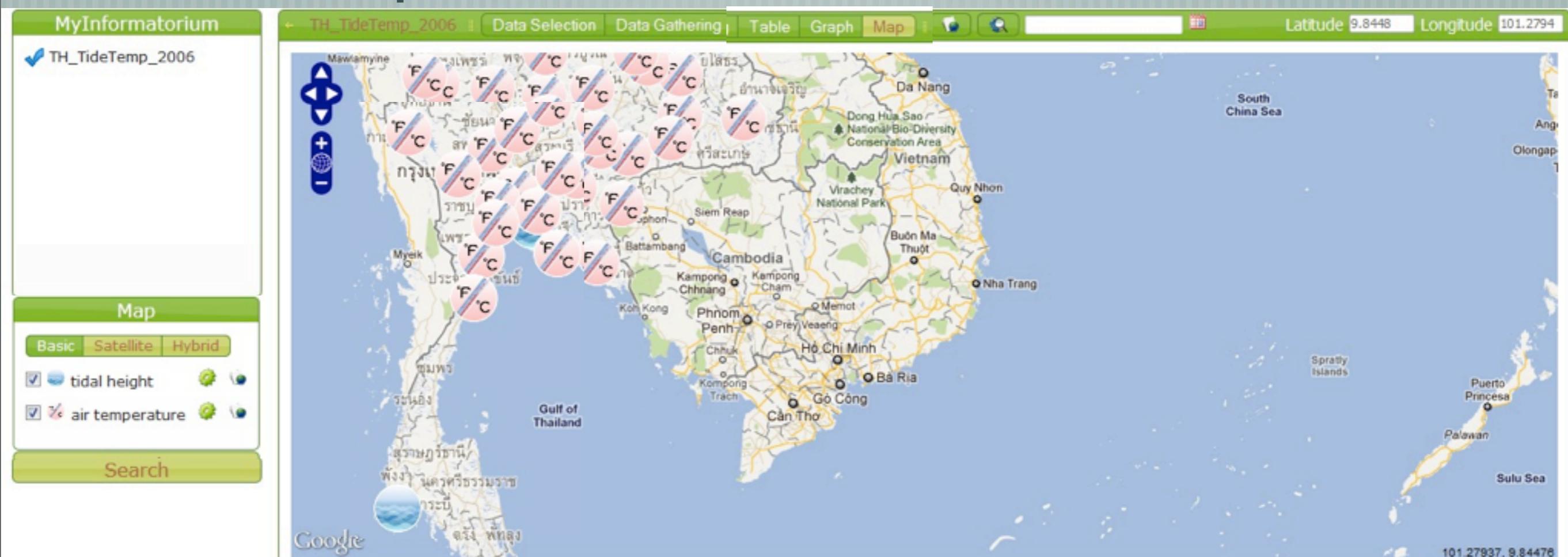


Data visualization

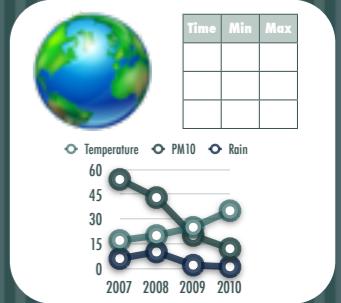


Works with data integration

“Data exploration”

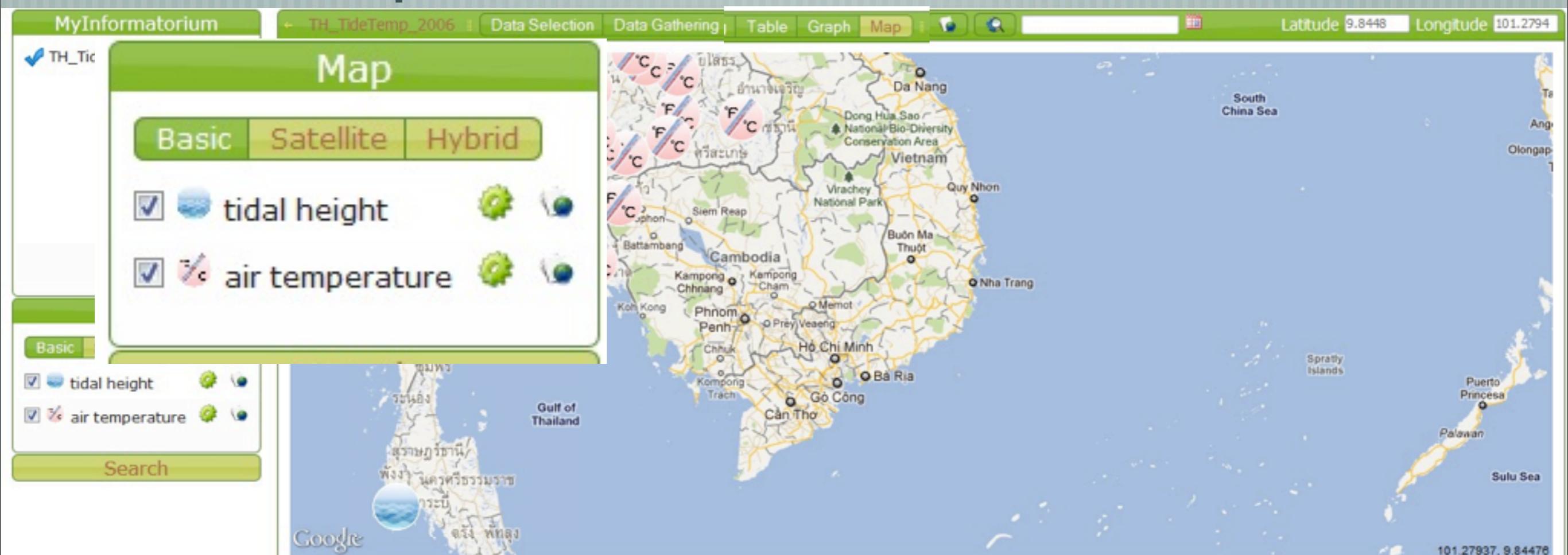


Data visualization

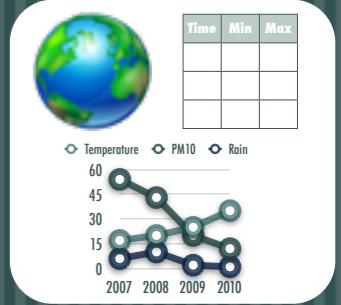


Works with data integration

“Data exploration”

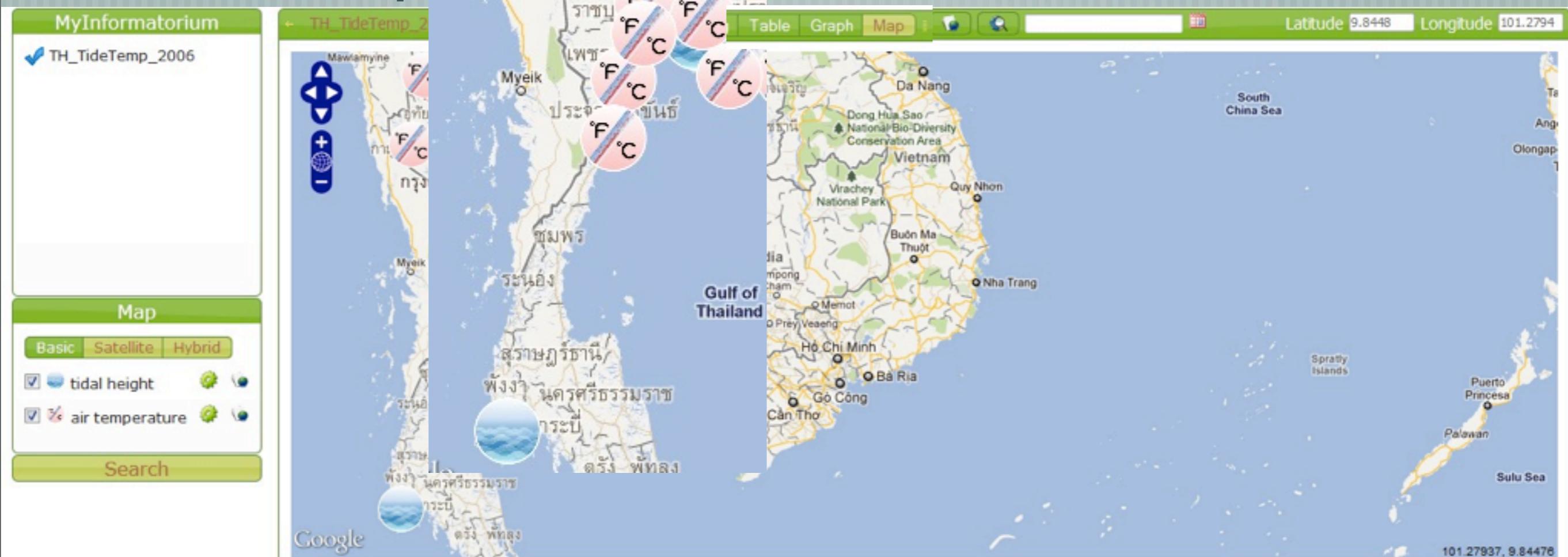


Data visualization

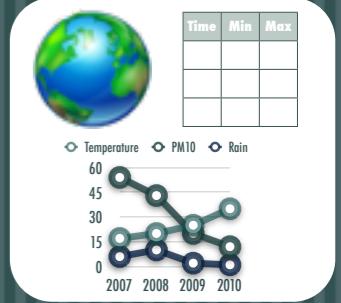


Works with data integration

"Data exploration"

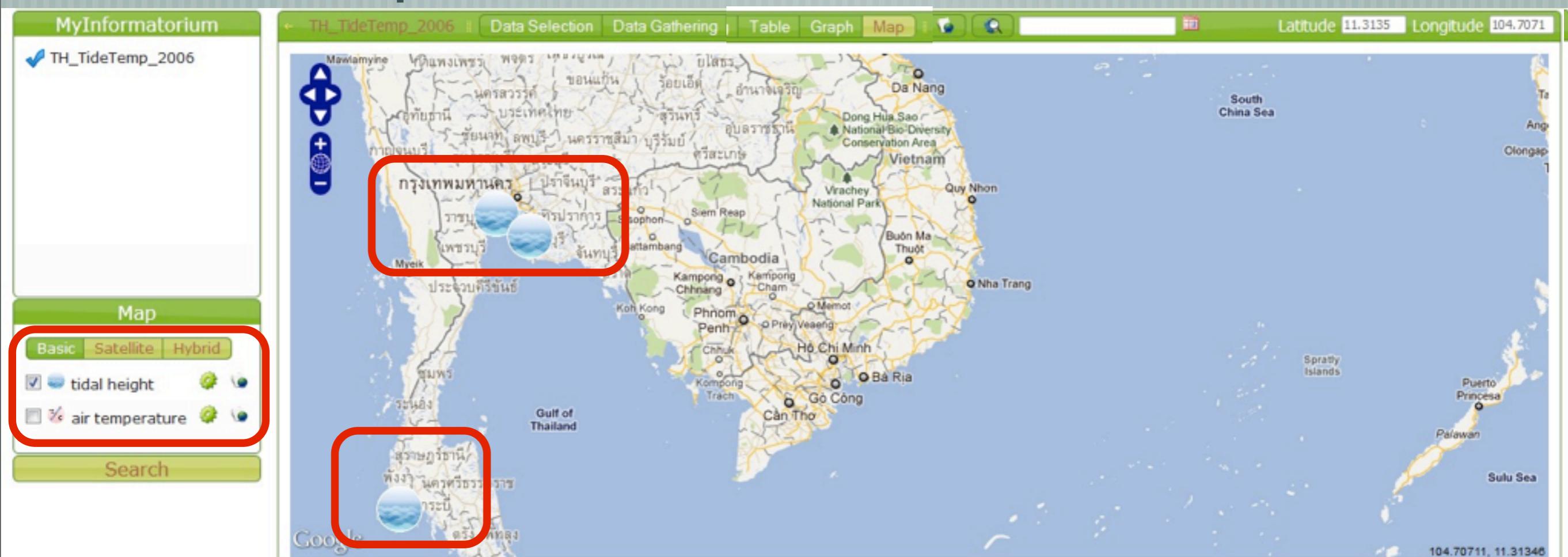


Data visualization

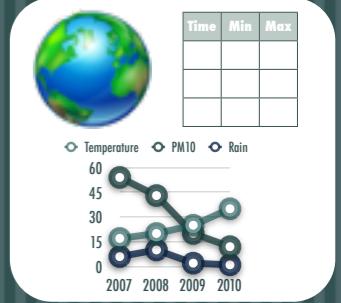


Works with data integration

“Data exploration”



Data visualization

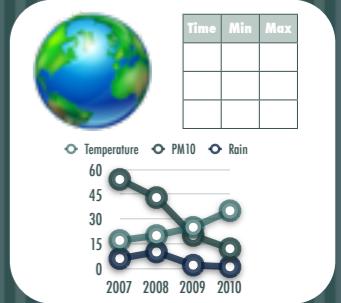


Works with data integration

“Data exploration”

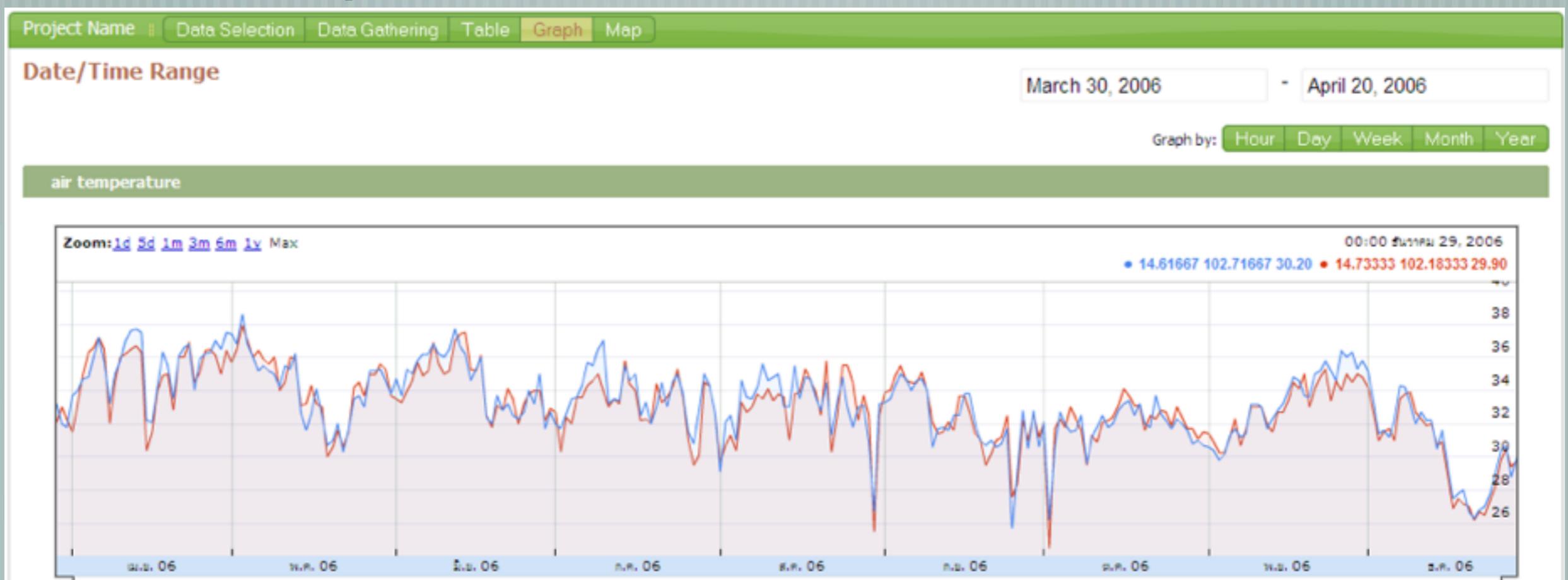
The screenshot shows a data visualization interface with a map of Southeast Asia as the central element. The map includes labels for countries like Thailand, Cambodia, and Vietnam, and cities like Bangkok, Phnom Penh, and Ho Chi Minh City. Overlaid on the map are several data layers represented by colored icons: blue for tidal height and green for air temperature. Two specific regions are highlighted with red boxes: one in the western part of Thailand (around the Andaman Sea) and another in the Gulf of Thailand. On the left side, there is a sidebar with a tree icon labeled "MyInformatormium". Under this, a section titled "TH_TideTemp_2006" is expanded. A "Map" tab is selected. Below it, there are three tabs: "Basic", "Satellite", and "Hybrid", with "Basic" being the active tab. Under "Basic", there are two checkboxes: "tidal height" (checked) and "air temperature" (unchecked). Both of these checkboxes are highlighted with a red box. At the bottom of the sidebar, there is a "Search" button.

Data visualization

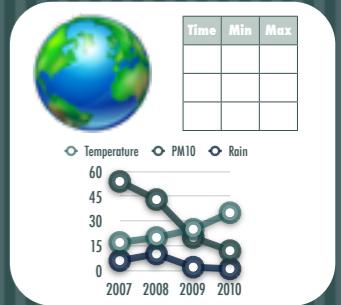


Works with data integration

“Data exploration”

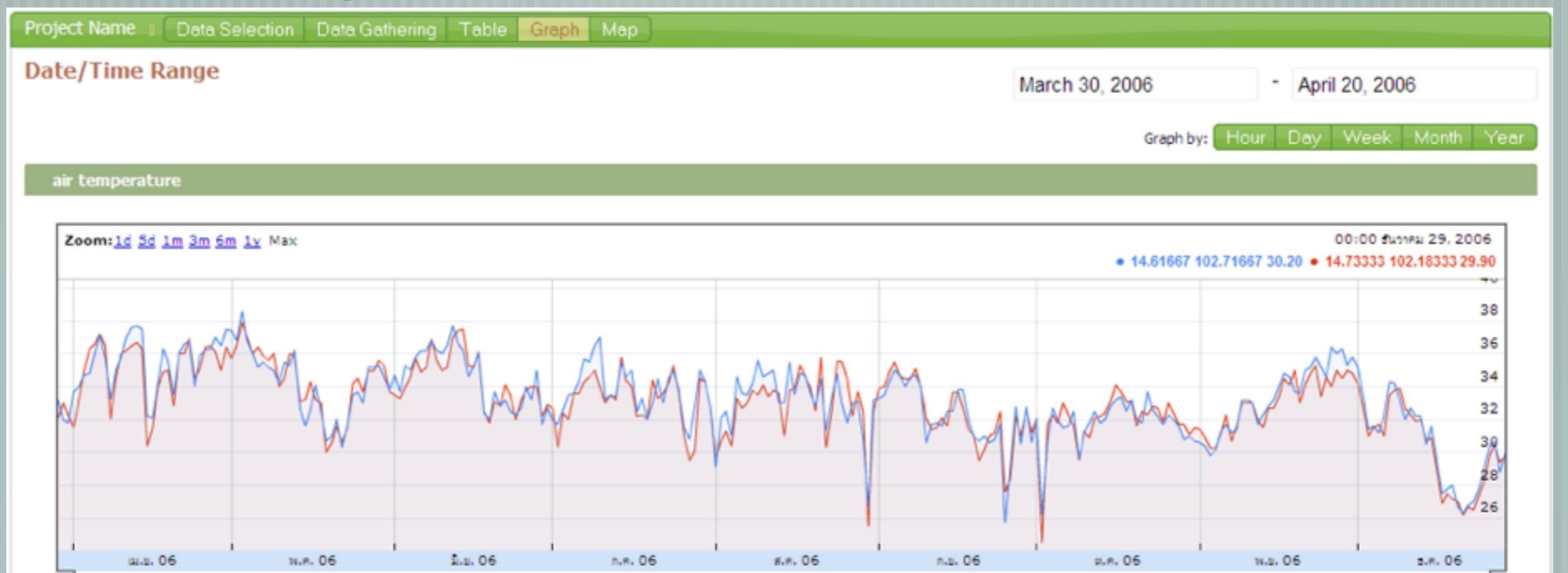


Data visualization



Works with data integration

“Data exploration”



Conclusion

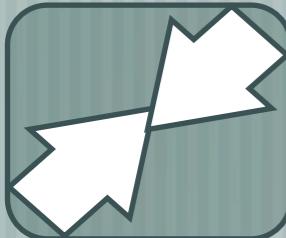
Service Registry



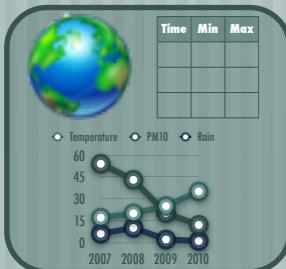
Query

What?
When?
Where?

Integration



Visualization



Environmental Informatory (E-Rium):

- One-stop service for multi-faceted observation data
- Data integration on-the-fly (multi-providers and -domain)
- Cost & time saving for all operations
- Encouraging exploration and utilization of any observation data
- Boundary is the data registered by data providers
- Sustainable social network among data providers and consumers

Call for Collaborations

- [Sharing your
 - observation data via E-Rium
 - preference of data visualization
 - preference of data format (for integration purpose)
 - common and useful scientific model in earth/geo science

Contact



[Dr. Naiyana Sahavechaphan
naiyana.sahavechaphan@nectec.or.th

[Dr. Apivadee Piyatumrong
apivadee.piyatumrong@nectec.or.th

E-Rium is at:

[<http://igrid1.lsr.nectec.or.th/erium>

Comments and suggestions are
very welcome :)