

Digital Typhoon and open science - a trans-disciplinary platform for typhoon-related data

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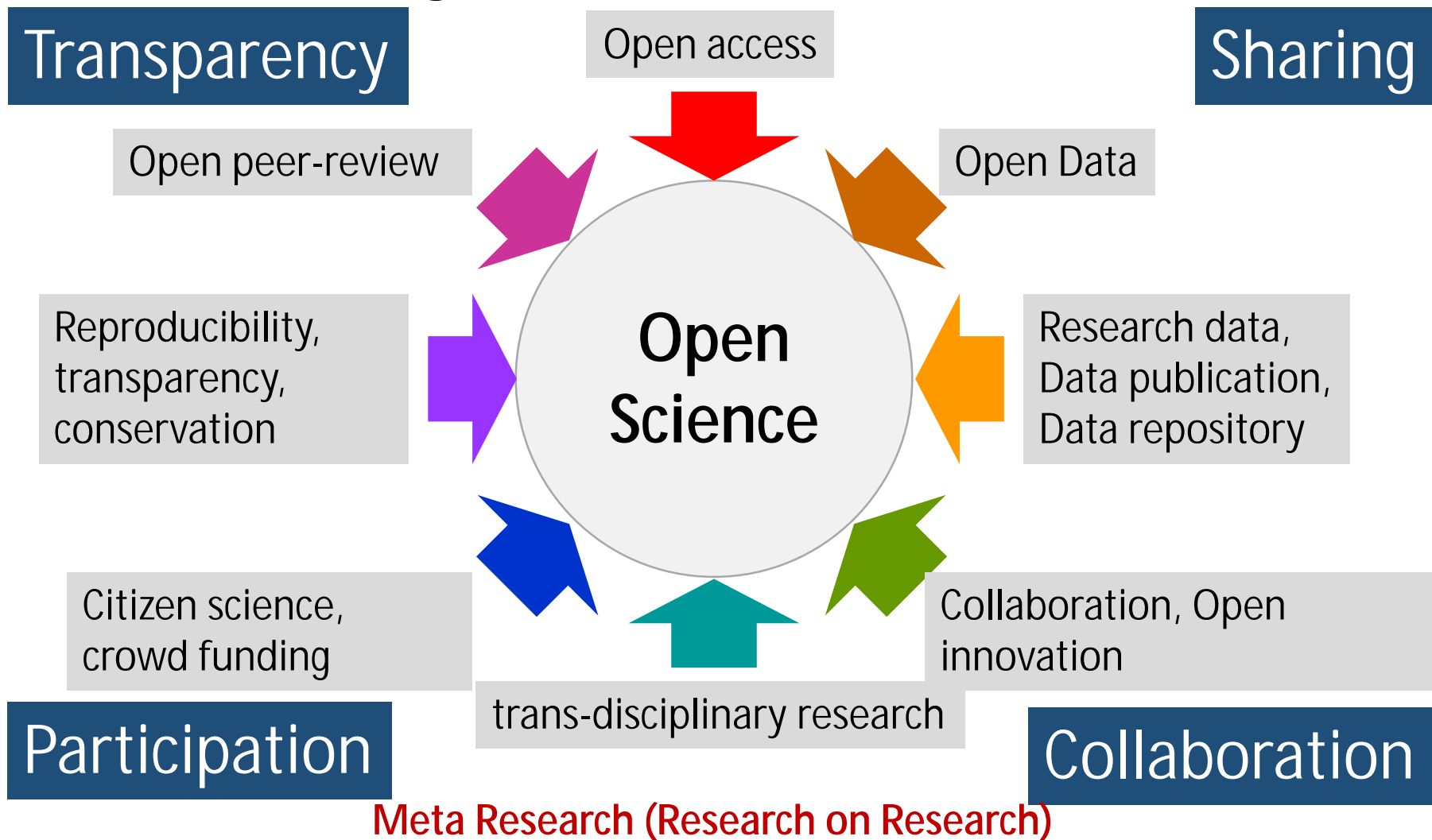
National Institute of Informatics

CODH-DS-ROIS

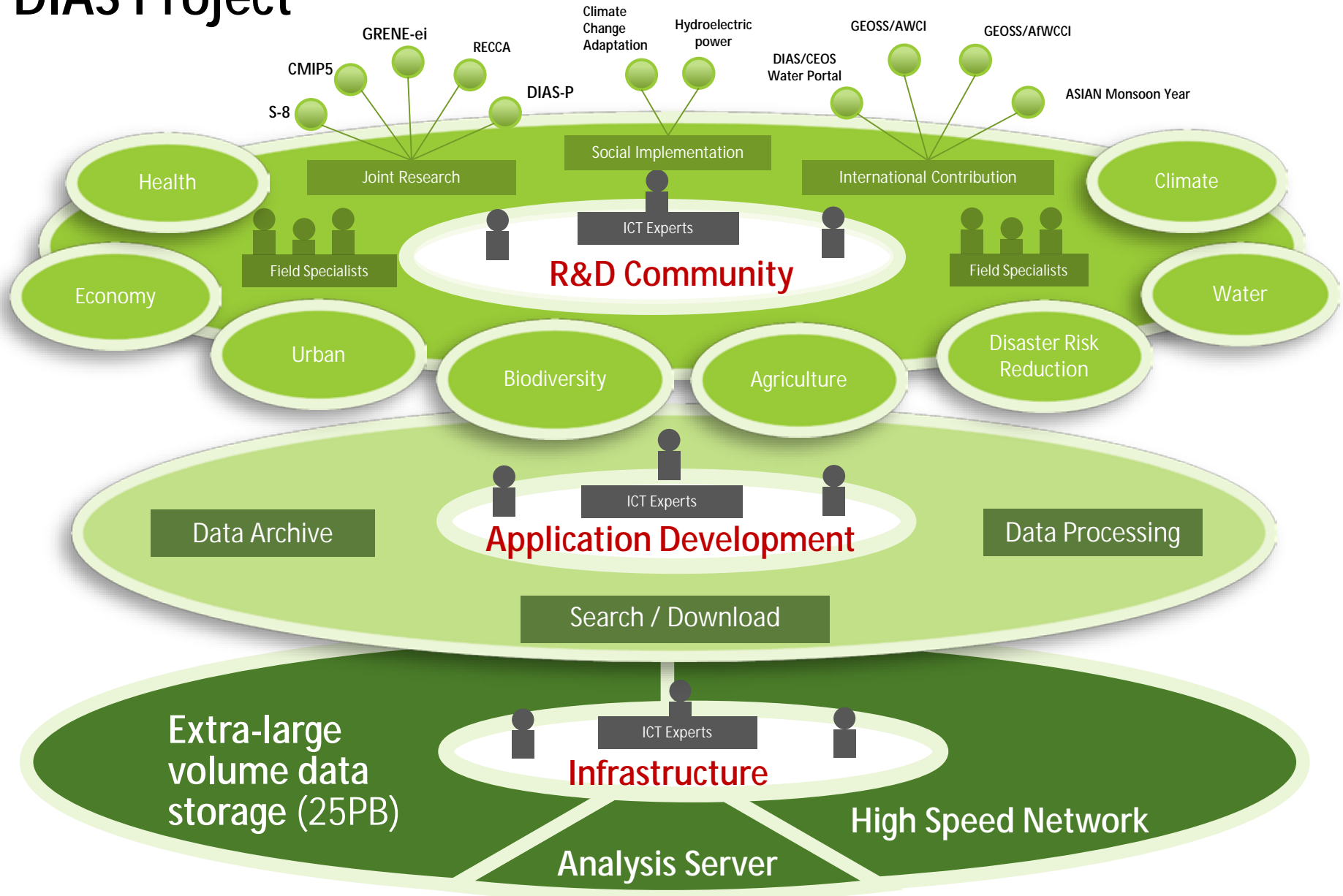
<http://researchmap.jp/kitamoto/>

@KitamotoAsanobu

Convergence to Open Science

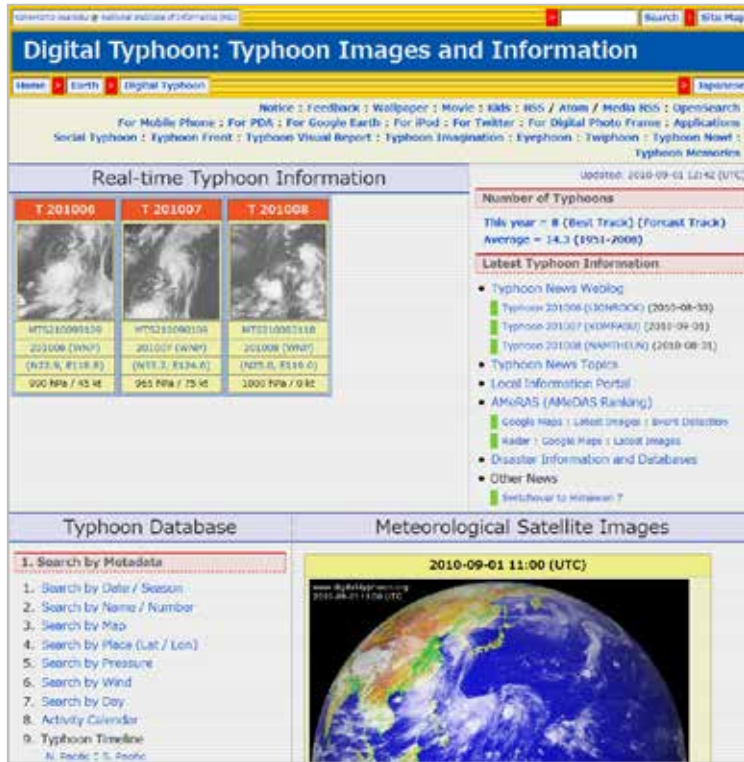


DIAS Project



Digital Typhoon

<http://agora.ex.nii.ac.jp/digital-typhoon/>



- An approach to open science from a **trans-disciplinary perspectives**.
- Not purely driven **by scientific interests**, but also **by societal problems**.
- One of the most famous typhoon-related website with **20 million annual PVs**.

Project started in 1999.
Website started officially in 2003.

Trans-disciplinary Platform



- **Scientist**: data for exploration and research.
- **Professional**: data for decision making.
- **Citizen**: data for curiosity and fun.

Data for Scientists

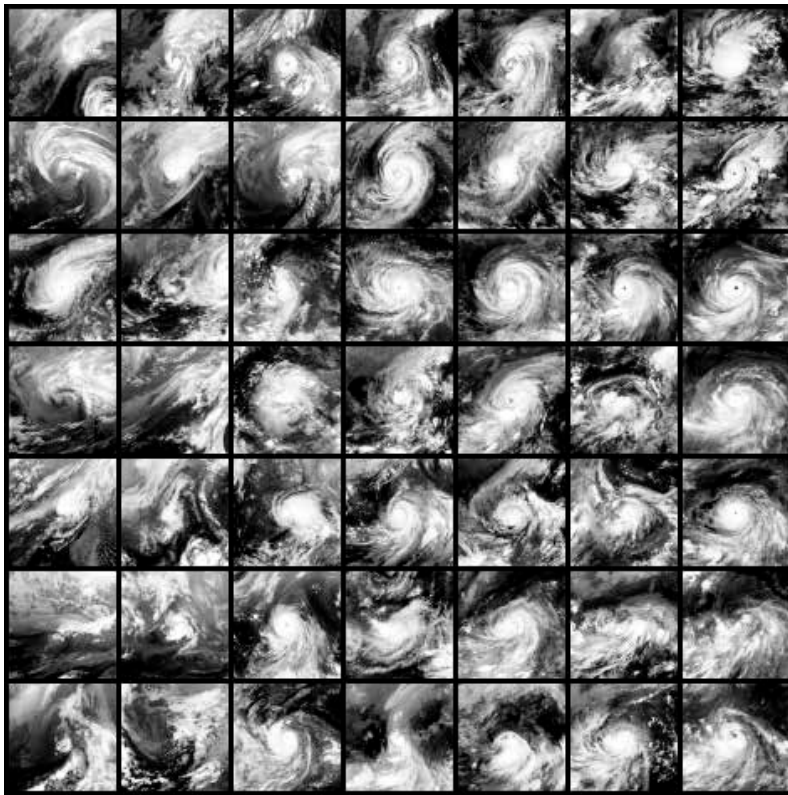
- Data repository is usually designed for “search and download” **without interactivity**.
- Digital Typhoon focuses on **interactive exploration** of datasets from many sources.
- **Search algorithms and machine learning** help to navigate through the datasets.
- Typical comments: “I use Digital Typhoon for getting ideas by browsing through datasets. ”

Datasets from Multiple Sources

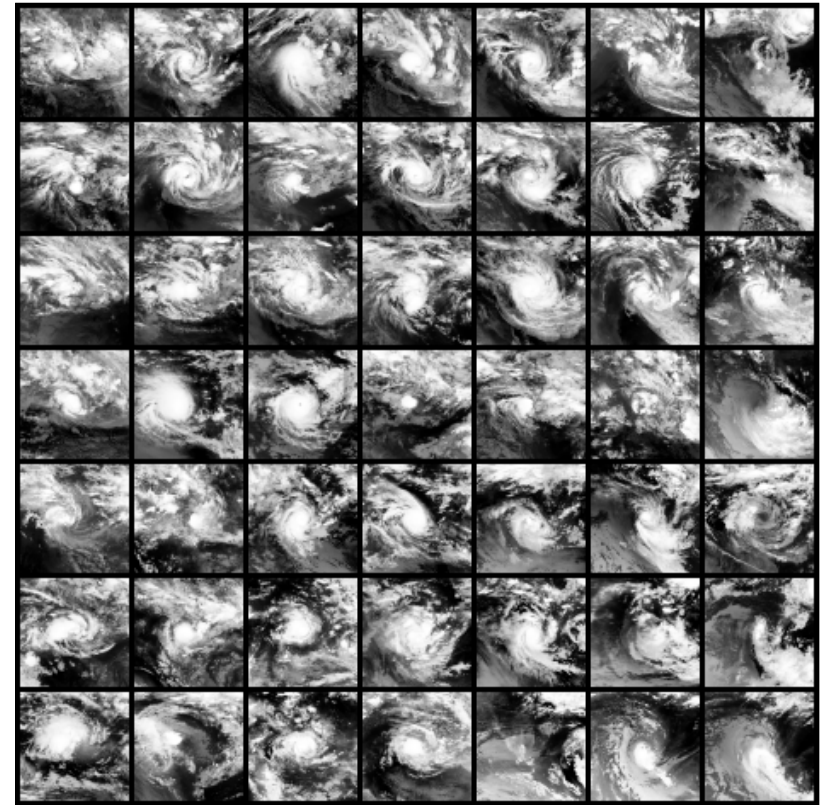
Satellite images (image)	1978-
Typhoon images (image)	1978-
Typhoon best track (trajectory)	1951-, 1907-
AMeDAS data (sensor)	1976-
Disaster reports (structured)	1971-
Weather radar (2D x time)	2004-, 1998-
JMA simulation data (3D x time x variable)	2002-
Online news (text)	2003-
Social media (blog / Twitter)	2004-, 2009-
Weather charts (drawing)	1883-
JMA weather bulletin (structured)	2012-

Tropical Cyclone Image Collection

Since 1978, about 159,200 for NH, and 50,200 for SH.



Northern Hemisphere



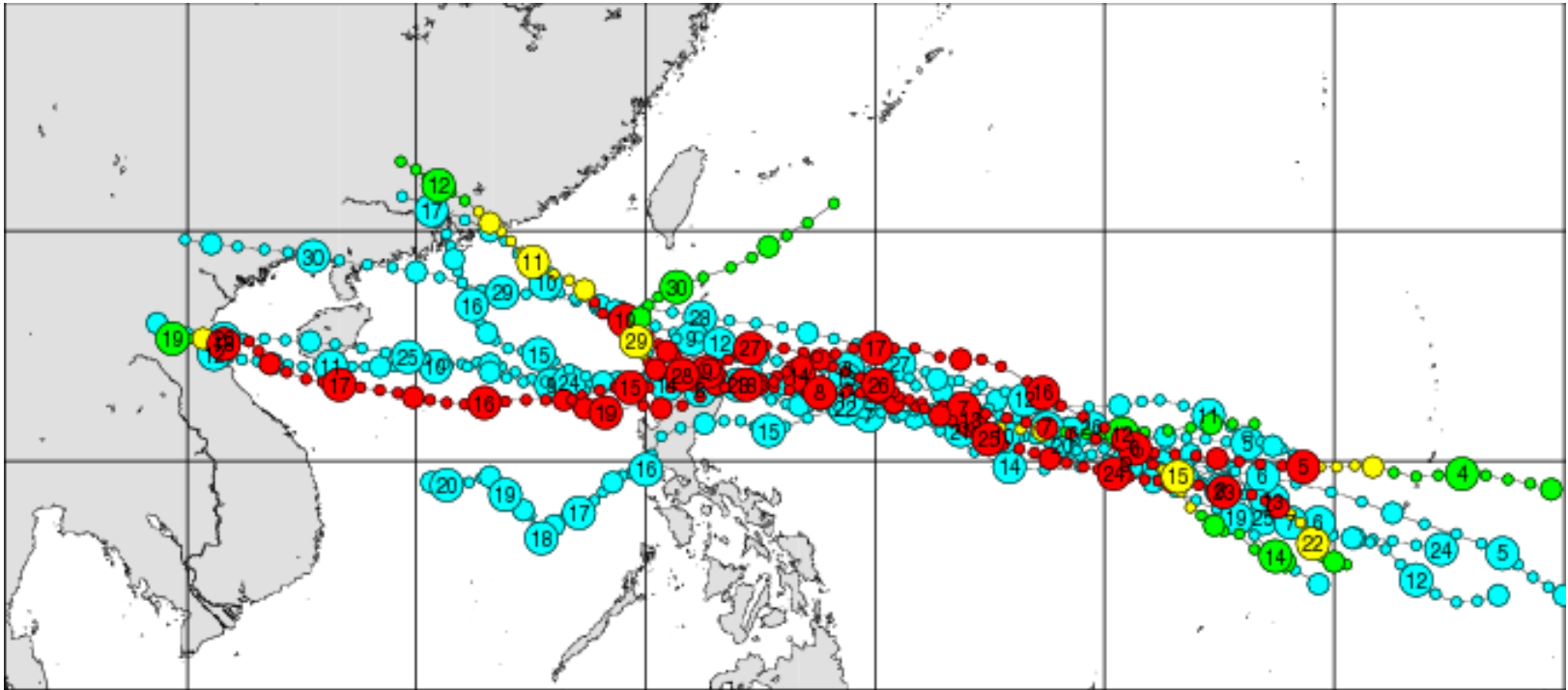
Southern Hemisphere

Search by Image Similarity

Query 1	1	2	3	4
MTS110101803	GMS181031416	GMS492110508	G0E904101711	GMS595103114
201013 (WNP)	198101 (WNP)	199228 (WNP)	200423 (WNP)	199520 (WNP)
(N17.4, E122.6)	(N14.5, E161.4)	(N18.2, E134.8)	(N20.2, E120.2)	(N12.4, E130.9)
885 hPa / 125 kt	975 hPa / 60 kt	915 hPa / 100 kt	940 hPa / 85 kt	955 hPa / 80 kt
5	6	7	8	9
GMS491112714	GMS389042113	GMS597083013	MTS106102811	GMS502030313
199128 (WNP)	198902 (WNP)	199718 (WNP)	200619 (WNP)	200202 (WNP)
(N12.7, E143.5)	(N14.5, E148.5)	(N16.6, E138.6)	(N15.2, E126.5)	(N10.3, E135.1)
900 hPa / 115 kt	920 hPa / 100 kt	985 hPa / 50 kt	975 hPa / 65 kt	960 hPa / 75 kt
10	11	12	13	14
MTS109091718	GMS386051912	GMS179101518	GMS179051212	GMS501122111
200914 (WNP)	198603 (WNP)	197920 (WNP)	197904 (WNP)	200125 (WNP)
(N22.5, E139.3)	(N11.6, E156.2)	(N18.9, E129.4)	(N11.0, E120.2)	(N10.5, E157.0)
945 hPa / 85 kt	910 hPa / 120 kt	925 hPa / 100 kt	1000 hPa / 0 kt	965 hPa / 70 kt

- **Content-based image retrieval**: search similar images to the query image.
- **Similarity is based on image features**; currently PCA, but ideally more complex.

Search by Track Similarity



- Using dynamic time warping for evaluating similarity between tracks.

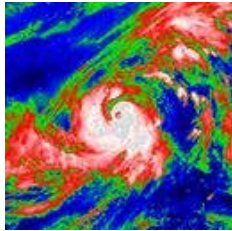
Data for Professionals

- **Weather forecaster**: information about the severity of events for TV weather programs.
- **Disaster-related officials**: information about similar events for disaster preparedness.
- **People working under nature**: agriculture, fishery, tourism, transportation, etc.
- **Education**: teachers can show real data for stimulating the curiosity of students.

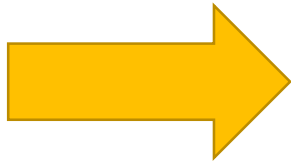
Evidence-based Decision Making

- Professional people need (quantitative) evidence for better decision making.
- They don't have time and expertise to process and visualize raw datasets.
- Ranking enhances understandability, such as "the strongest typhoon in history."
- Combination of standard workflow with improvisational inquiry into datasets.

Search by Situation



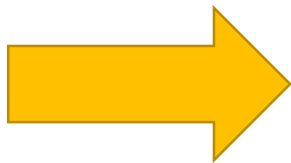
Satellite image



Find similar typhoon cloud patterns in the past.



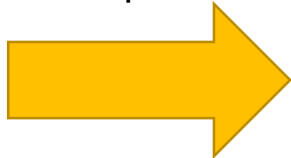
Online news



Find similar news articles or events in the past.



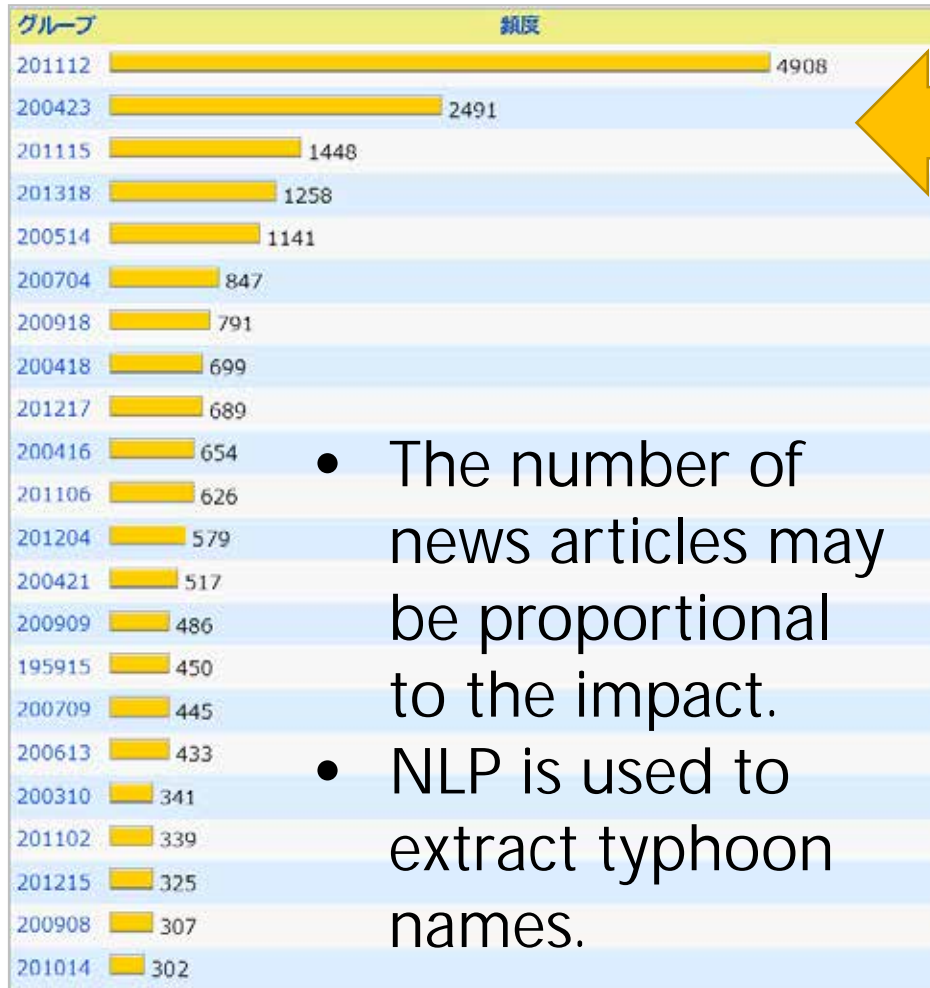
Rain pattern



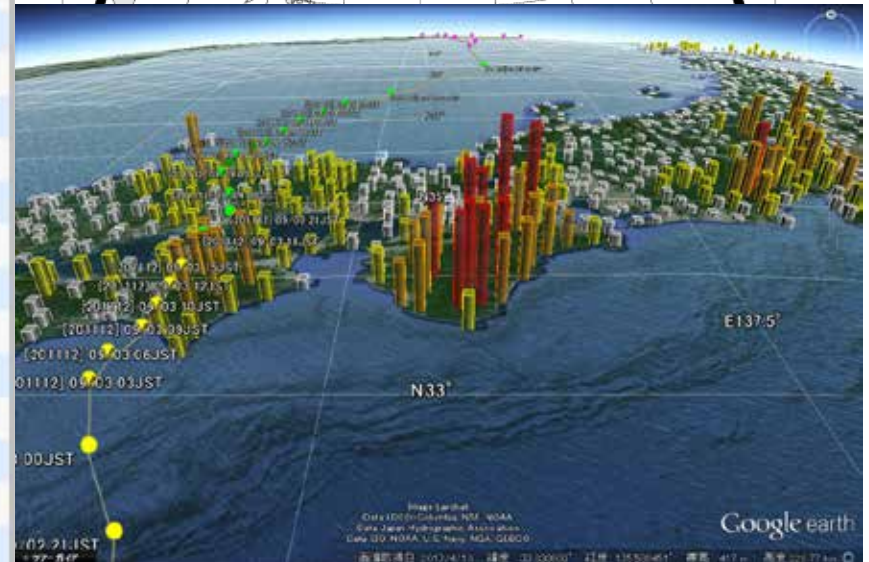
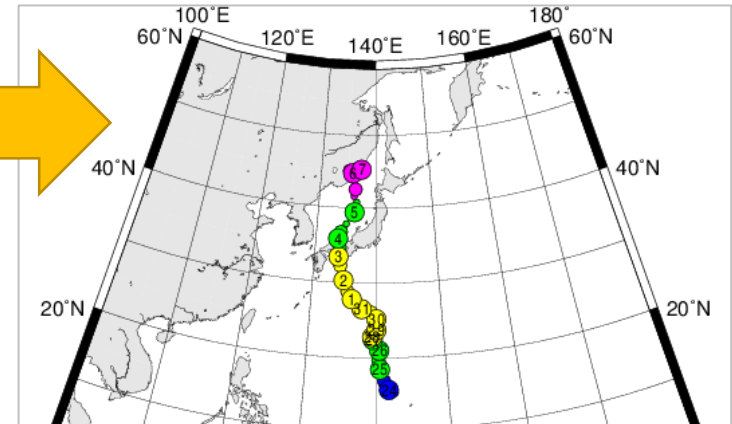
Find similar precipitation patterns in the past.

Decision making is often made in comparison to past events. Search related events to the current situation.

Search by News Articles



- The number of news articles may be proportional to the impact.
- NLP is used to extract typhoon names.



Data for Citizens

- **Weather enthusiasts, including kids**, like curiosity-driven exploration of datasets.
- **Surfers** constantly monitor the track of typhoons for good waves.
- **Motivated volunteers** cooperate with gathering local information.
- **Casual users** communicate with other people about how they feel and will act on data.

Findability and Social Media



- Digital Typhoon official Facebook page has about 40,000 followers.
- Digital Typhoon also maintains several Twitter bots.
- Findability for citizens means appearance on social media streams.

Three Roles of Data Platform

1. **Preservation**: long-term value (data archivist)
2. **Organization**: basic value (data librarian)
3. **Curation**: added value (data curator)

Digital Typhoon demonstrates how data curator can add value to datasets.

Universal and Inclusive Design



Users are continuum. A universal and inclusive design should be useful for both citizens and scientists.

Sustainability of Services

- The platform depends on **personal activity and grants**; therefore not sustainable.
- **Relative information** (such as ranking) **is reproducible** only within a snapshot.
- **Service offers experiences**, not only facts, hence you cannot freeze it for depositing.
- **Data is solid, but service is fragile**. How to publish a “**service paper**” for citation?

Summary

- **Digital Typhoon** is a trans-disciplinary platform for typhoon-related data.
- Digital typhoon demonstrates how **a data curator can add value** to datasets.
- Design principle is “**universal and inclusive**” for scientists, professionals and citizens.
- **Sustainability of services** is under discussed but needs a new model for proper credit.



Related Websites

- **Digital Typhoon**
 - <http://agora.ex.nii.ac.jp/digital-typhoon/>
- **DIAS Project - NII Group**
 - <https://dias.ex.nii.ac.jp/>