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Data Integration System Development

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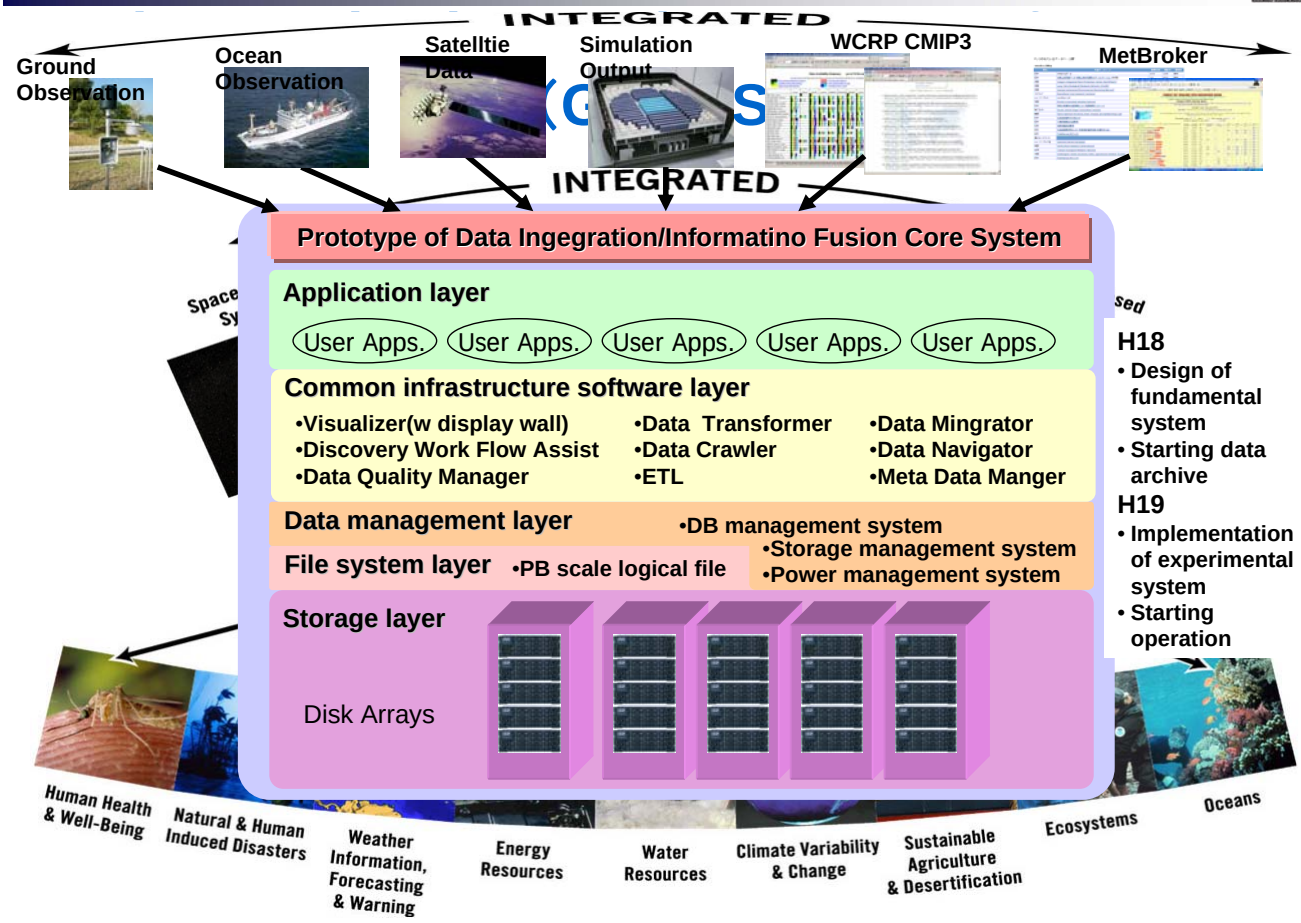
CEOP Centralized Data Integration System



System specification introduced in 2007

- Consist of 5 subsystems
- Capacity
  - 604TB（13D+2P RAID6）
- Read performance
  - 2.4GB/s per subsystem at maximum, total 12GB/s
- Cache
  - 2GB per subsystem, total 10GB
- Energy-saving function
  - Automatically turn off the power of inactive portions
  - Automatically turn on the power on access demand

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Sensor Data Visualization for Agricultural Application

Field Server - Sensor network node -

NARC (National Agricultural Research Center),
NARO (National Agriculture and Food Research Organization), Japan

Component of Field Server

- Weatherproof cabinet
- Substrate of Web server
  - Field Server engine
- Sensor
  - air temperature, humidity, solar radiation, soil moisture, UV, CO_2
- Camera
- WiFi based
- Data collection / Remote control agent
- Middleware for data grid
  - MetBroker

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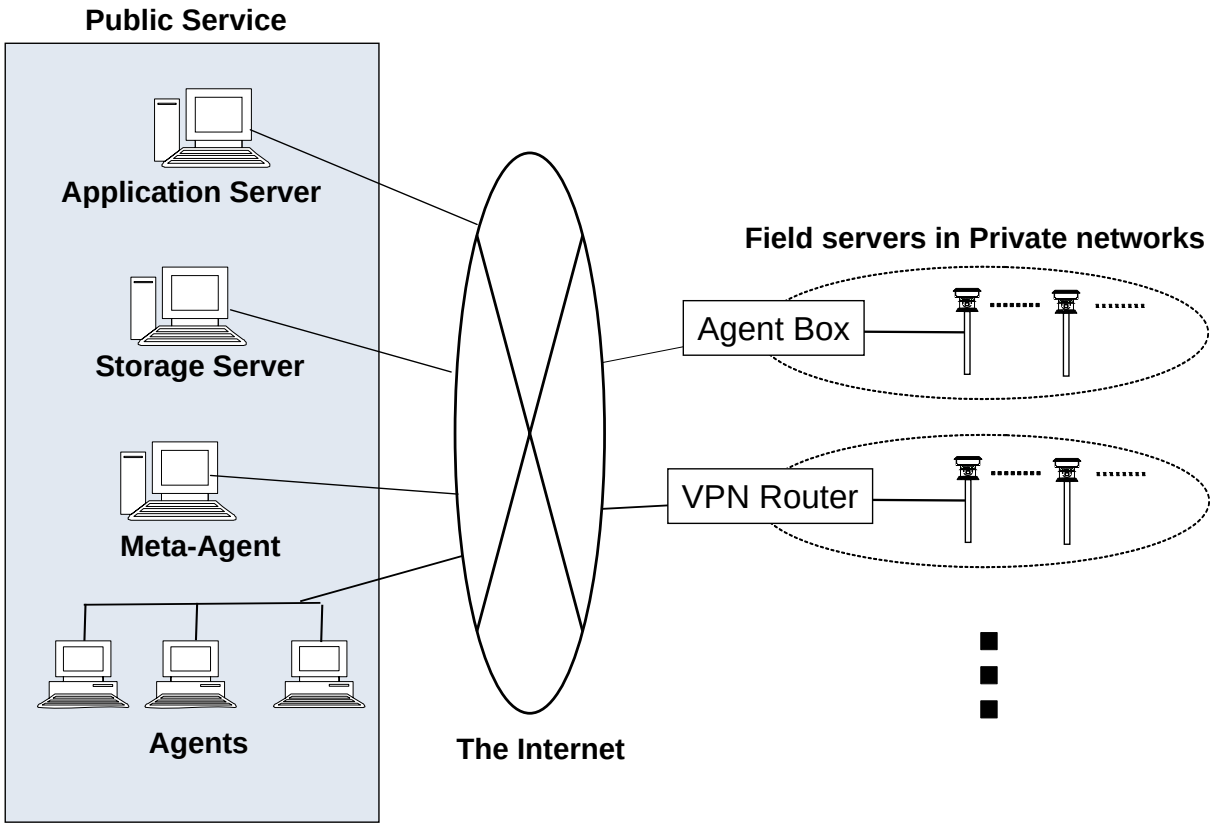
Data Collection and Server Control by Agent



Current Workings

- Collaboration with National Agricultural Research Center (NARC), National Agriculture and Food Research Organization (NARO)
- Preparing a replica of FieldServer archives at UT (Original is NARC)
  - ➢ Periodic data crawling (1 week)
- Developing various tools that can support the data analysis by the users

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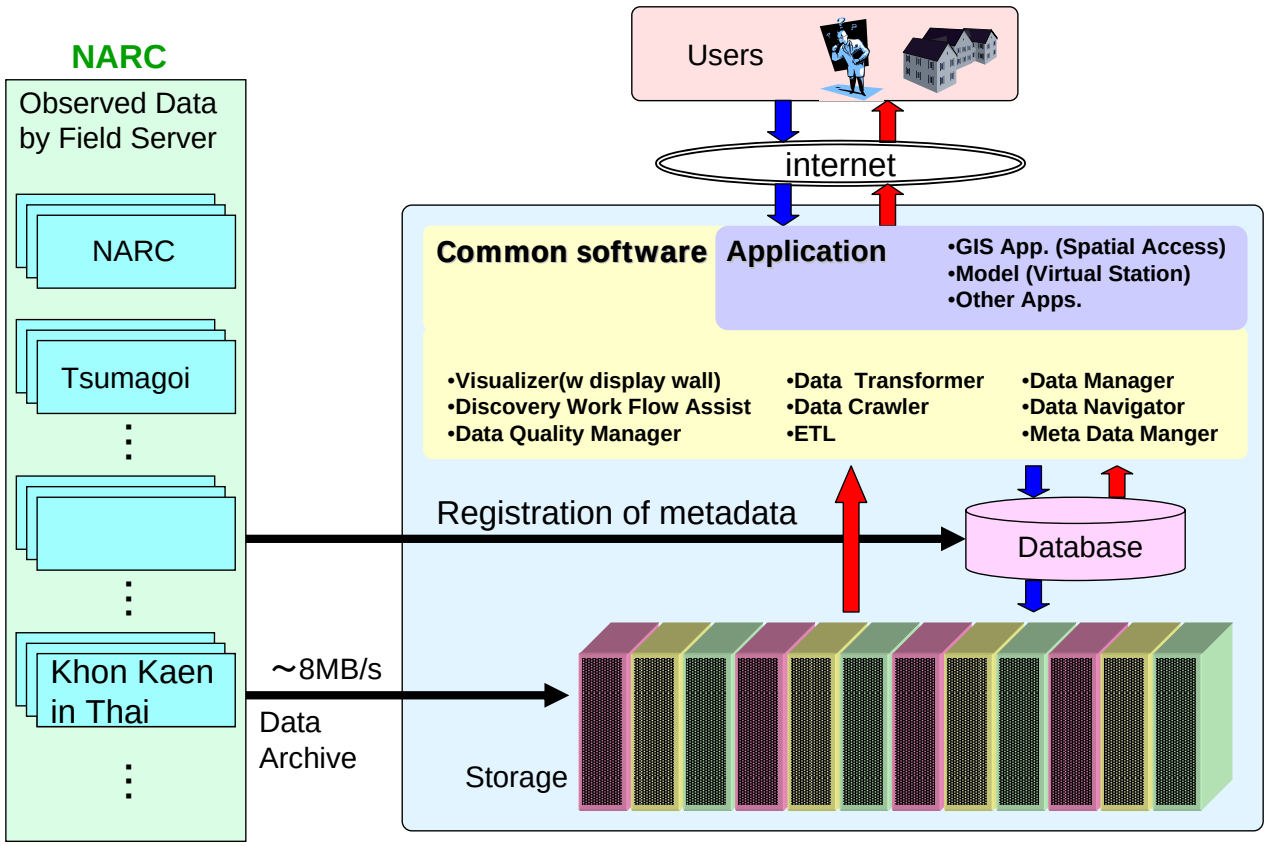
FS Data Archive and Service



Ccentralized data integration system @ UT

Number and Size of FS Scenes (13M scenes)

Installation Site	Start	End	Number of Scenes "A" (Mar., 2007)	Number of Scenes "B" (Nov., 2007)	Growth of Scenes (B-A)	Total Size (KB)
Azuma, Tsukuba-shi, Ibaraki	2005/1	2007/6	374,350	422,393	48,043	16,723,720
China	2004/7	Current	444,866	449,140	4,274	18,490,948
Pear farm, Chiba	2003/7	2007/10	309,612	373,258	63,646	20,801,544
Florida Univ., USA	2005/5	Current	1,705,630	2,014,419	308,789	89,088,308
NARC, Niigata	2005/4	2006/10	244,817	244,817	0	11,474,736
Ibaraki Univ.	2004/11	2005/10	367,594	367,594	0	24,577,696
Ichikawa-shi, Chiba	2005/7	Current	15,009	139,480	124,471	8,730,860
UCC farm, Kona, Hawaii	2002/12	Current	1,191,152	1,886,225	695,073	76,742,972
Mandarin Farm, Wakayama	2005/7	2007/1	107,638	107,638	0	5,081,076
Filed, NARC	2003/1	Current	6,895,151	7,431,653	536,502	845,990,216
Obuse, Nagano	2006/5	Current	401,392	851,203	449,811	37,893,080
Mikkabi, Shizuoka	2004/9	Current	149,326	149,461	135	9,631,788
Peach Farm, Fukushima	2003/5	2006/1	231,771	231,771	0	250,009,900
Gunma Agricultural Tech. Center	2006/6	Current	64,649	305,590	240,941	9,981,480
Western Region, NARC	2005/11	Current	488,917	809,556	320,639	33,589,600
Rice field, Yawara	2004/7	2006/9	307,339	309,998	2,659	15,021,580
Himalayan	2007/11	Current		182	182	8,576
Yachimata, Chiba	2007/4	Current		137,807	137,807	5,894,908
JAXA	2007/7	2007/9		28,885	28,885	889,716
Khon Kaen, Thai	2006/12	Current		10,241	10,241	597,052
Faculty of Agriculture, UT	2007/8	2007/10		30,147	30,147	1,665,904
		Total	13,299,213	16,301,458	3,002,245	1,482,885,660

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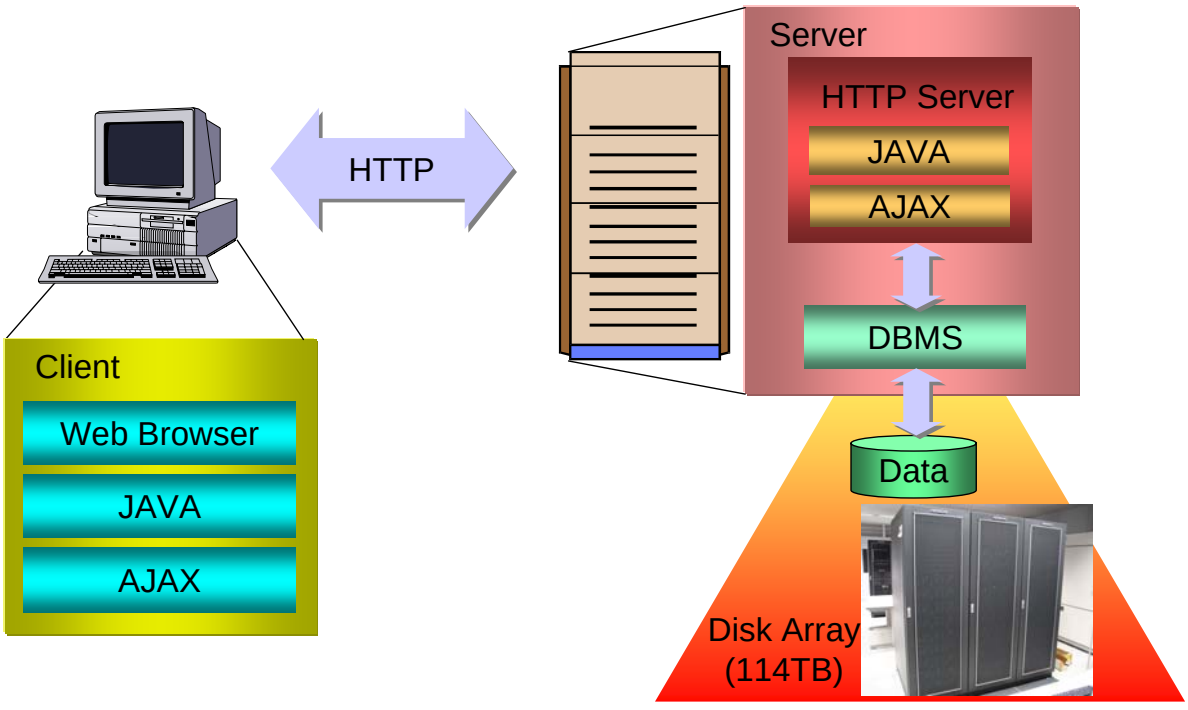
Structure of FS Image Browser



FieldServer Image Browser

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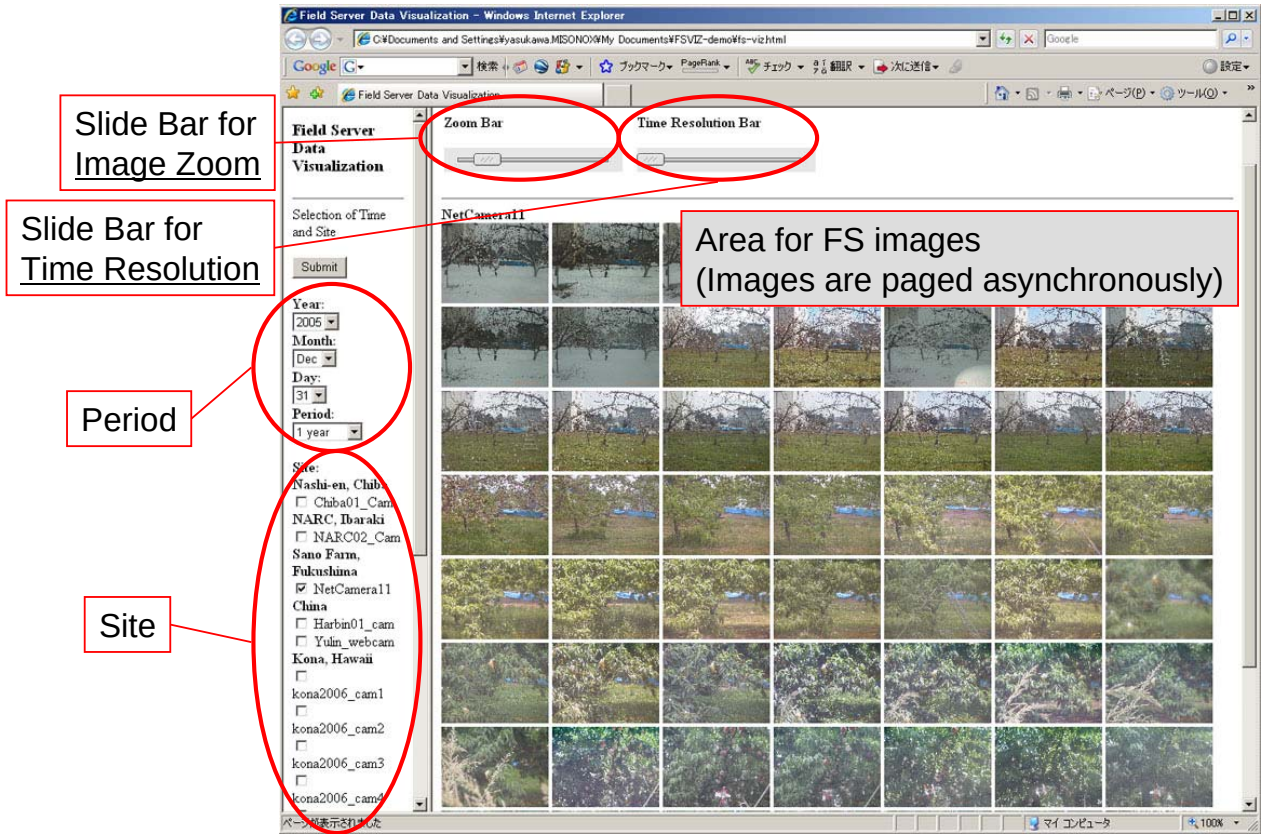

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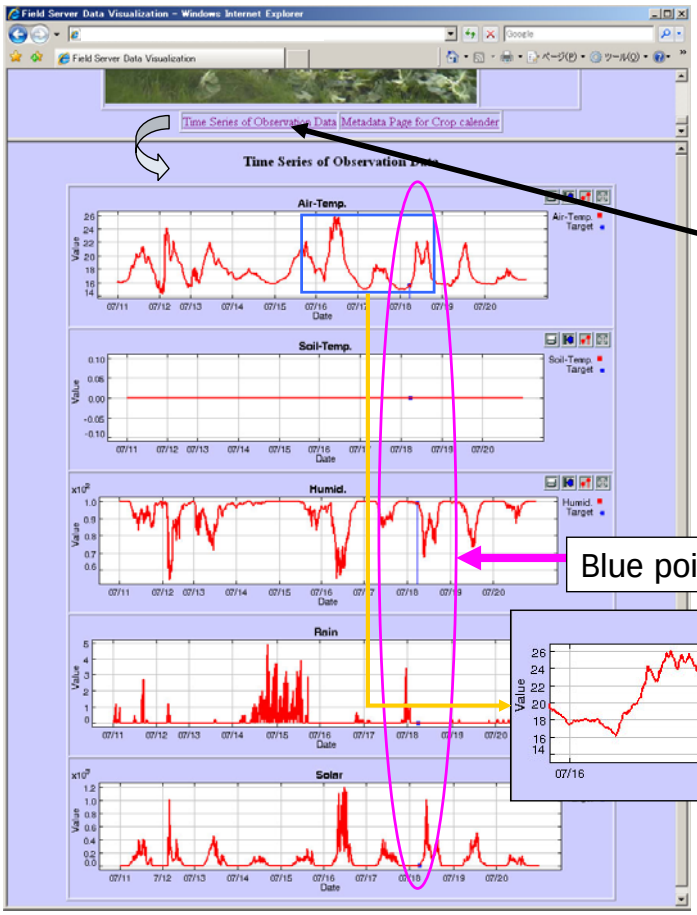
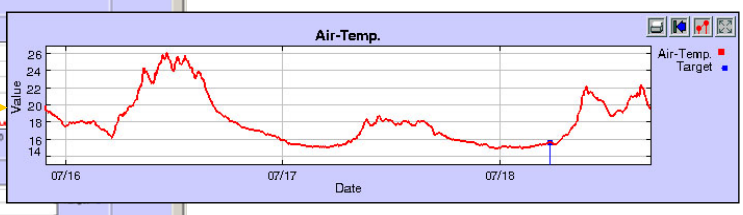
Time Series Display Page for Observation Data of Each Sensor



Move to time series graph page by clicking the link

Observation Data is exported and graphed. Time range of graph is ten days (from seven days ago of target day to two days after).

Blue point is the time of the selected image



When the area (blue square) is selected by using mouse device, the graph is zoomed.

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A Prototype of JRA-25 Visualization Tool

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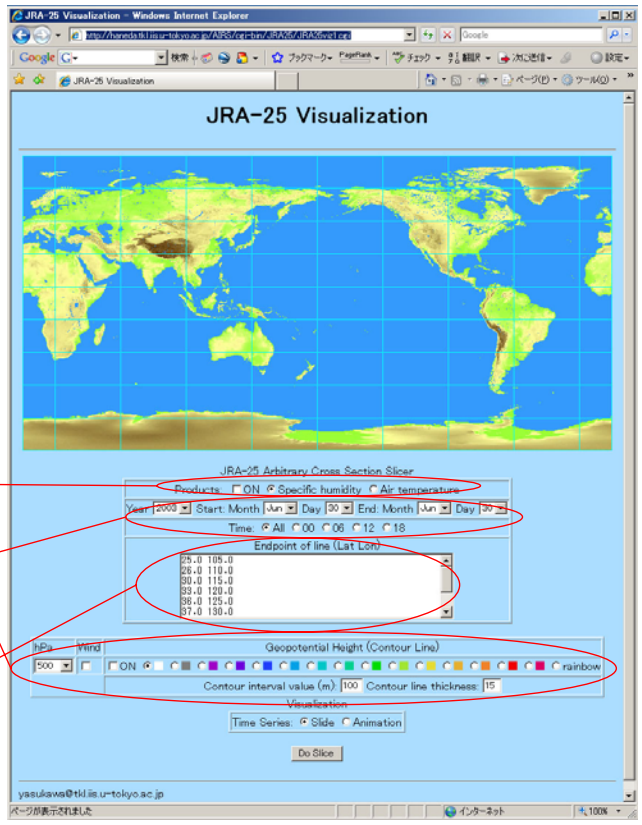
A Prototype of JRA-25 Visualization Tool

- Analysis of moisture flow
- Verification of finding
- Understanding characteristics of JRA-25

JRA-25 (Japanese 25-year Reanalysis)

- Joint research project of Japan Meteorological Agency (JMA) and Central Research Institute of Electric Power Industry (CRIEPI)
- http://jra.kishou.go.jp/
- Reanalysis Period : from Jan. 1979 to Dec. 2004 (26 years)
- The global model resolution : T106L40 (110km grid, 40 pressure levels, model top: 0.4hPa)
- Element (Geopotential height [gpm], Air temperature [K], Specific humidity [kg/kg], Zonal wind [m/s], Meridional wind [m/s], etc)
- About 8.0TB is archived in UT

JRA-25 Data Retrieval Page

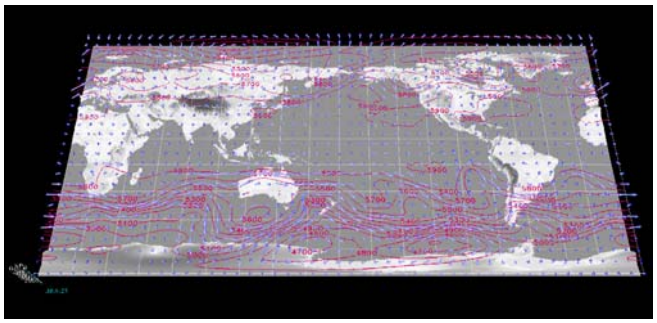


Data element

Period

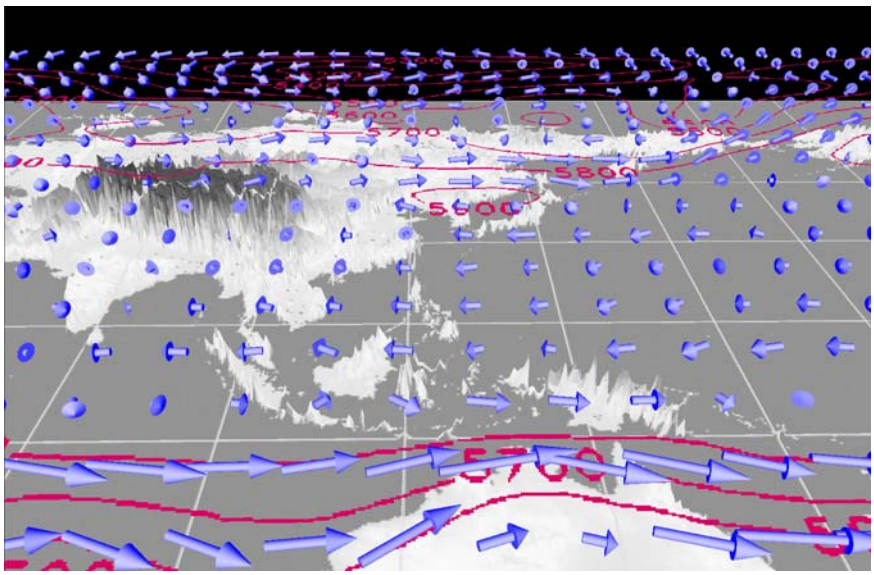
Points on arbitrary cross section (latitude, longitude)

Ex.1：JRA-25 horizontal data display using VRML



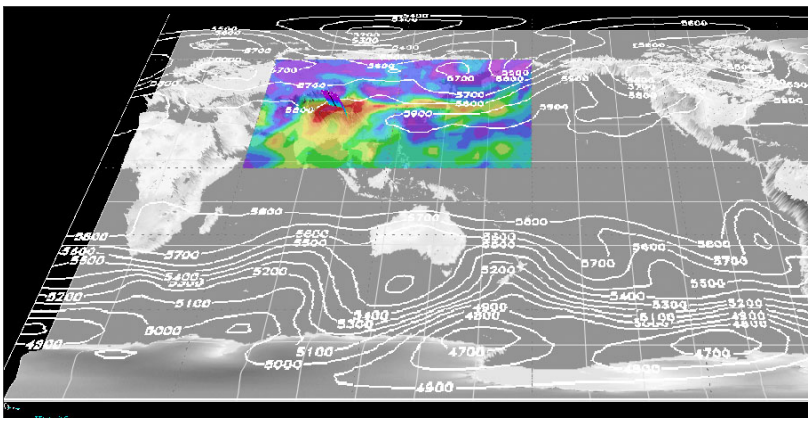
- Clipping of horizontal plane for wind data
- Overlay of wind and geopotential height
- Topography display using GTOPO30

- UT18:00, 30 June, 2003
- Visualization of wind using 3D arrows (length is wind intensity)
- Geopotential height of contour chart
- Perpendicular axis is pressure level



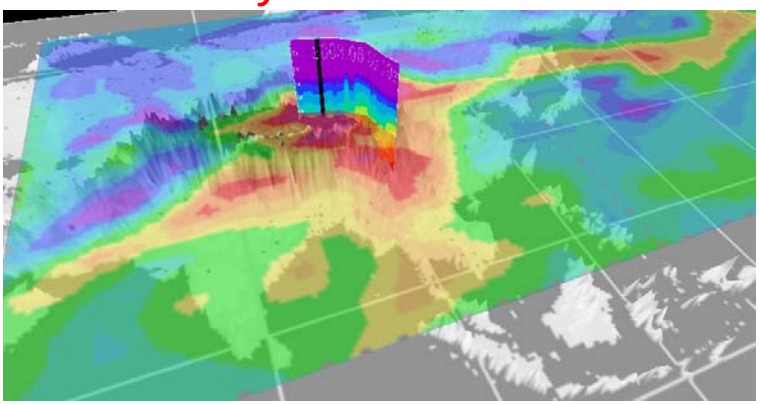
Change of view and angle

Overlay of Specific humidity and Geopotential height



- Specific humidity: Shaded color image (red→high)
- Geopotential height: Contour chart

Ex.2：Overlay of JRA-25 data and AIRS data



- JRA-25: Specific humidity of horizontal plane
- AIRS: Water vapor ratio of arbitrary cross section

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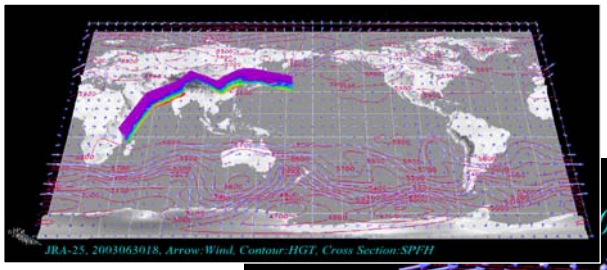
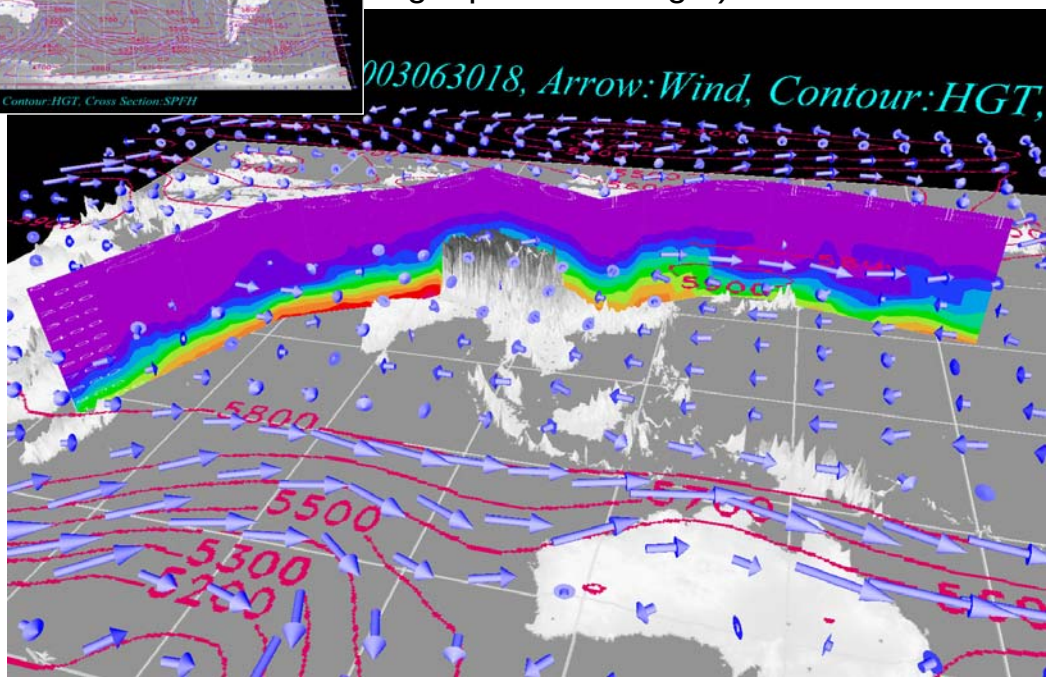
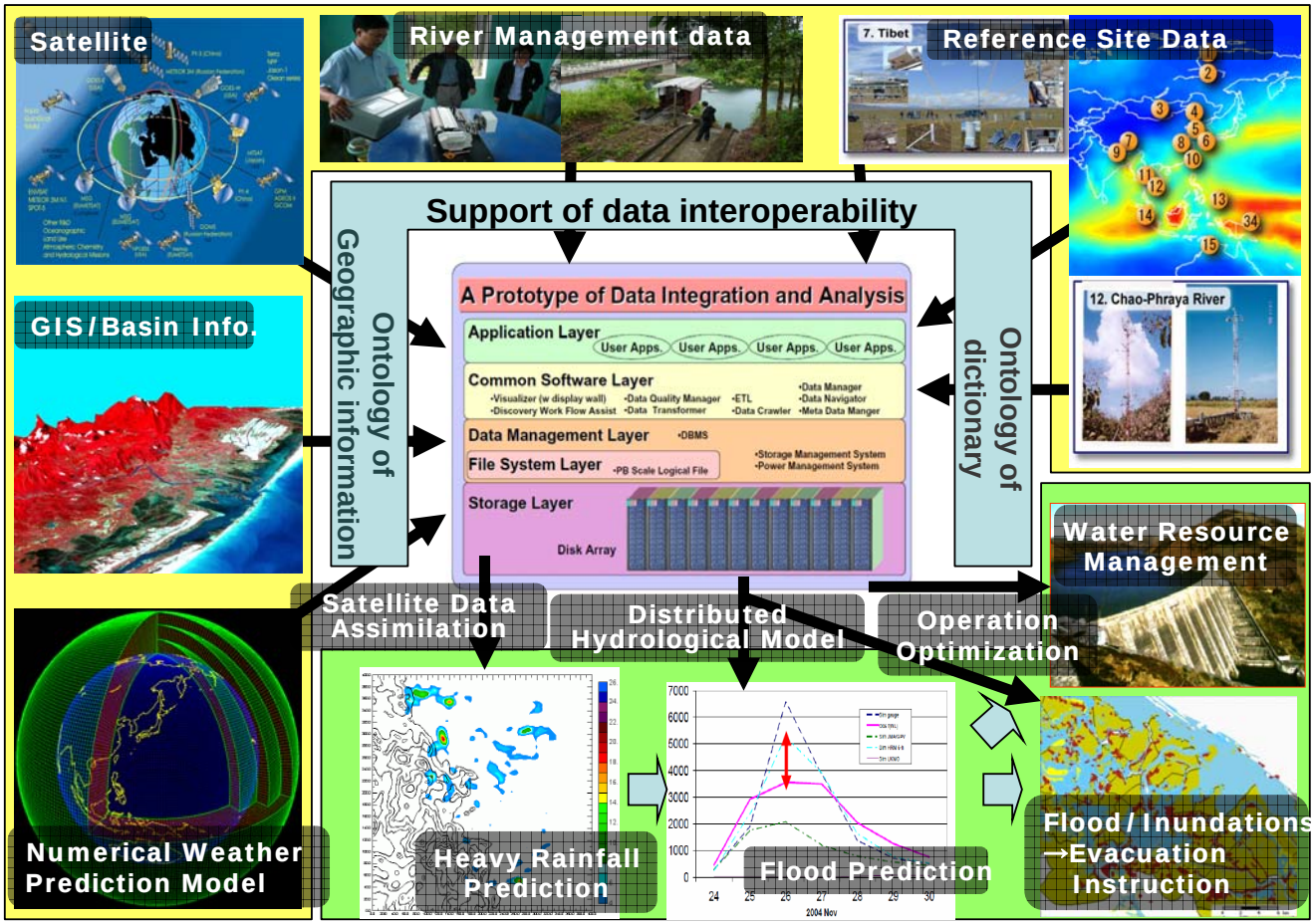
Ex.3: Display of Arbitrary Cross Section for Specific Humidity



- Arbitrary cross section of specific humidity
- Overlay of other elements (wind, geopotential height)



- UT18:00, 30 June, 2003
- specific humidity of color (red: high, purple：low)
- Flexible allocation of value and color


Satellite
River Management data
7. Tibet
Reference Site Data
GIS/Basin Info.
Support of data interoperability
Ontology of Geographic information
A Prototype of Data Integration and Analysis
Application Layer
User Apps.
User Apps.
User Apps.
User Apps.
Common Software Layer
•Visualizer (w display wall)
•Discovery Work Flow Assist
•Data Quality Manager
•Data Transformer
•ETL
•Data Crawler
•Data Manager
•Data Navigator
•Meta Data Manger
Data Management Layer
•DBMS
File System Layer
•PB Scale Logical File
•Storage Management System
•Power Management System
Storage Layer
Disk Array
Ontology of dictionary
12. Chao-Phraya River
Water Resource Management
Satellite Data Assimilation
Distributed Hydrological Model
Operation Optimization
Numerical Weather Prediction Model
Heavy Rainfall Prediction
Flood Prediction
Flood / Inundations →Evacuation Instruction