

HEPDG2005, May 23 ~ 27, 2005, Hotel Interburgo, Daegu,
Korea

e-Science and Earth System Study in Korea

2005. 5. 26

Jai Ho Oh

Pukyong National University, Busan, Korea

jhoh@pknu.ac.kr

21st Century Weather/Climate

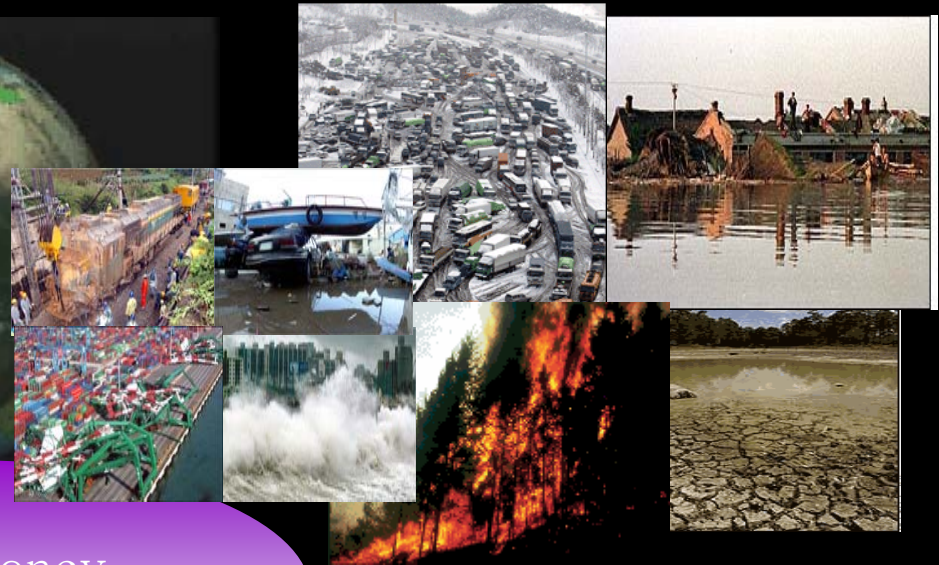
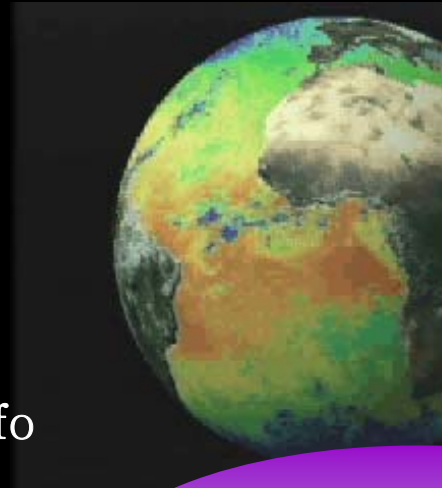
Severe Weather Info

Request-Reply

User Oriented Info

Ubiquitous Info

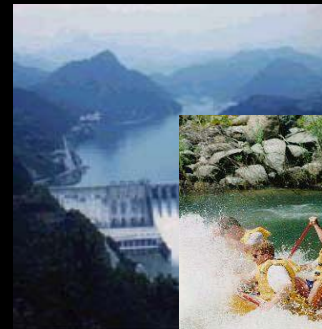
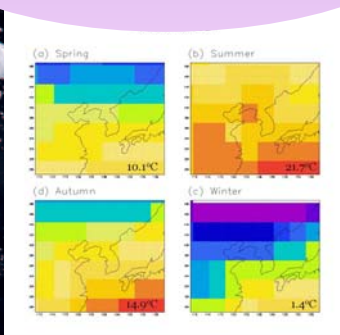
Extended forecast Info



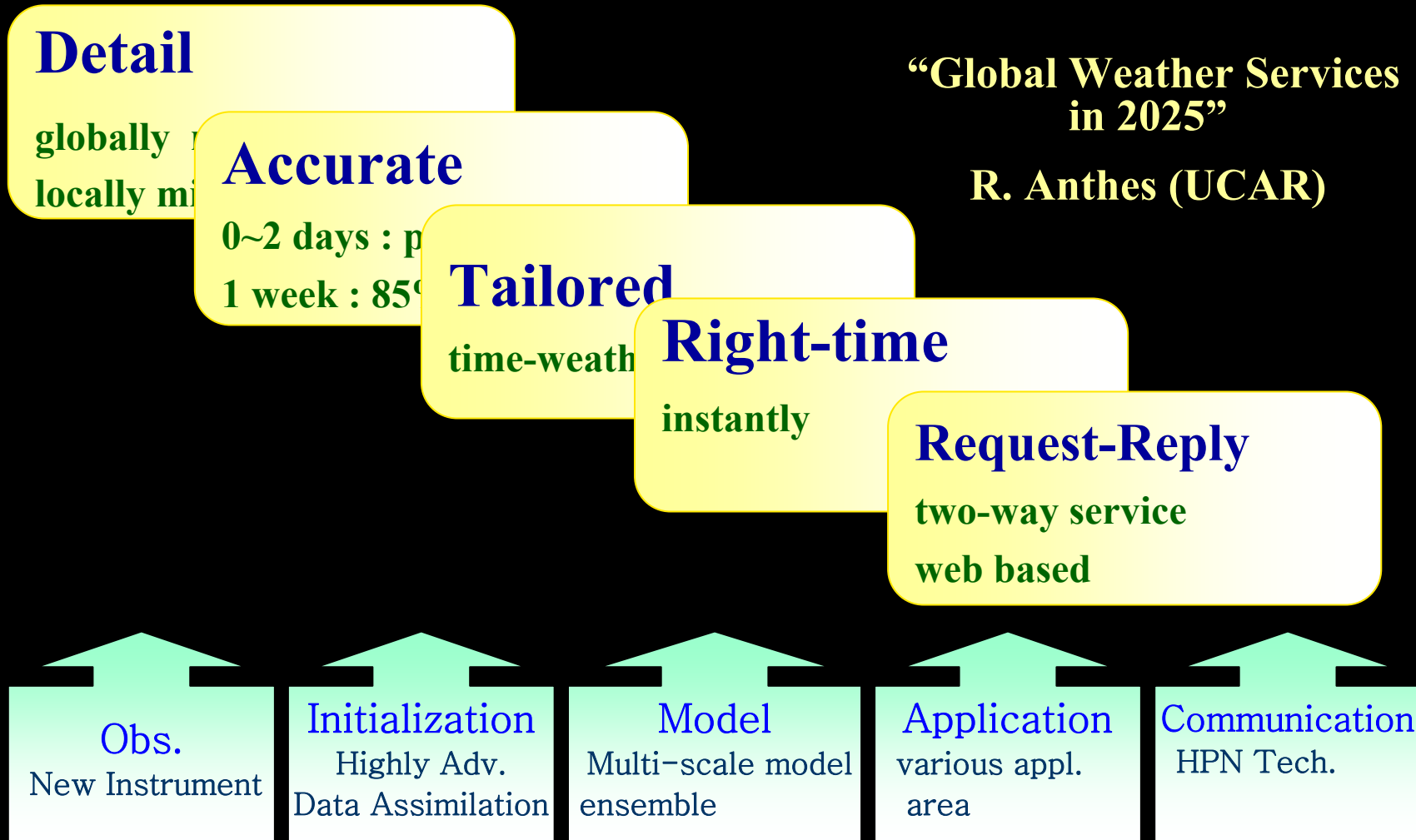
Emergency
Response Syst

Climate Change
& Impact

Appl. Meteor

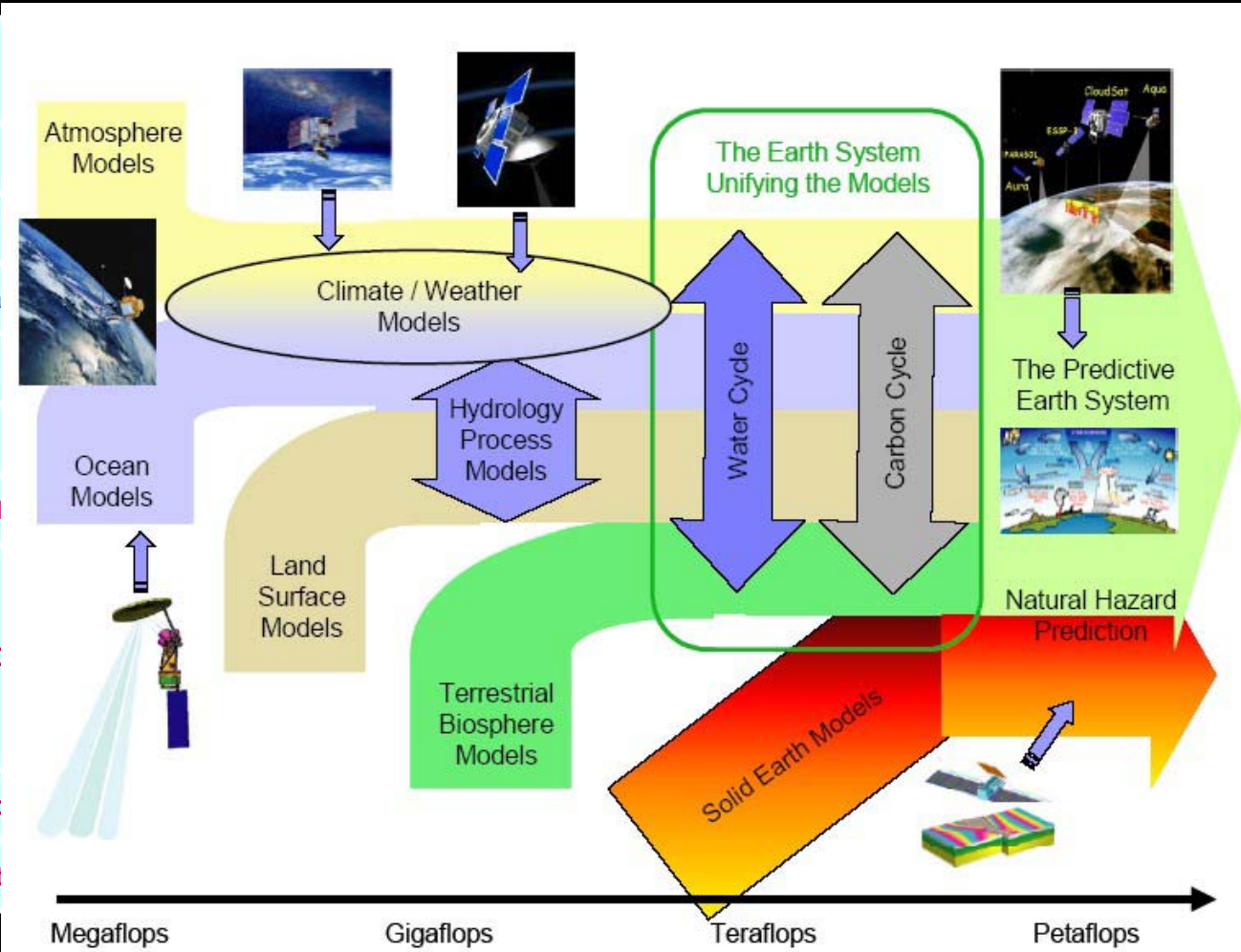


21st Century Weather Information



Enhancement of Model and Increasing Data Size

70s	80s	early 90s
Atm	Atm	Atm
	Land	Land
		Ocn, Sea
		Aerosol
		Land C
	Ocn, Sealce	Ocn Carb
	Clouds	Chemist



Components are developed "offline" and then are integrated into comprehensive coupled models

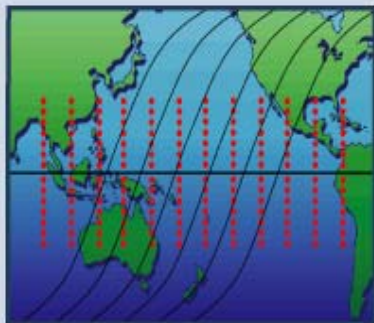
Down Sizing Data for Stakeholder

Downlink Speed

Petabytes 10^{15}

Multi-platform, multiparameter, high spatial and temporal resolution, remote & in-situ sensing

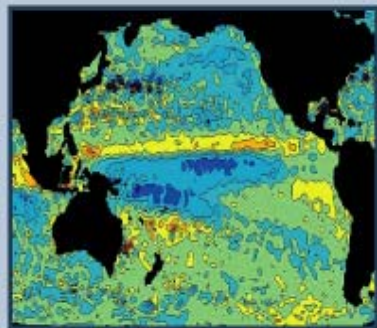
Advanced Sensors



Terabytes 10^{12}

Calibration, Transformation To Characterized Geophysical Parameters

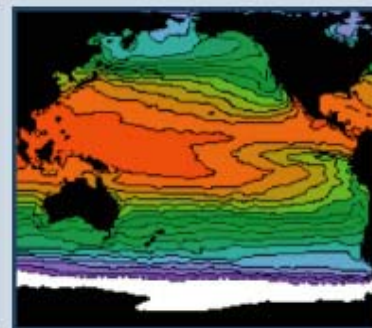
Data Processing & Analysis



Gigabytes 10^9

Interaction Between Modeling/Forecasting and Observation Systems

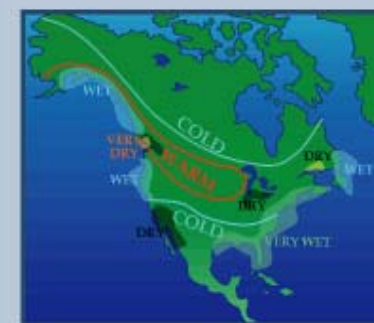
Information Synthesis



Megabytes 10^6

Interactive Dissemination and Predictions

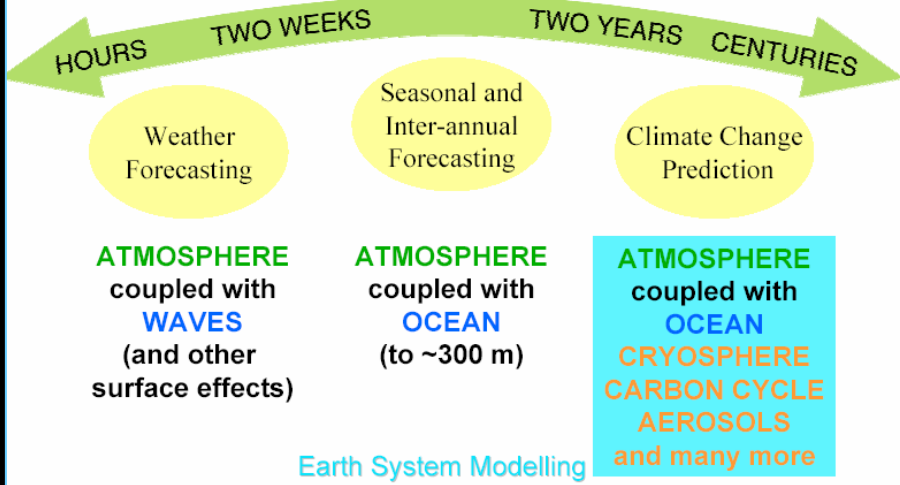
Access to Knowledge



Emergence Response
국가/지역 비상대응체계



Major model components used
uWISE implementation by KMA

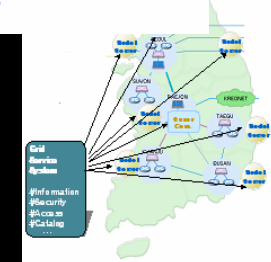
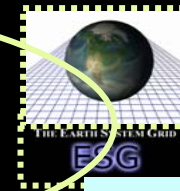
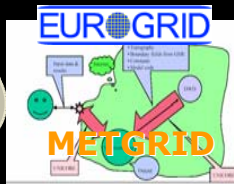


Climate Change Impact Assessment



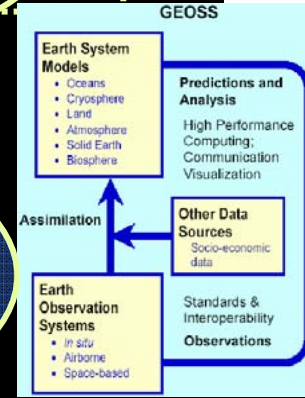
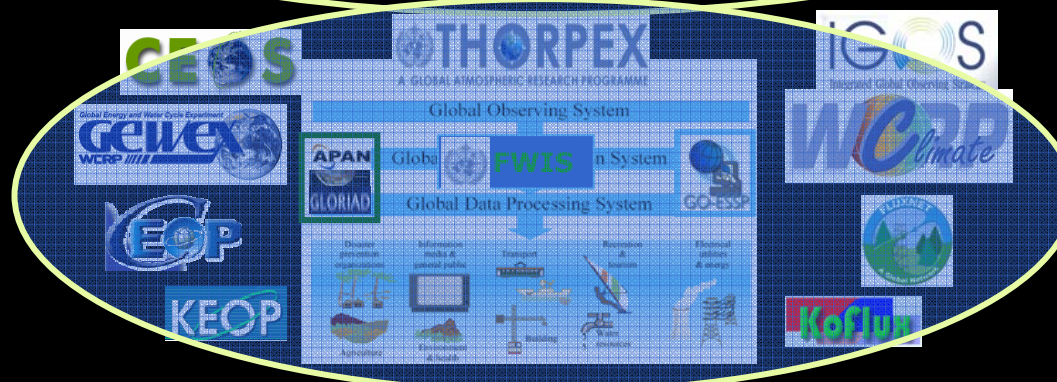
Implementations

NWP Model



Communication

Observation



IT Framework



On going Activities

- WIS : V-GISC, WAMIS,
RAII & V VPN pilot project,
- METGRID
- Korea-German Collaboration
- GEOSS

- Data Exchange(data, products and information) – Request-Reply System
- Exchange New Tech. Information
- Common s/w development
- Resource Share

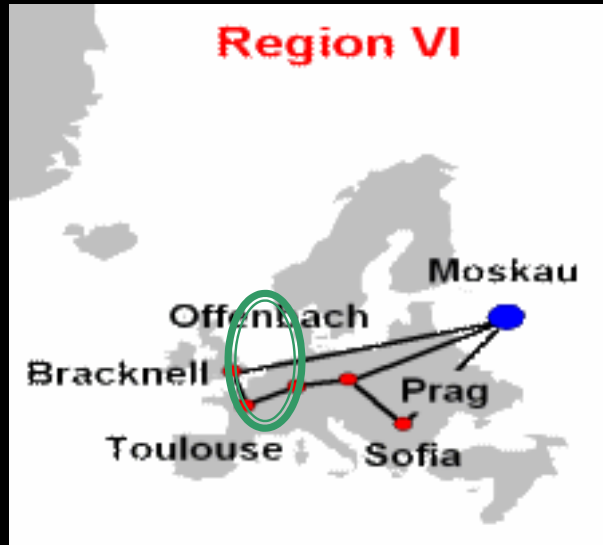
Main Goal of Existing Projects

- THORPEX/TIGGE
- WMO FWIS
- GEOSS
- METGRID
- CBS Severe Weather Forecasting Demonstration Project
- ...



Single
Global
Interactive
Weather
Forecasting

PILOT PROJECT OF V-GISC at RA-VI

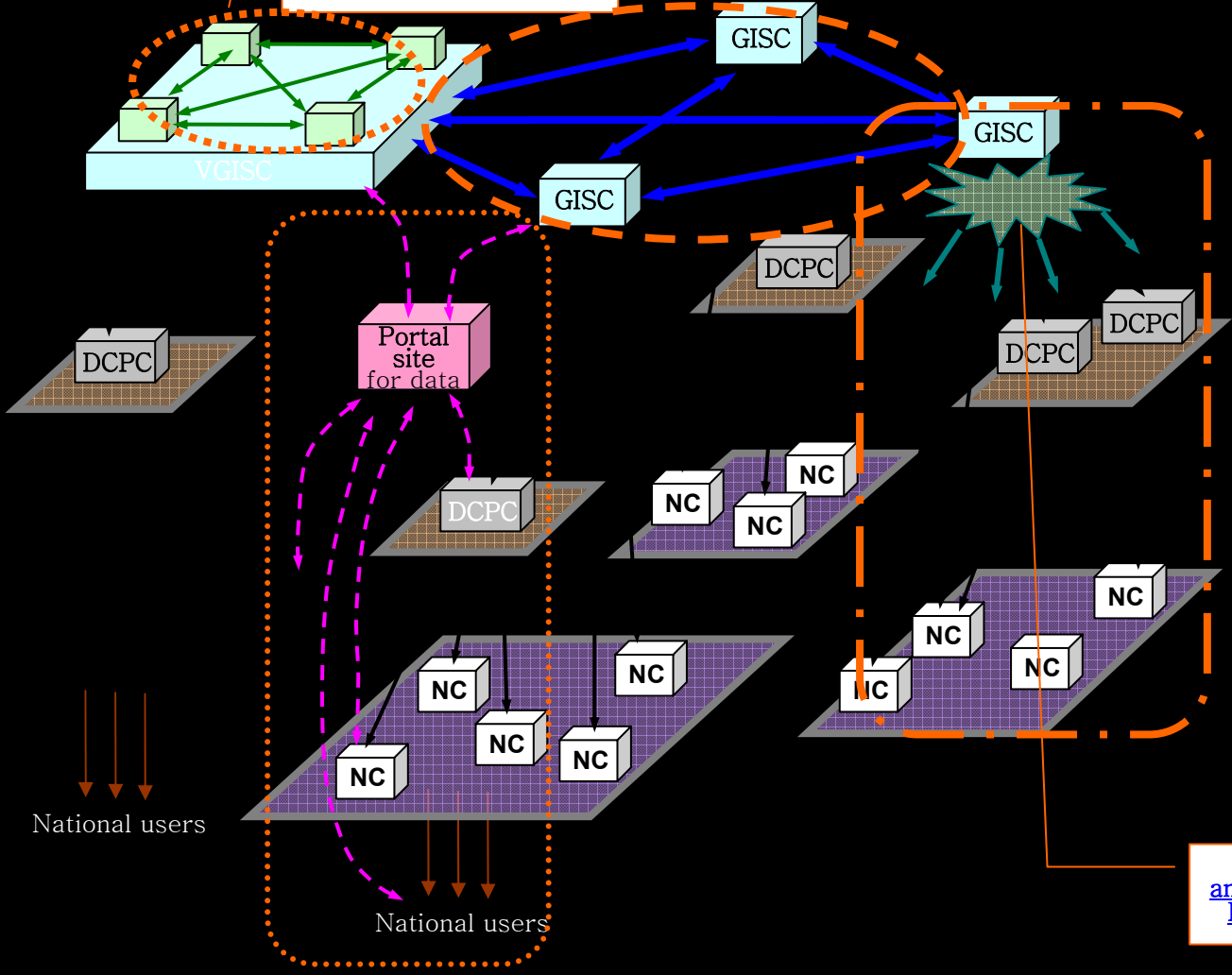


- ❖ PILOT Project at RA-VI
 - a. To check Feasibility of FWIS
 - b. To demonstrate usefulness of VGISC
- ❖ VGISC (Virtual Global Information System Center)
 - a. DWD suggested
 - b. GISC of FWIS
 - c. Several Virtual Centers
- ❖ Feasibility of VGISC Concept
 - a. Save Invest by each member
 - b. Stability Increase by mutual Back-up
 - c. Easy treatment of massive Data
- ❖ Technical Conference during 14th CBS Meeting

Feasibility Study of Virtual GISC

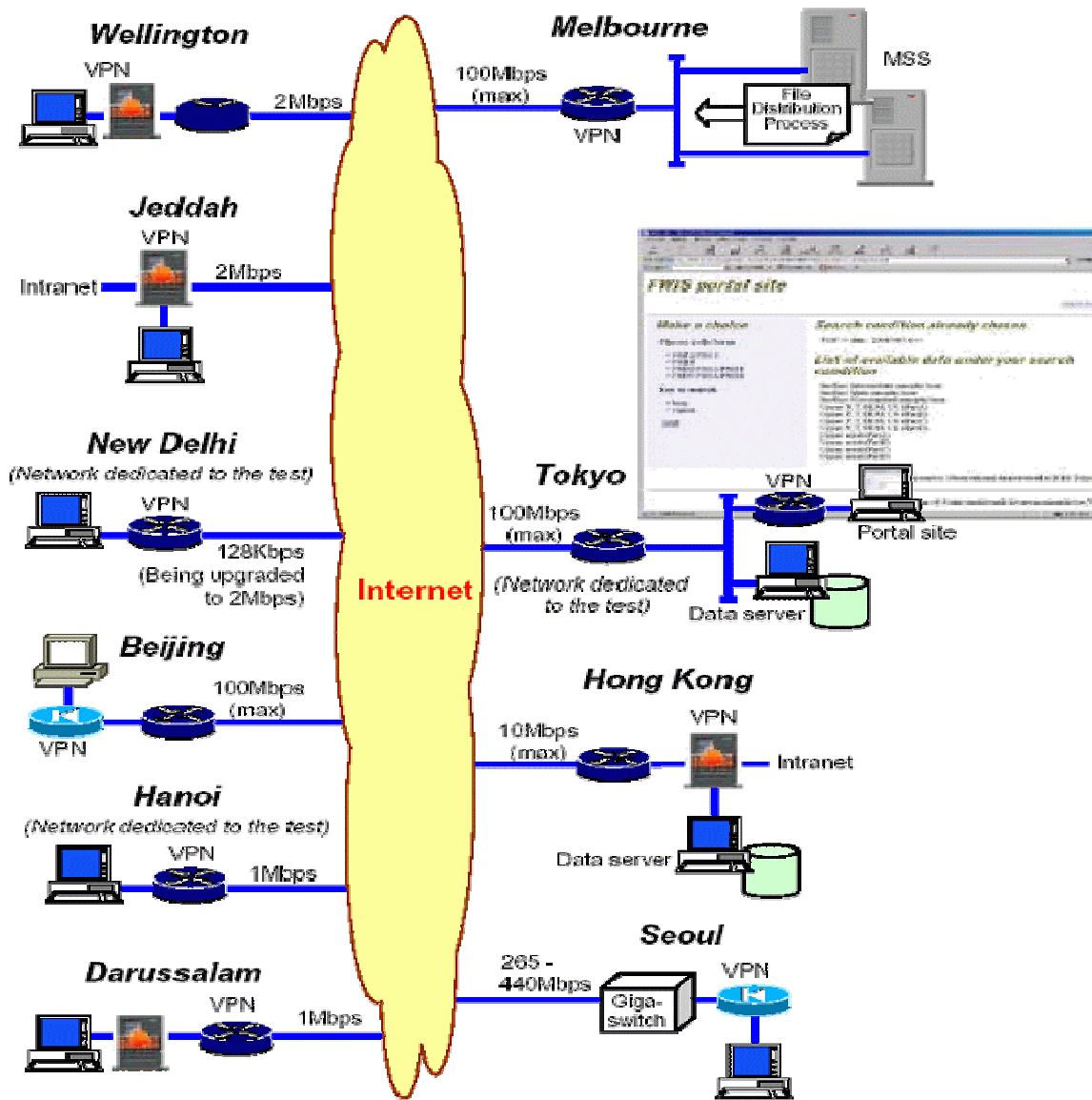
Test for Collaboration among GISCs through a core network

Concept of V-GISC/FWIS



Test for Collaboration among Asian Countries for FWIS VPN Pilot Project

FWIS VPN Network in Asia



FWIS VPN Participant in Asia

Country, territory	Organization	Site
Region II		
China	China Meteorological Administration	Beijing
Hong Kong, China	Hong Kong Observatory	Hong Kong
India	India Meteorological Department	New Delhi
Japan	Japan Meteorological Agency	Tokyo
Republic of Korea	Korea Meteorological Administration	Seoul
Saudi Arabia	Presidency of Meteorology & Environment	Jeddah
Vietnam	National Hydrometeorological Service	Hanoi
Region V		
Australia	Bureau of Meteorology	Melbourne
Brunei	Brunei Meteorological Service	Darussalam
Malaysia	Malaysian Meteorological Service Department	Kuala Lumpur
New Zealand	MetService	Wellington

Forecasters identify a Global Weather System

Interactive Global Forecasting Protocol is triggered

Lead Forecast Center estimates (in coordination with other forecast centers)

GIWFS Protocol

Data Preparation for Initial Forecast

Model Run with GRID

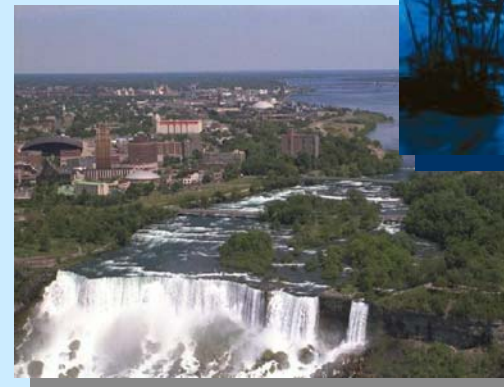
Societal and Economic Response Model

Timely Action

To evacuate or shelter people

To minimize the spread of water-borne diseases

To protect specific structures identified as being at risk



METGRID

1st Step : Ensenble Data Exchange

2nd Step : Computing Resource Share

Name	System installed	Contact
CMA	IBM Power 4	SHI Peiliang
DWD	IBM Power 3	Geerd-R. Hoffmann
ECMWF	IBM Power 4/5	Walter Zwiefelhofer
KMA	CRAY X1E	Dongil Lee
Météo France	Fujitsu VPP 5000	Dominique André
NCAR	IBM Power 3/4	Al Kellie
UKMet	NEC SX-6	Steve Foreman

Running simple job on UNICORE(DWD)

The screenshot displays the UNICORE Client interface with the following components:

- Job Preparation Panel:** Shows a job named "HelloWorldJob" with a script "HelloWorldScript". A red box highlights the "DWD 2 (ext, FW, 4.0)" resource, with a red arrow pointing to it and the text "Select DWD unicare resource".
- Job Monitoring Panel:** Shows a tree view of resources. A red box highlights the "DWD 2 (ext, FW, 4.0)" resource, with a red arrow pointing to it and the text "DWD Gateway". A blue box highlights the "KMA gateway" resource, with a blue arrow pointing to it and the text "KMA Gateway".
- Resource Info Dialog:** A dialog box titled "UNICORE: Resource Info" is open, showing detailed information for the selected resource. It includes sections for "Information" and "Applications".

UNICORE Site: DWD 2 (ext, FW, 4.0), KMA gateway

Virtual Site: ibm_sp(cos5_ext <NJS>), ibm_sp(ikt5_ext <NJS>)

Information:

- NJS information: Tue Jan 25 11:51:41 GMT+00:00 2005
- NJS information: 4.0.2_build2
- Priority Whenever: cos5 LL queue normal
- Priority Development: cos5 LL queue compile
- Priority Low: cos5 LL queue lang
- Priority Normal: cos5 LL queue normal
- Priority High: cos5 LL queue normal
- Number of CPUs: 832.0
- GMESUB DB Options: aruse=j,iferr=go,ak=nix,dbase=gme,id=routarz,rki=routi,rt=m,unload=n,ty=i1 28f
- GME: default number of processors for X: 1.0
- GME: default number of processors for Y: 1.0
- GME: default number of processors for IO: 0.0
- LM: default number of processors for X: 1.0
- LM: default number of processors for Y: 1.0
- LM: default number of processors for IO: 0.0

Applications:

Name	Description	version
LMSTART	Data Preparation for LM Application	V0.1
LMSTART	Data Preparation for LM Application	V0.0
GME	Global Model results interpolation program	V0.1

Close

kmalee C:\Program Files\UNICORE 5\UNICORE_Client_5.0.4\examples\HelloWorld ajo 10.33Mb/15.45Mb

Global Interactive Forecasting System

- Lead Center : 3 level Center structure (Global, Regional, National)
- Ensemble Data Exchange : THORPEX/TIGGE, WIS, METGRID
- Model Run With GRID : METGRID
- Observation Data ,Dissemination, Gap Filling : GEOSS, THORPEX

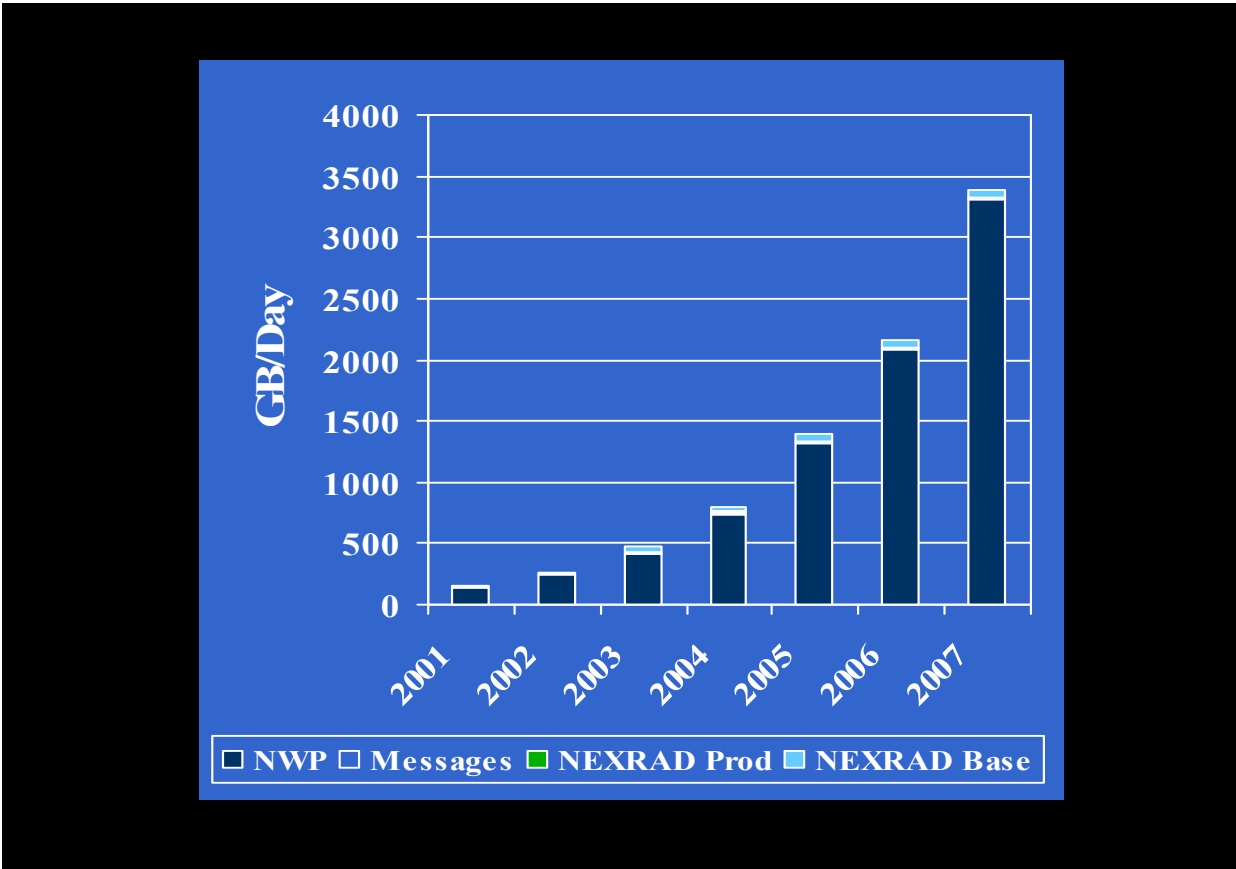
THORPEX

A Global Atmospheric Research Programme

THORPEX: a Global Atmospheric Research Programme for the 21st Century

(a) Representatives of countries:

- Australia
- Canada
- China
- France
- Germany
- India
- Japan
- Morocco
- Norway
- Republic of Korea
- Russian Federation
- South Africa
- United Kingdom
- USA



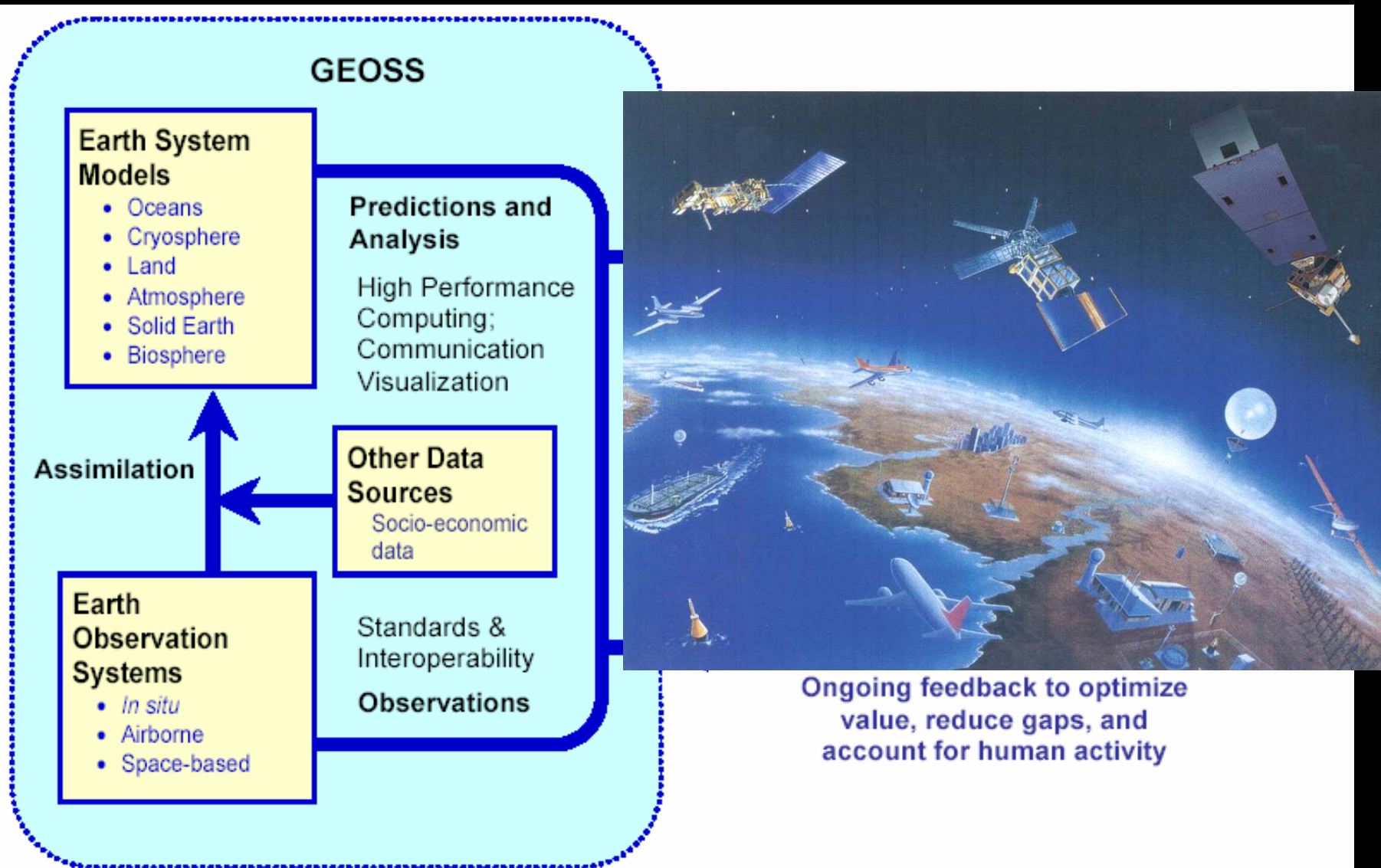
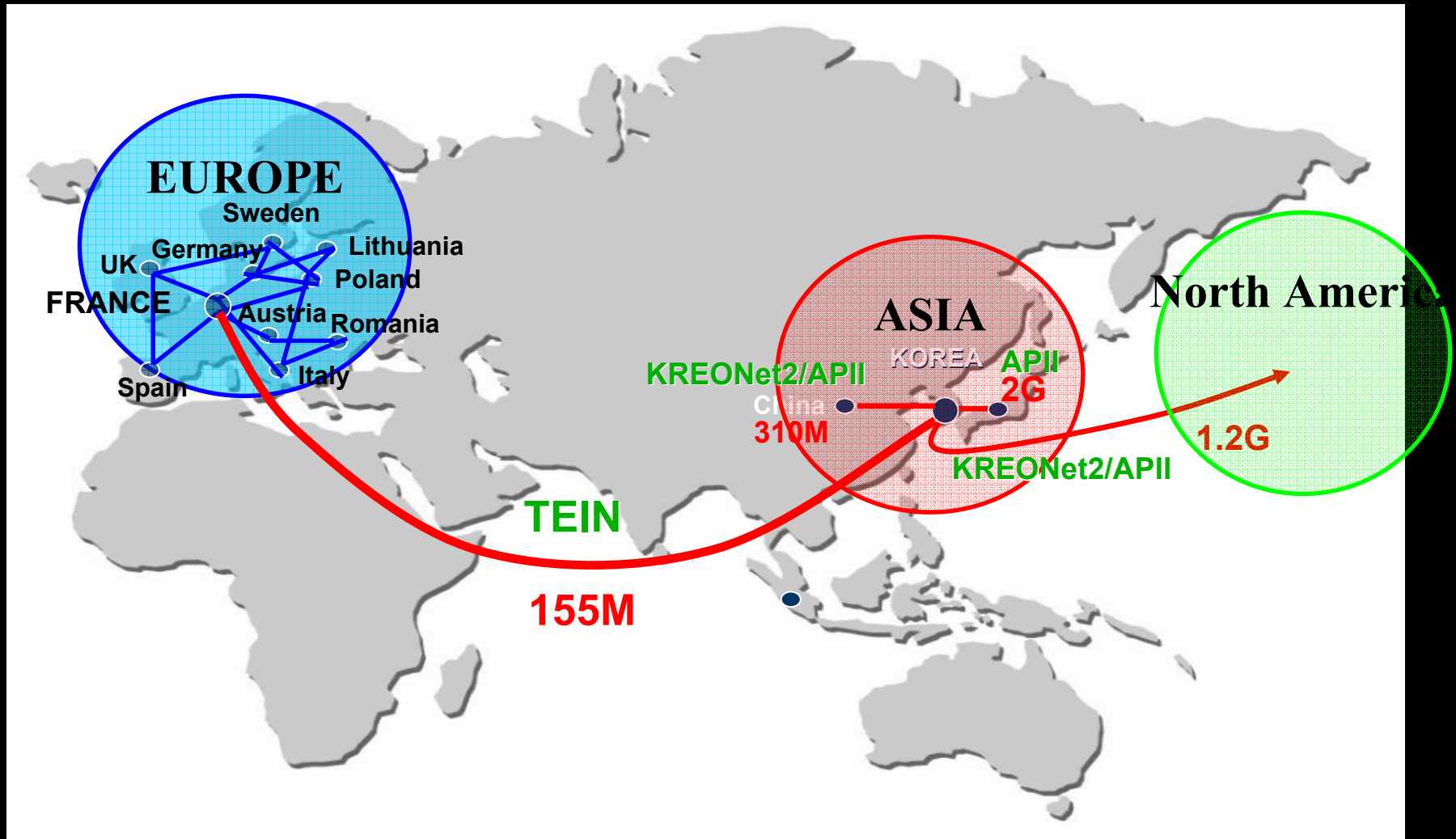


Figure 2.1: The diagram demonstrates the end-to-end nature of data provision, the feedback loop from user requirements, and the role of GEOSS in this process. The primary focus of GEOSS is on the left side of the diagram.

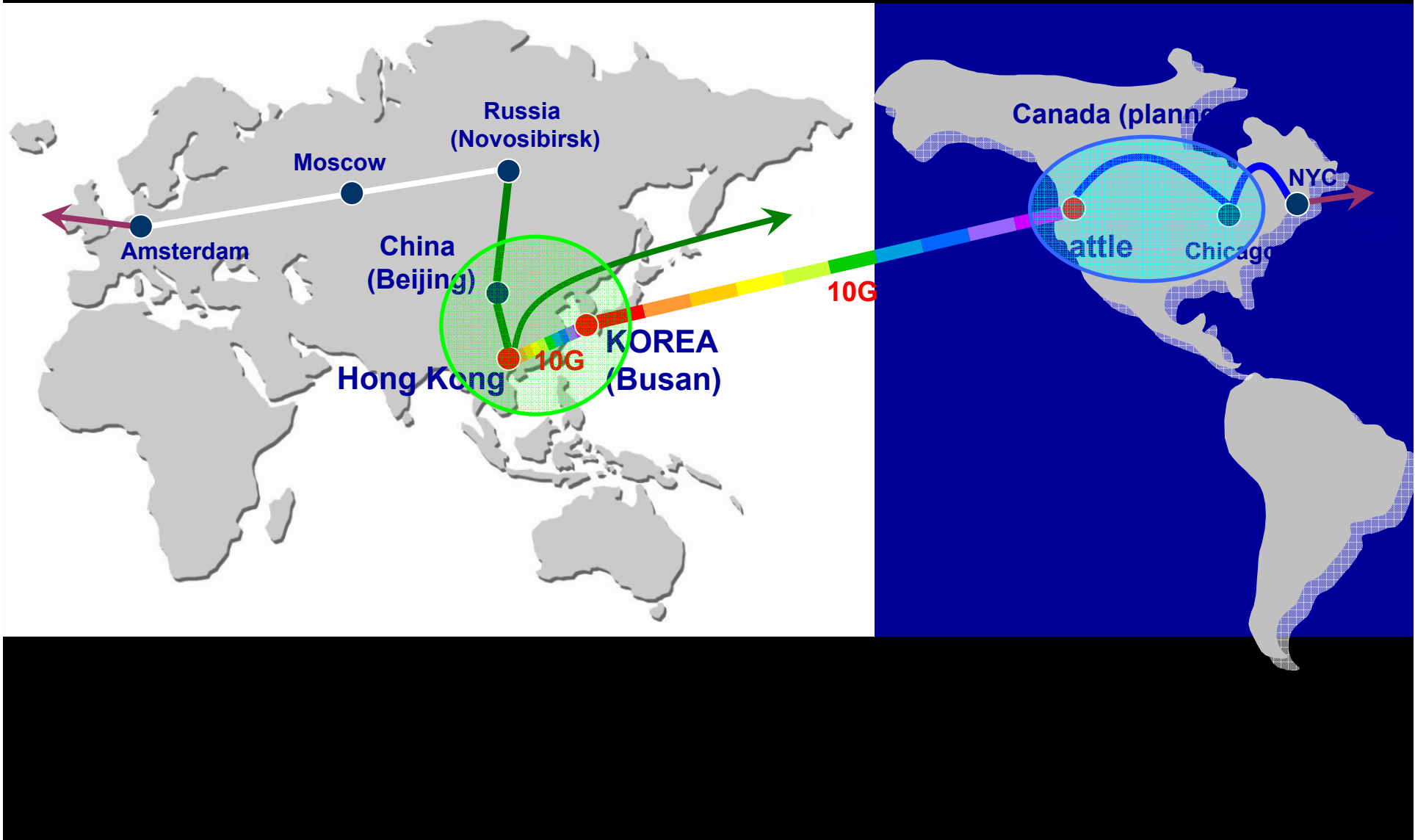
Fundamental Tech.: Cyber Infrastructure

- High Performance Communication (Network)
- High Performance Computing
- Grid as middleware
- User Application (Earth System Model)

Korea's Intl. Link Topology



Korea's Asia Pacific Link for GLORIAD



Super Computer at KMA

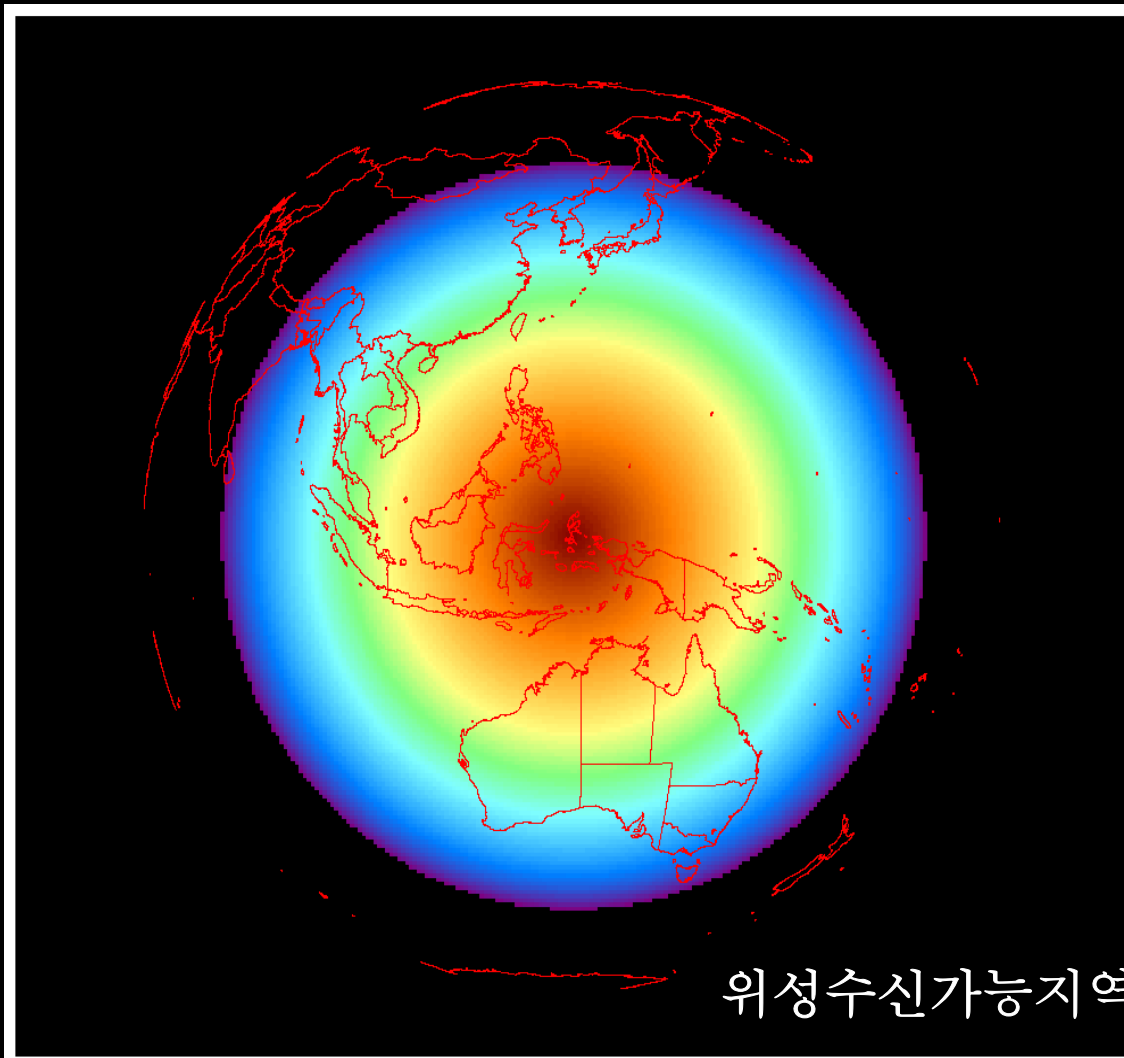


세계 10위권의 성능
대용량 자료저장 장치

18Tflops

세계의 전지구모델 및 앙상블 운영 센터
13개국 14개 센터 중 2005년 2월 현재 3위의 컴퓨터 성능
2005년 8월 설치 후 2007년까지 2위 성능 보유 예정

Korea's COMSAT & Broadcasting

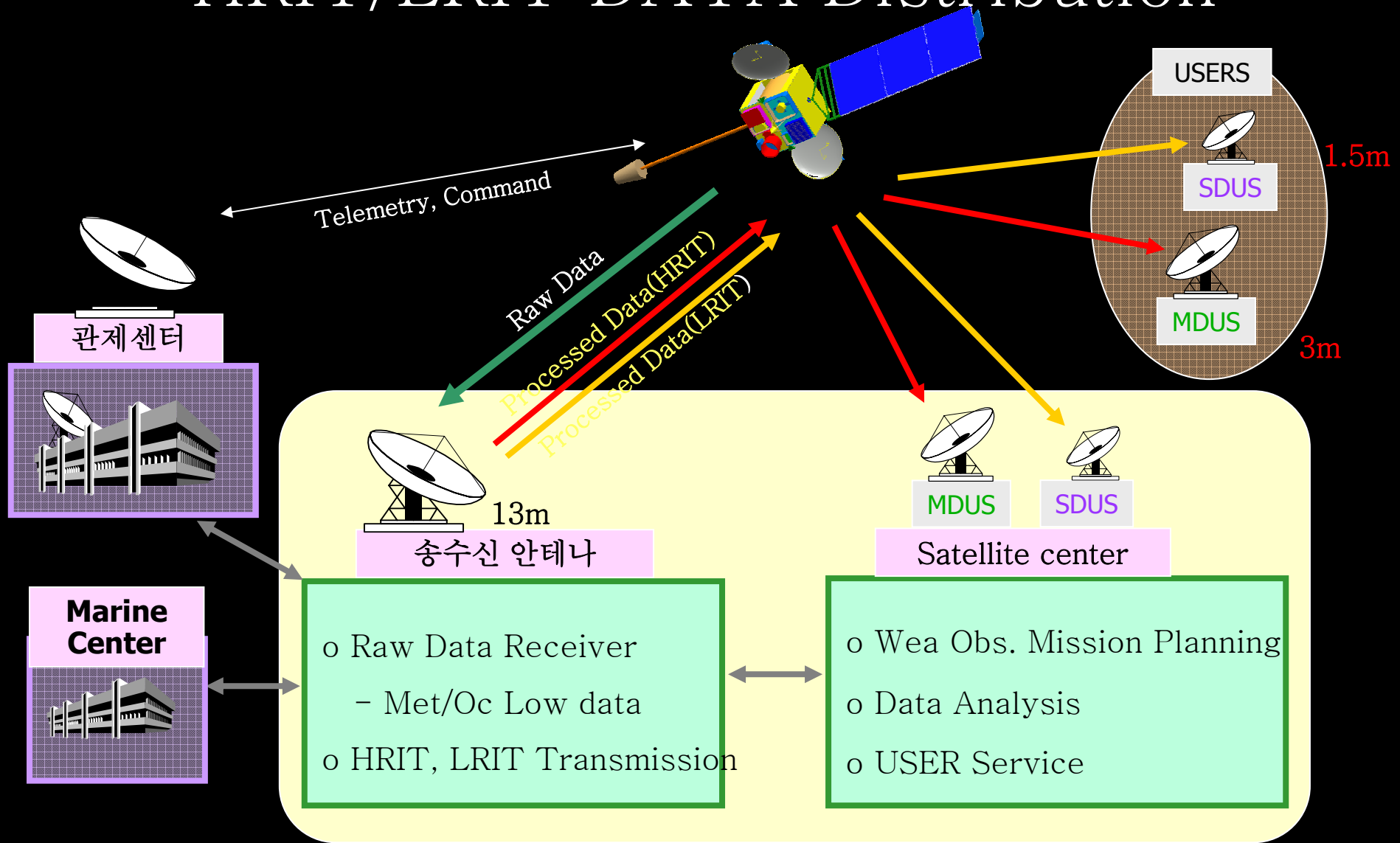


HRIT

LRIT : 256kbps

- New digital service on Satellite Information
- HRIT : High Rate Information Transmission
 - Trans. speed : 256 kbps ~ 10Mbps
- LRIT : Low Rate Information Transmission
 - Trans. speed : 10 kbps ~ 256 kbps
 - Replacement of WEFAX

HRIT/LRIT DATA Distribution



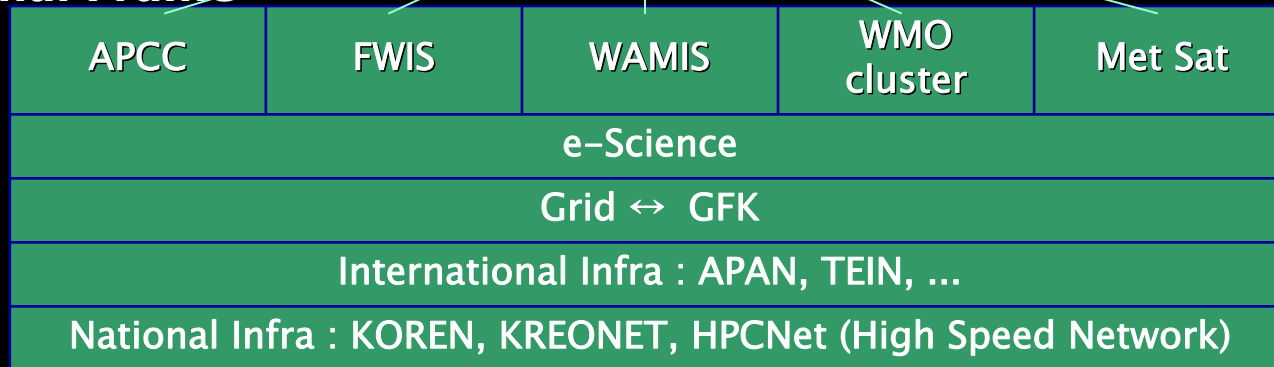
※ HRIT : High Rate Information Transmission
 ※ LRIT : Low Rate Information Transmission

※ MDUS : Medium-scale Data Utilization Station
 ※ SDUS : Small-scale Data Utilization Station

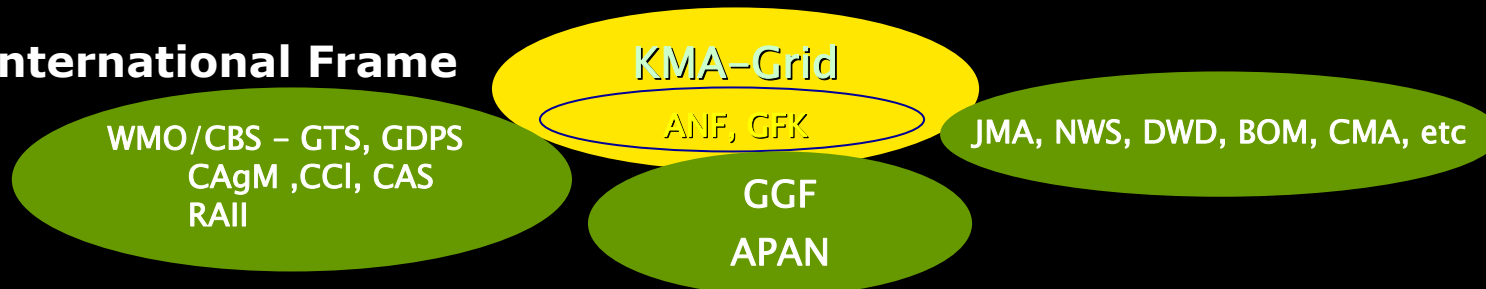
KMA Implementation

KMA

❖ National Frame

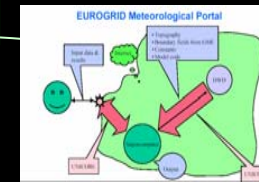
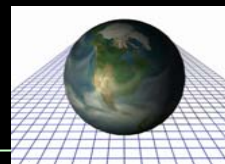
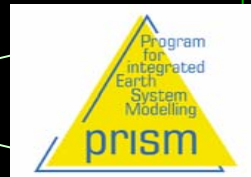


❖ International Frame

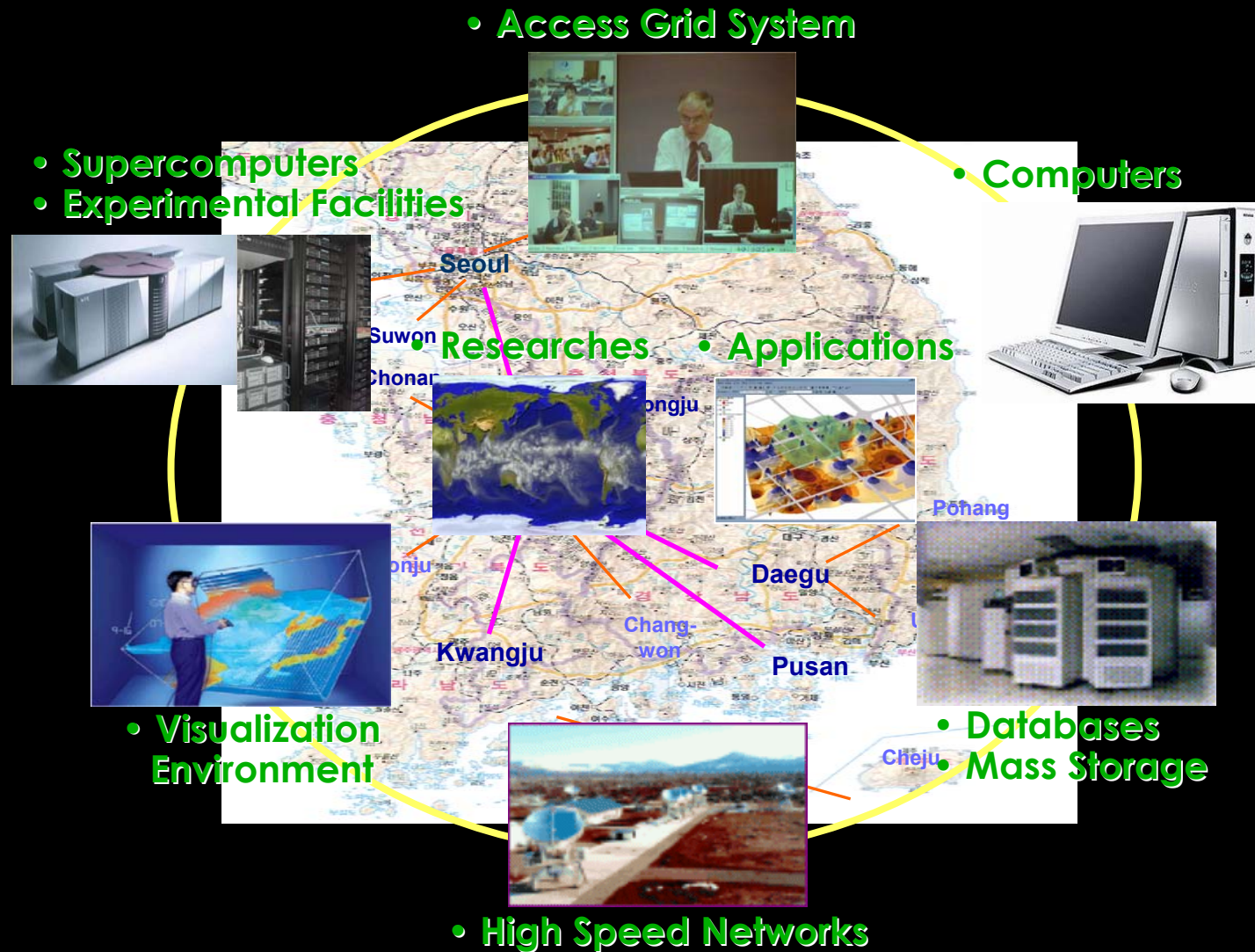


BENCHMARKING

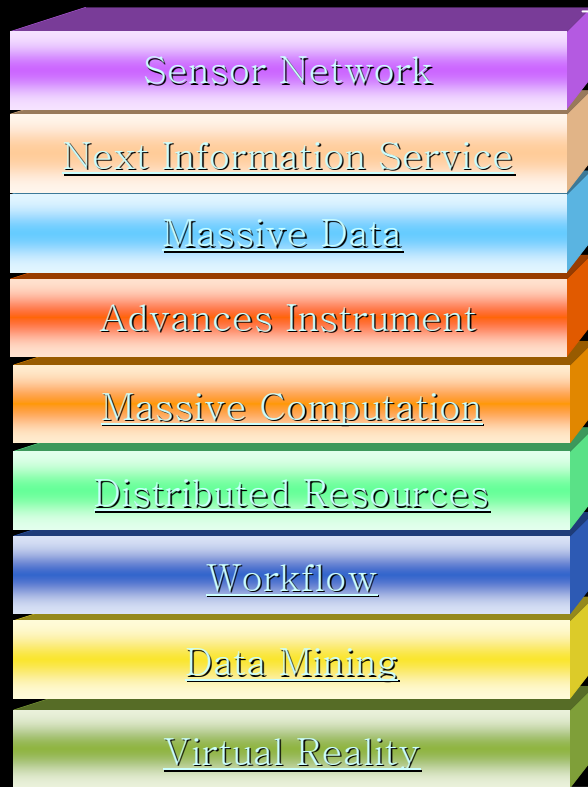
- Earth System Grid (USA)
- Earth Simulator (Japan)
- EUROGRID/PRISM (EU)



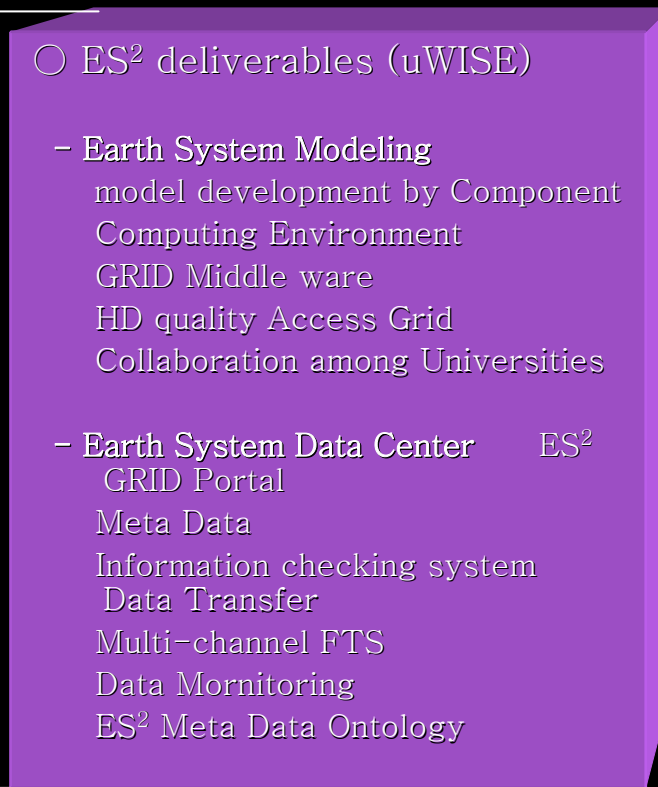
ES² Framework in Korea



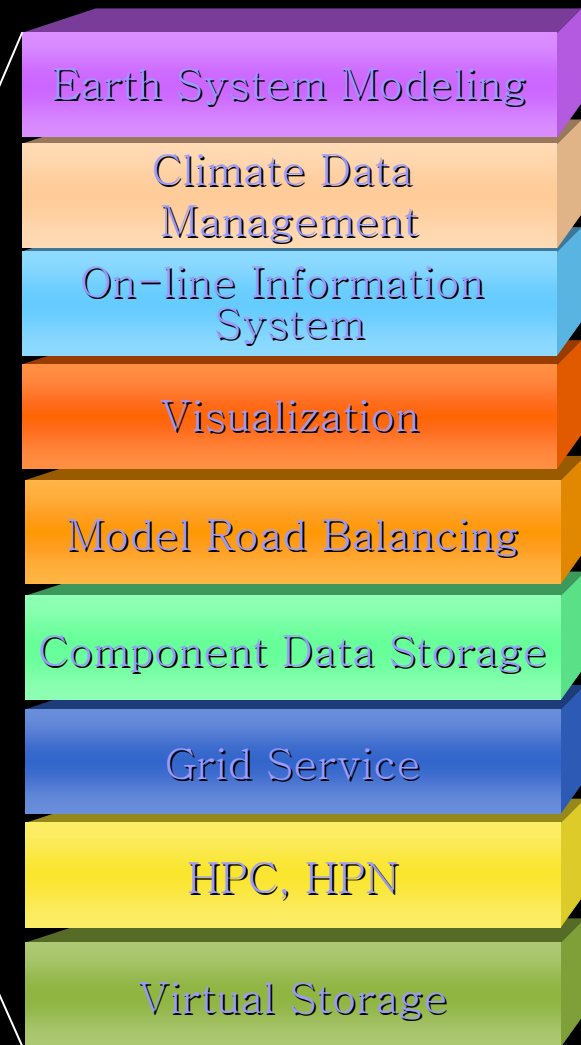
ES² Technical Architecture



Core Areas



ES² Deliverables

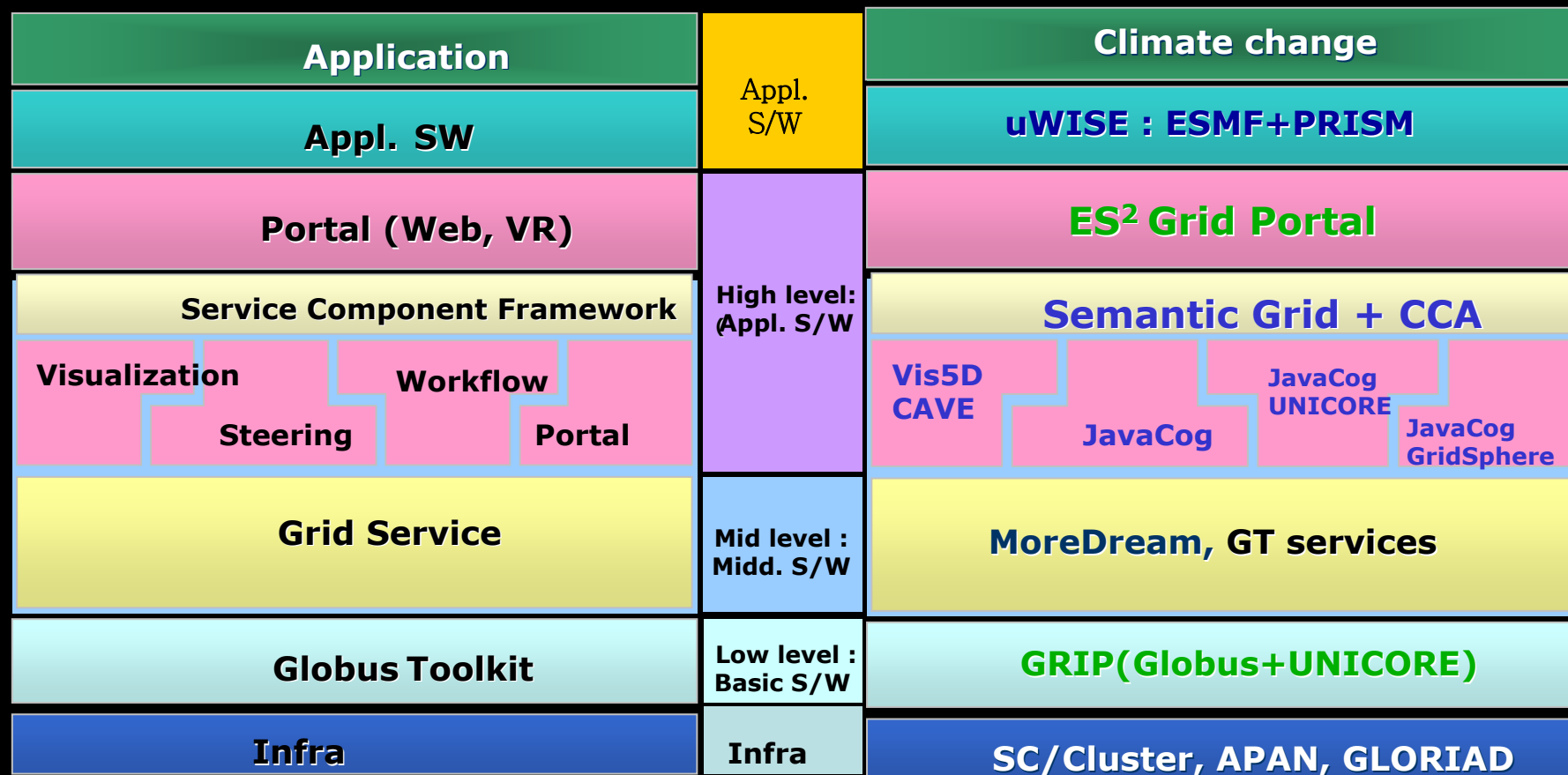


ES² Requirements

Service oriented Architecture of ES²

Basic

ES²



ES² Bullet

Technology

- Network Infrastructure
- Distributed Computing
- Parallel Computing
- Unicore
- Computational Grid

Research Group

- Gravity_wave_drag
- Moist_processes
- Fvcore
- Lake
- Infrared_R
- Turbulence
- Land_ice
- Data_ocean
- Vegetation
- Catchment

Research Aim

- Observation
- Disaster
- Nowcasting
- Climate Change
- History

Management

- Web Portal
- Data Exchange
- Data Grid

Application

- Access Grid
- Utility
- Visual
- Tutorial

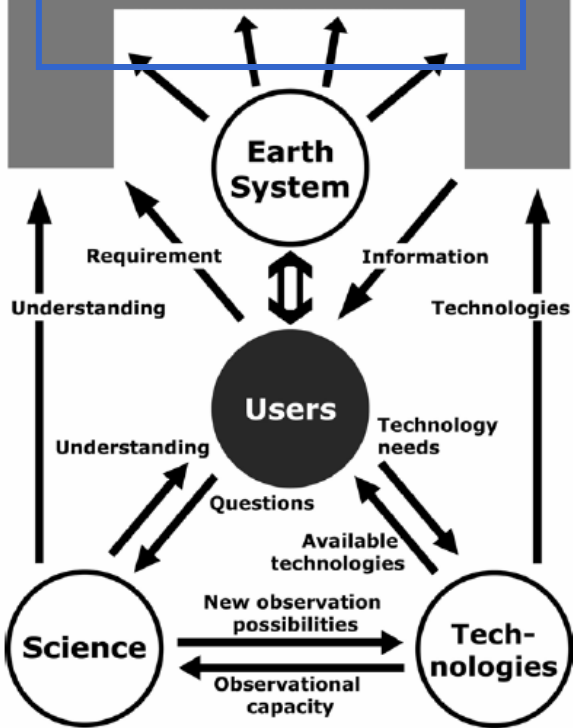
To establish "e-Science Environment"



DATA GRID
Data Portal



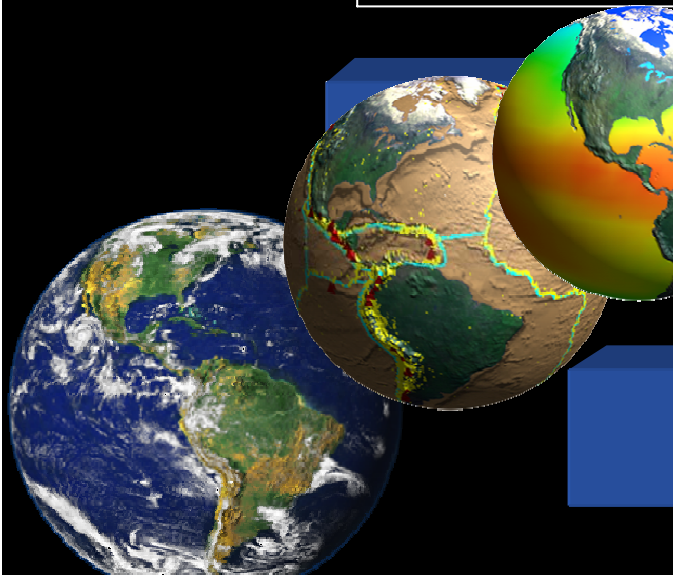
Global Earth Observation System of Systems (GEOSS)



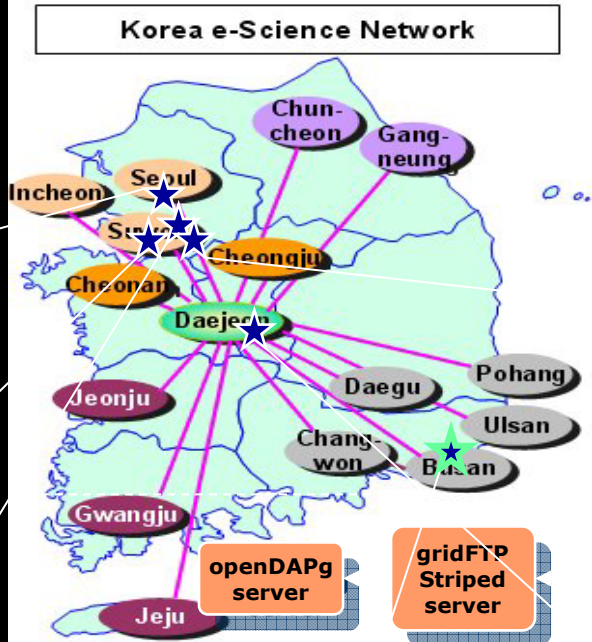
uWISE



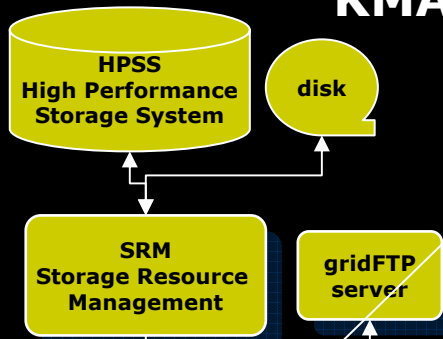
Comp. GRID
Unicore/Globus



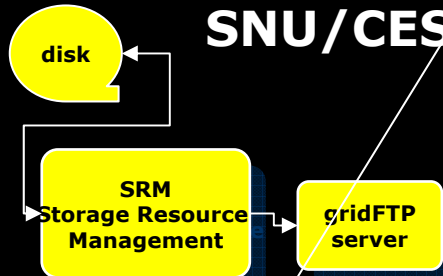
ES² Data System



KMA/SCC



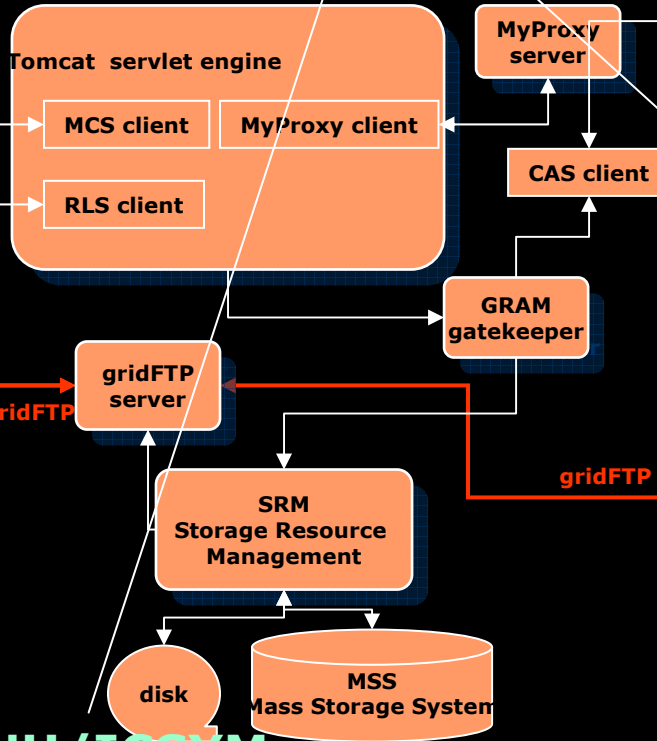
SNU/CES



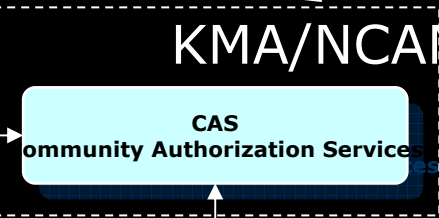
KMA/NCAM



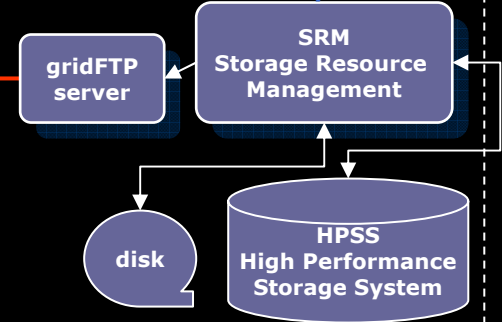
PKNU/ICSYM

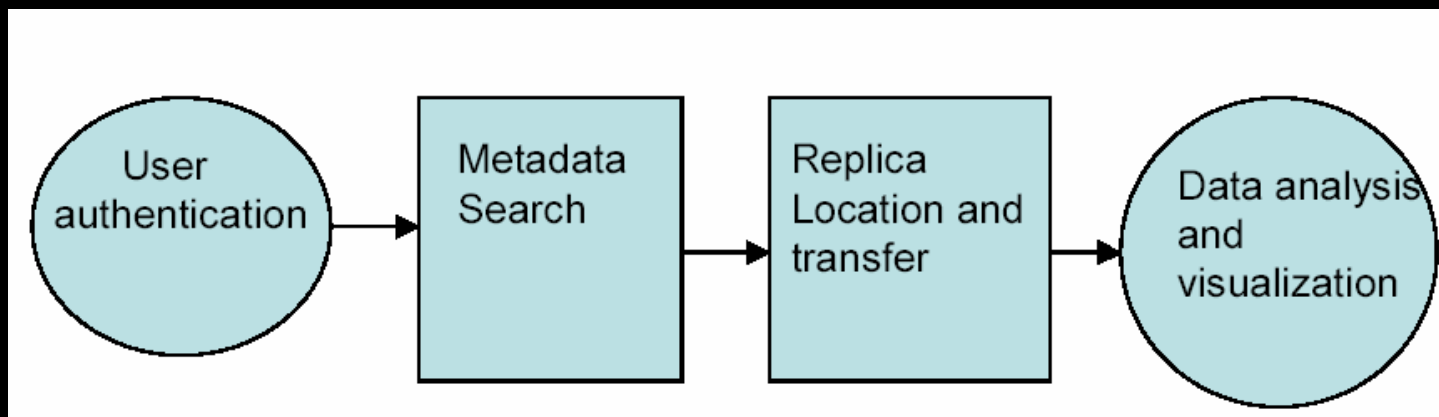
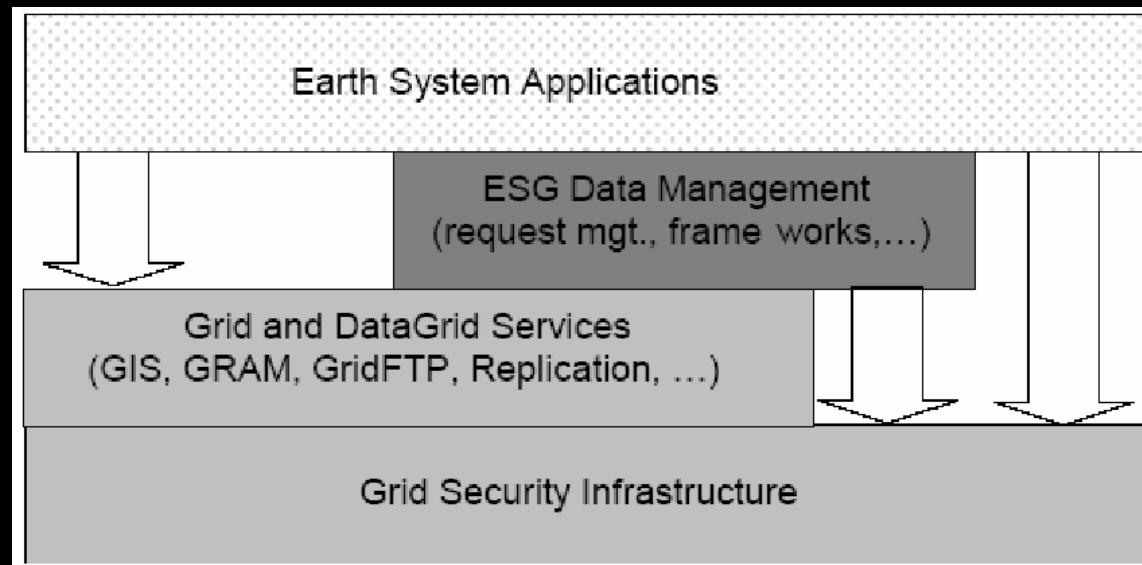


KMA/NCAM

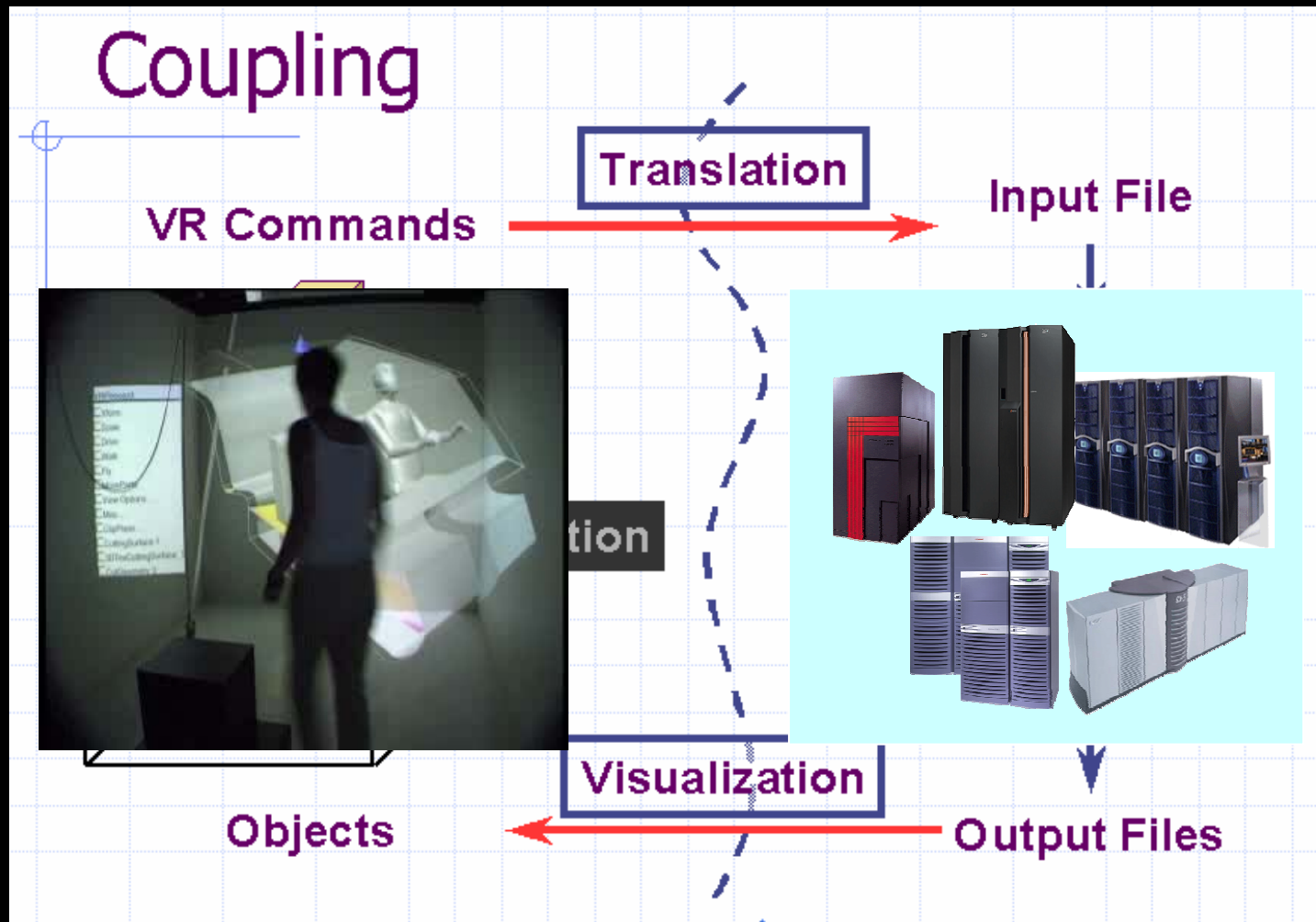


KISTI/K*Grid

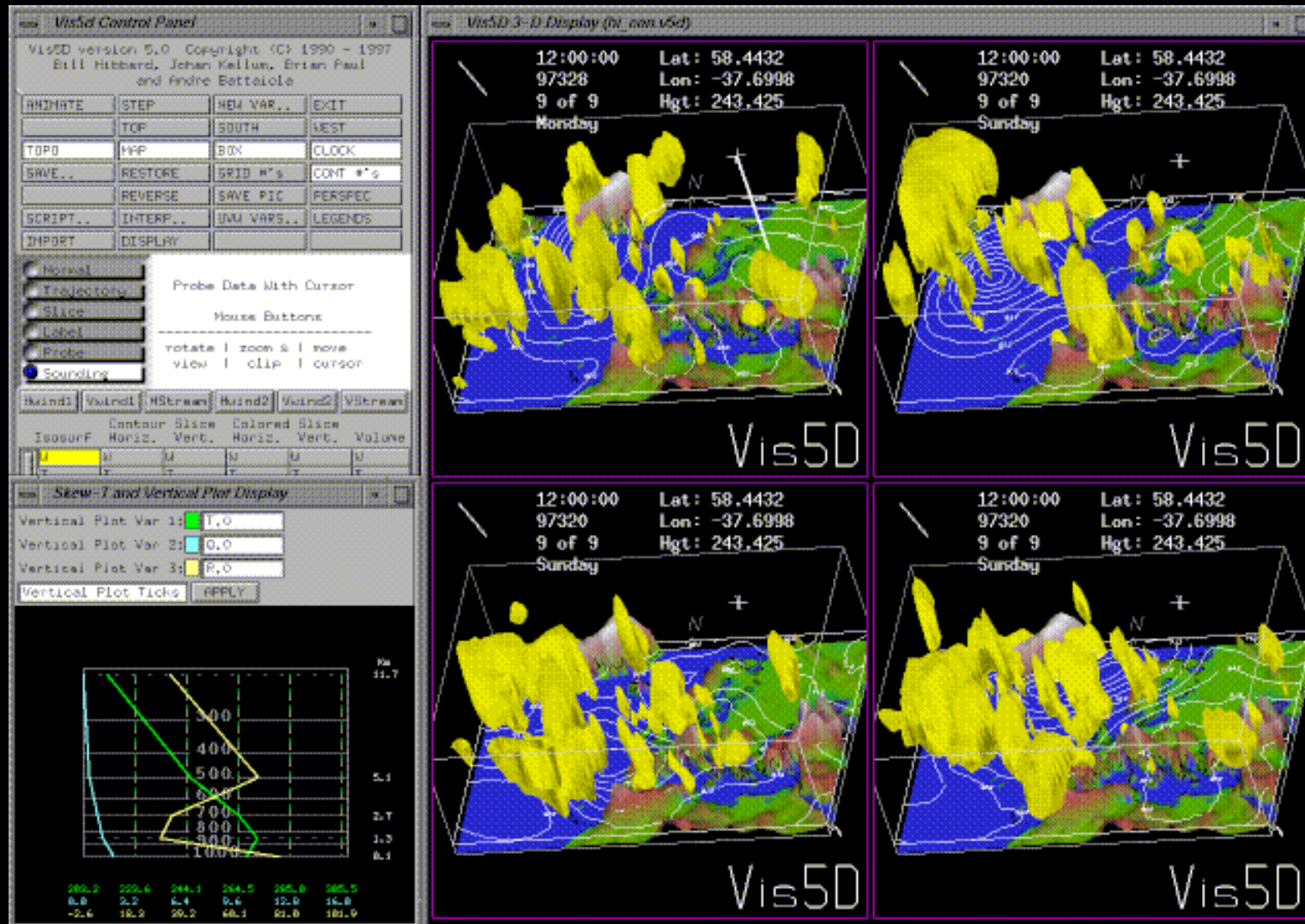




Visualization

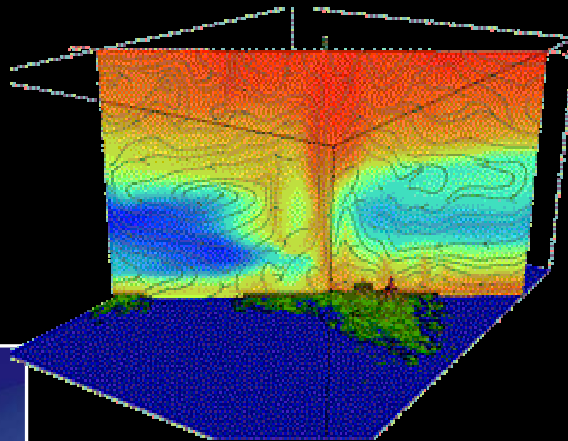


Vis5D

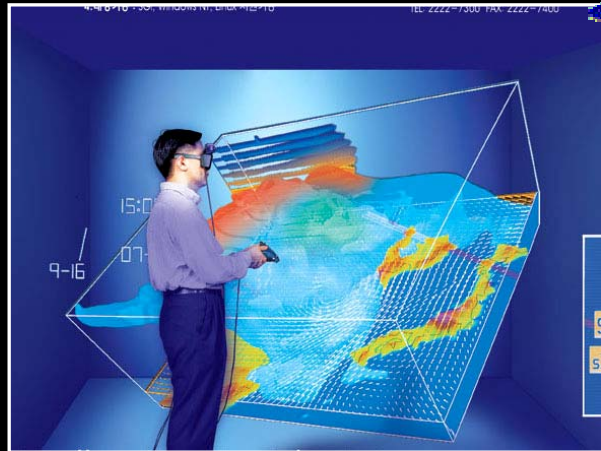


CAVE5D

CAVE5D = Vis5D + CAVELib



SeeMore



Visualization

SGI Onyx3400

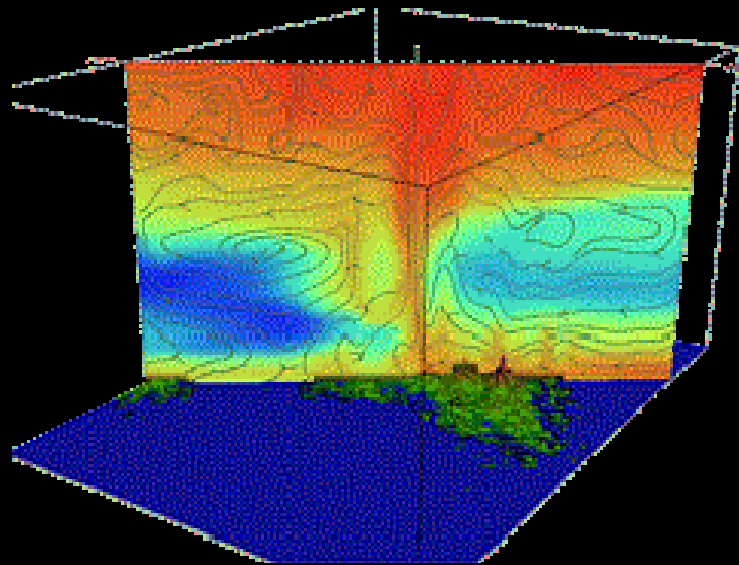


Gigabit Ethernet
1000Mbps

Simulation

3D Scientific Visualization S/W

Desk Top



Vis5D



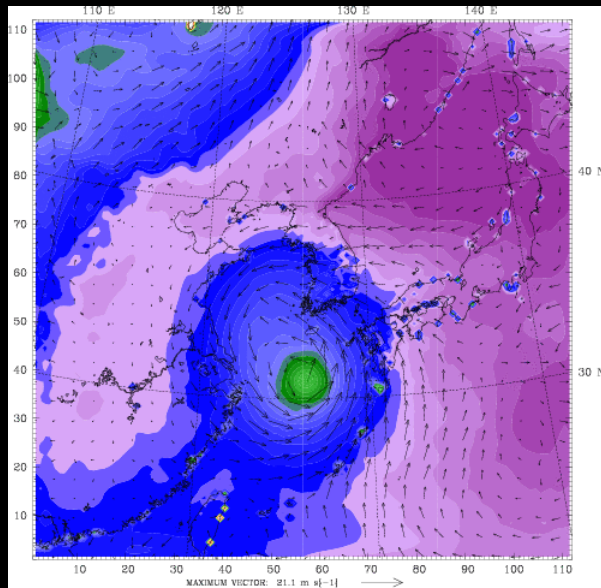
VR



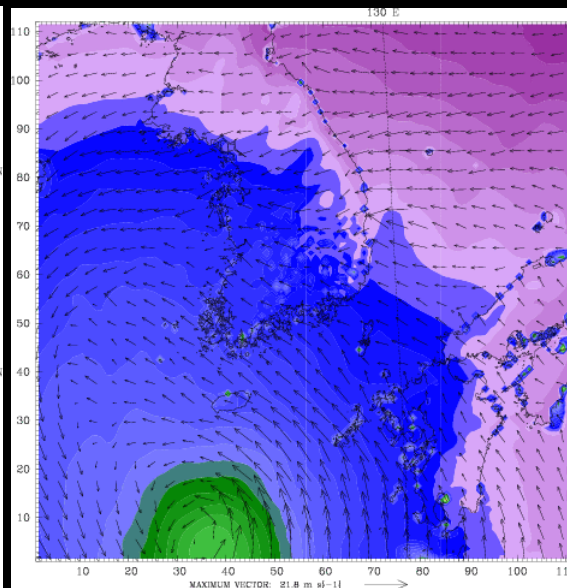
CAVE5D

Typhoon "Maemi (2003. 9. 12 - 13)"

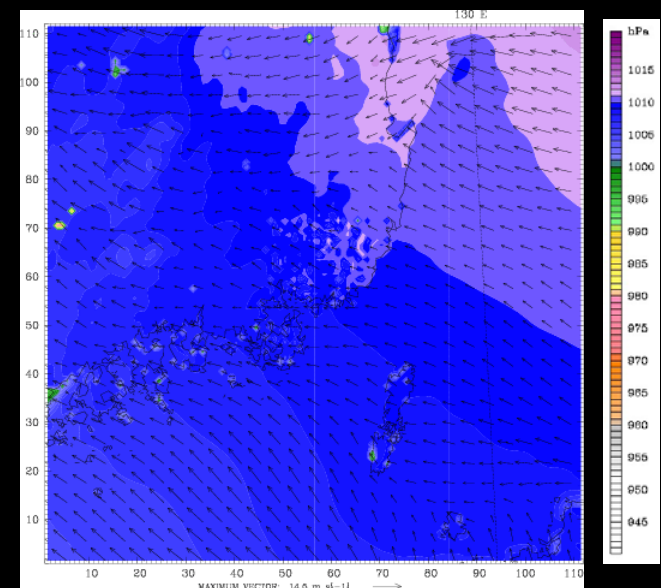
Asia (27 km)



Korea (9 km)



Busan (3 km)

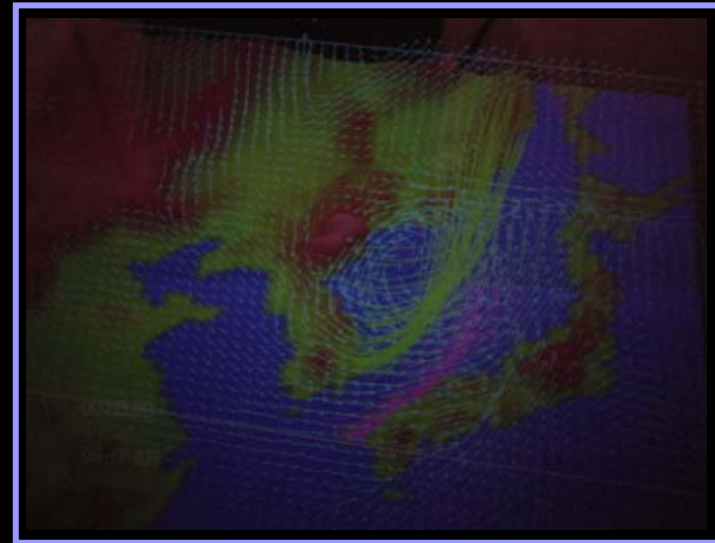


2003. 9. 12 12 LST ~ 2003. 9. 13 06 LST

3-D Animation

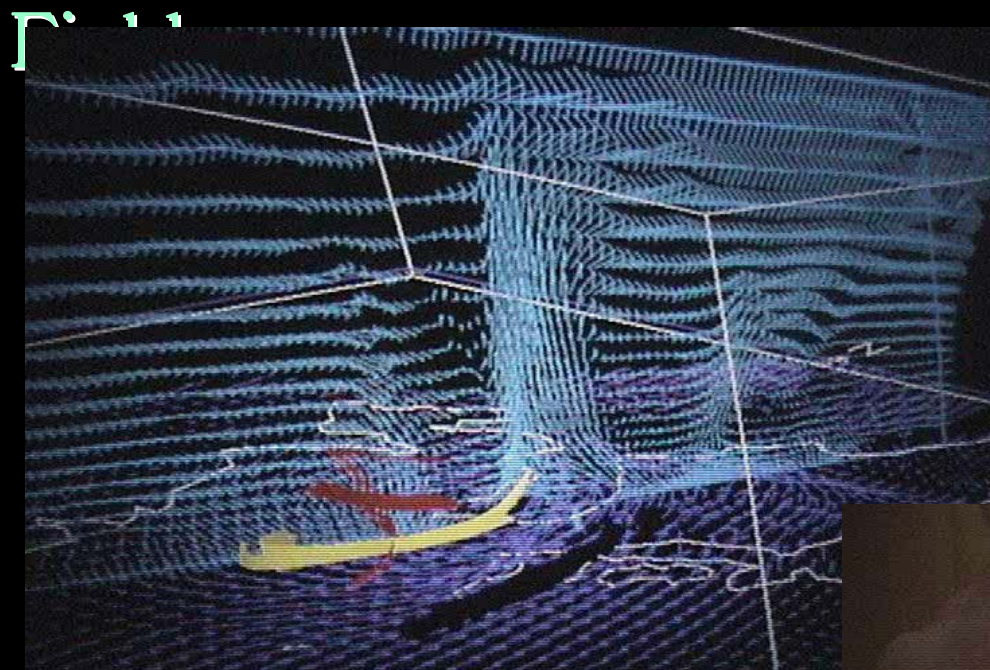
VR (Virtual Reality) Visualization Resources

SeeMore



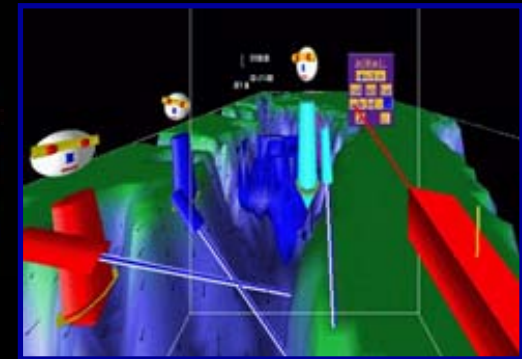
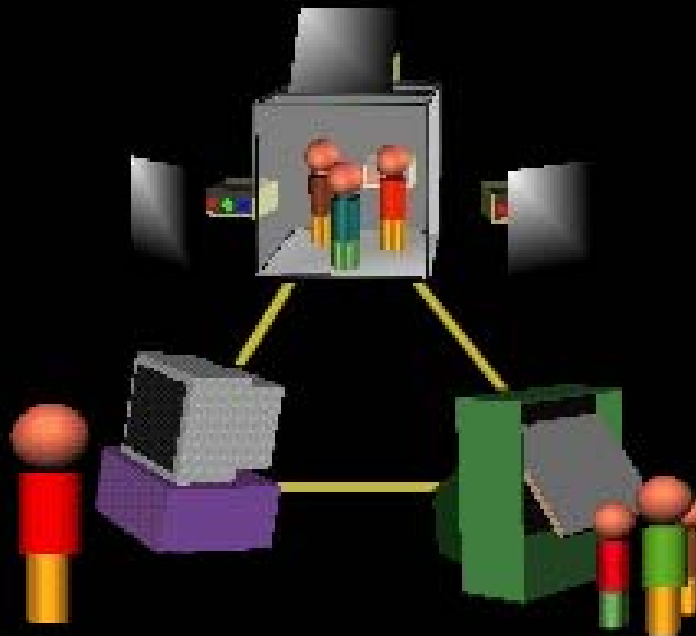
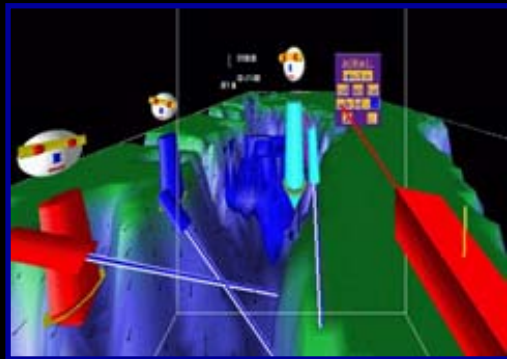
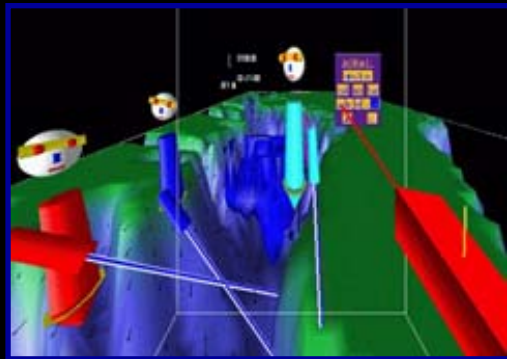
- The equipment like *SeeMore* is generally called **CAVE (Cave Automatic Virtual Environment)**
- First developed in EVL (Electronic Visualization Laboratory) at University of Illinois (UIUC).

Visualization of Simulated Ty. "Maemi" 3-D Wind



CAVE6D

CAVE6D = CAVE5D + Network





Thanks for Your Attention!

Image Credit: Electronic Visualization Lab, UIC