A Visualization System for 3D Data

Masaki Yasukawa[1], Toru Tamura[2]
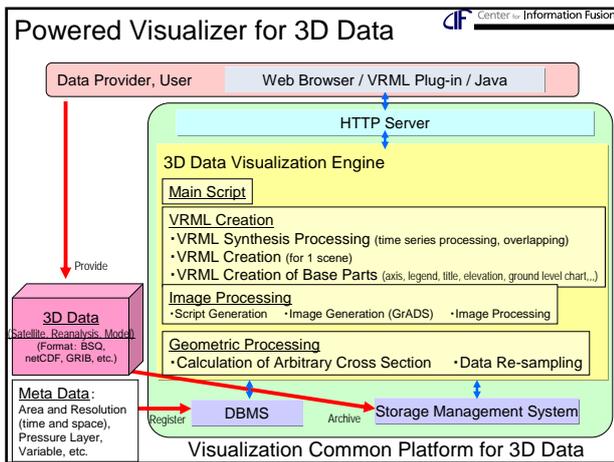**Kenji Taniguchi[3], Toshio Koike[1,2]**
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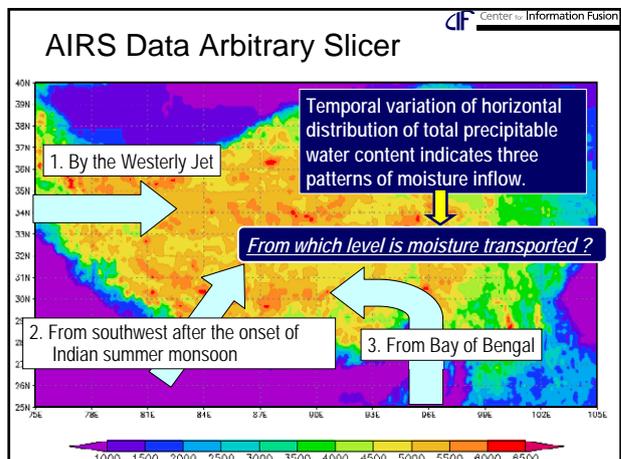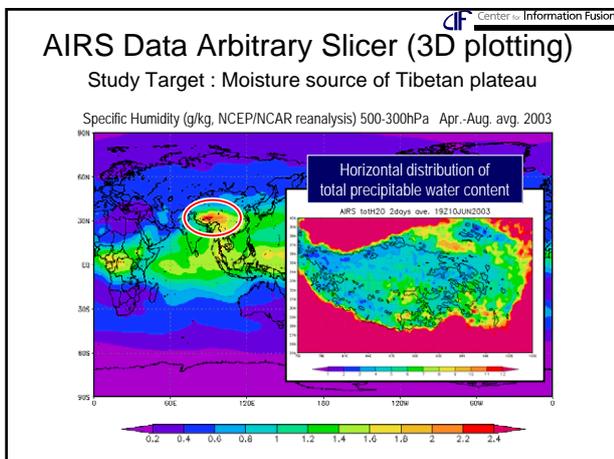
Powered Visualizer for 3D Data

Visualization system for three-dimensional datasets (AIRS products and JRA25 output)
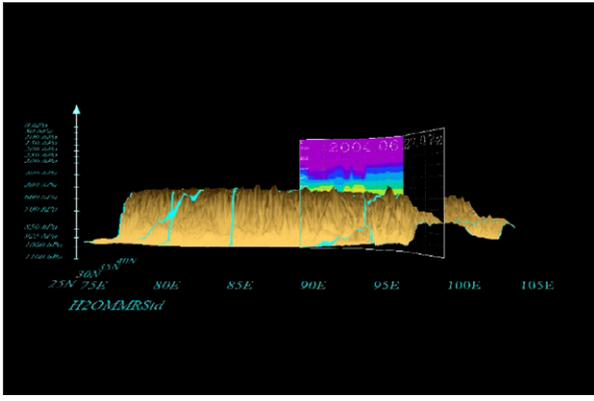Three key functions are implemented. The first is a rather naive function that allows users to visualize three-dimensional raw data through VRML. Second, the user can specify an arbitrary curve over the three-dimensional data set and then visualize its cross section. This has been proven to be very powerful for analyses of flow phenomena flow analysis. Third, users can easily specify various kinds of related data in IFRES to overlay on the cross section.

Powered Visualizer for 3D Data

Analysis of Moisture Inflow in Tibetan Plateau

AIRS Data Arbitrary Slicer (3D plotting)

Study Target : Moisture source of Tibetan plateau

Specific Humidity (g/kg, NCEP/NCAR reanalysis) 500-300hPa Apr.-Aug. avg. 2003

Horizontal distribution of total precipitable water content

AIRS totH2O 2days ave. 19Z10JUN2003

AIRS Data Arbitrary Slicer

Temporal variation of horizontal distribution of total precipitable water content indicates three patterns of moisture inflow.

From which level is moisture transported ?

1. By the Westerly Jet

2. From southwest after the onset of Indian summer monsoon

3. From Bay of Bengal

Analysis of Bai-u front in Japanese Islands

Heavy Rainfall in Niigata Prefecture and Fukui Prefecture in 2004

◆ 2004/07/09-2004/07/14
◆ Water vapor ratio of AIRS products
  • AIRS (Atmospheric Infrared Sounder) on Aqua Satellite
  • 28 pressure levels
  • Arbitrary cross section (Shaded contour plot)
◆ Geopotential height and wind of NCEP/NCAR reanalysis data
  • 17 pressure levels (Original)
  • Contour line (geopotential height)
  • Arrow (wind)
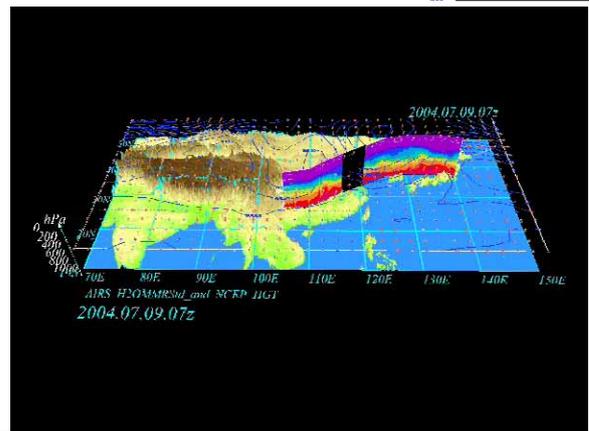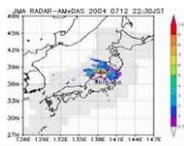
Recent Development of Visualization System for 3D Data

Powered Visualizer for 3D Data

Visualization system for three-dimensional datasets
(AIRS products and JRA25 output)
Three key functions are implemented. The first is a rather naive function that allows users to visualize three-dimensional raw data through VRML. Second, the user can specify an arbitrary curve over the three-dimensional data set and then visualize its cross section. This has been proven to be very powerful for analyses of flow phenomena flow analysis. Third, users can easily specify various kinds of related data in IFRES to overlay on the cross section.

PVES: Powered Visualizer for Earth Environmental Science
Masaki Yasukawa, Masaru Kitsuregawa, Kenji Taniguchi, Toshio Koike
IEEE Systems Journal, 2, 3, 390-400, 2008

⬇ System Enhanced

New Target: NCEP/NCAR reanalysis data
(daily long term mean)
and its processed data

Data Selection Page

3D Visualizer for NCEP Reanalysis Data

NCEP Reanalysis Data
Start: Month May Day 01 End: Month May Day 01

Period

Area Start Latitude 60 End Latitude 10 Start Longitude 70 End Longitude 180

Area (Lat/Lon)

Products: Anomaly Temp (K) Adiabatic Heating (K) Diabatic Heating (K)
Horizontal Advection (K)
Thred Elevation: From 5000 km To 7500 km

Products: Anomaly Temp (K) + Wind Adiabatic Heating (K) + Wind Diabatic Heating (K) + Wind
Thred Omega Weight 500 Elevation: From 500 hPa To 150 hPa

Target Data
(Users can select
multiple elements)

Products: Anomaly Temp (K) + Divergent Wind Adiabatic Heating (K) + Divergent Wind
Diabatic Heating (K) + Divergent Wind Horizontal Advection (K) + Divergent Wind
Thred U-V Wind Weight 500 Omega Weight 500 Elevation: From 500 hPa To 150 hPa

Troposphere: No Yes

Visualization
Time Series: Slide Animation

Display Method
(Slide or animation type)

Do Slide

The analysis on the tropospheric warming around the Tibetan Plateau at the onset phase of the Asian summer monsoon using the 3-dimensinal visualized data
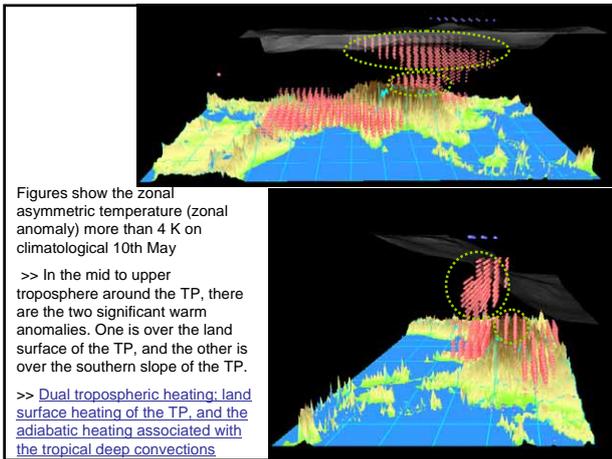
Background

The Asian summer monsoon (ASM) is associated with the thermal contrast between land and sea in the deep troposphere.

>>Previous studies have suggested that the thermal forcing of the Tibetan Plateau (TP), as an elevated heat source, play an important role in the generation of the ASM. However, more recent studies (Taniguchi and Koike, 2007; 2008) revealed that the TP land surface heating cannot explain the upper tropospheric warming near the tropopause at the onset phase of the ASM, i.e. before the summer rainy season over the TP.

>>Objective: To Reveal the mechanism of the upper tropospheric warming over the TP at the onset phase of the ASM.

Data, Method

Data is processed based on the climatology (1968-1996) derived from the NCEP/NCAR reanalysis data. Visualize the temporal and spatial variation of the atmospheric temperature as well as the heat budget analysis.

Figures show the zonal asymmetric temperature (zonal anomaly) more than 4 K on climatological 10th May

>> In the mid to upper troposphere around the TP, there are the two significant warm anomalies. One is over the land surface of the TP, and the other is over the southern slope of the TP.

>> Dual tropospheric heating; land surface heating of the TP, and the adiabatic heating associated with the tropical deep convections

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Summary
- PVES
  - Moisture inflow around Tibetan Plateau
  - Heavy rainfall in Niigata and Fukui
- Enhanced PVES
  - Tropospheric heating around the Tibetan Plateau

Future Plan
- Expansion of PVES for NCEP/NCAR reanalysis data
  - Increasing target data
  - Expansion of integration display