Division of Global Environment and Biological Sciences

Global Environmental Science Group
Hiroshi L. Tanaka
(Group Leader)
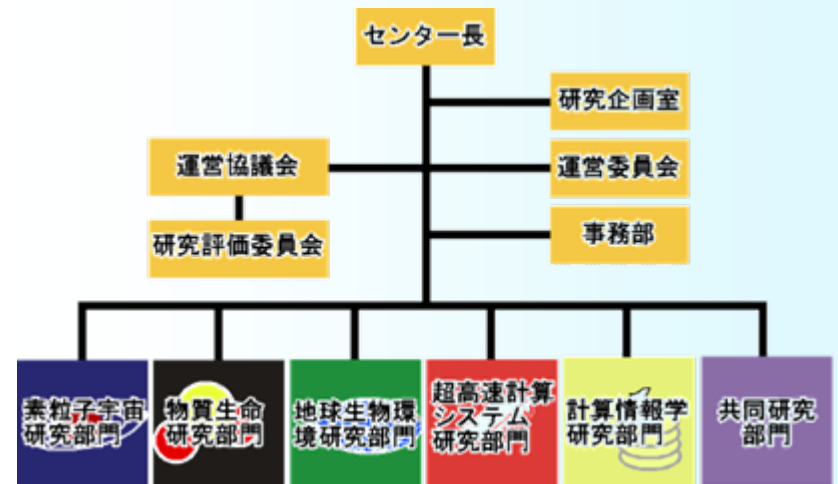
Group Member

- Hiroshi L. Tanaka, Prof.   CCS Staff (Since 2004)
- Hiroyuki Kusaka, Asst. Prof.   CCS Staff (Since 2006)
- Fujio Kimura, Adjunct Prof.   Geoenvironmental Sci.
- Akio Kitoh, Affiliated Prof.   MRI/JMA

Graduate Student:

DC: (3) Matsuda, Ishizaki, Terasaki

MC:(10) Yokoyama, Io, Fujita, Takemoto, Suzuki-M, Suzuki-I.
Kondo, Kato, Yamazaki, Seta,

Tanaka   **Kusaka**   **Kimura**   **Kitoh**

Research activity (H.L. Tanaka)

- General circulation of the atmosphere
- Global warming and Arctic Oscillation
- Global warming and tropical circulation
- Global spectral energetics
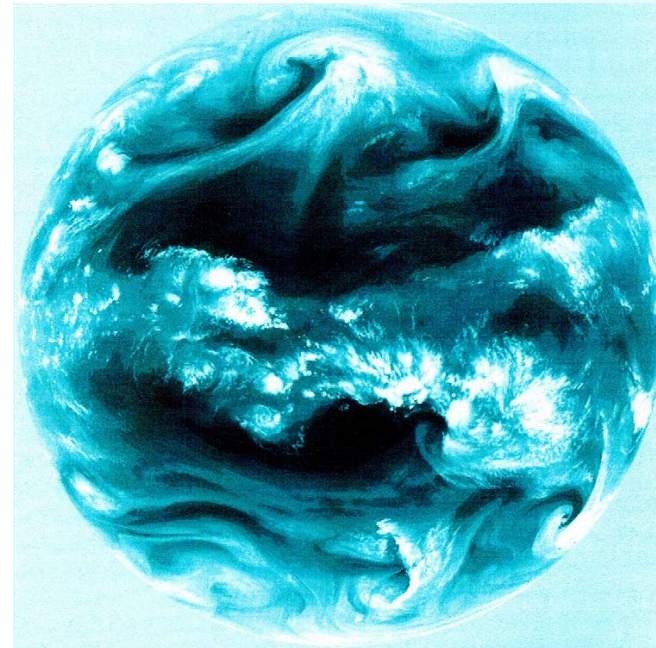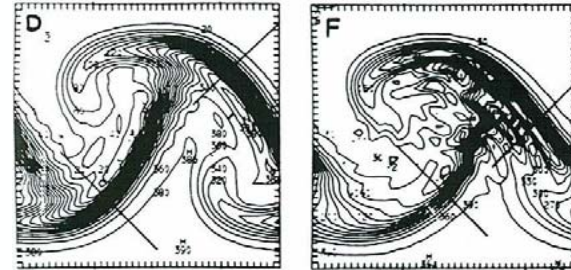- Blocking and abnormal weather
- Dynamics of baroclinic waves

Research activity (H. Kusaka)

- Regional modeling using WRF3.0
- Urban climate modeling
- Meso-scale precipitation system
- GPS and data assimilation
- Surface heat budget and radiation
- Real-time prediction system

General Circulation Study

- Data analysis
- Dynamical theories
- Numerical Modeling
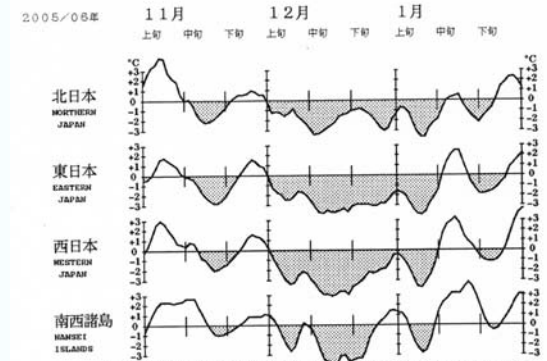
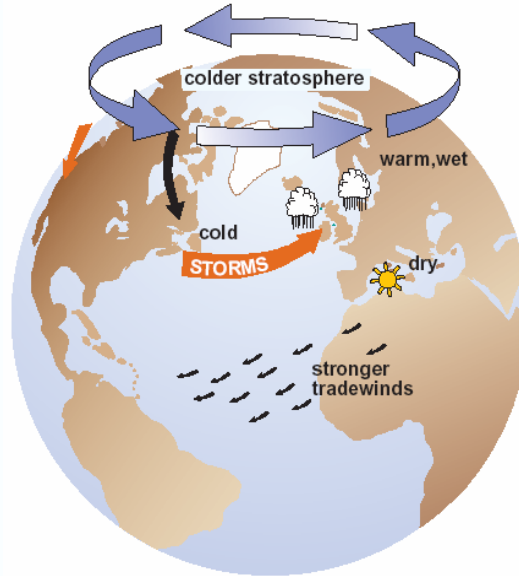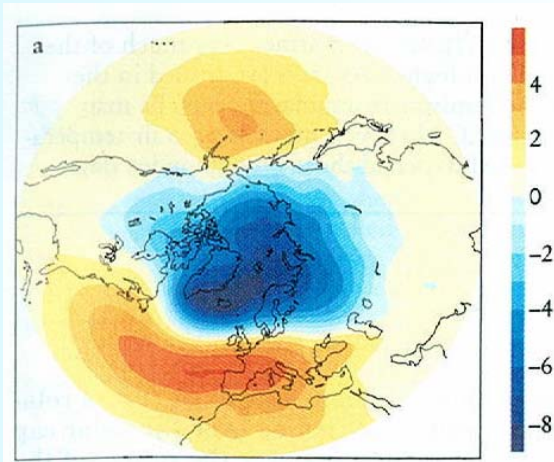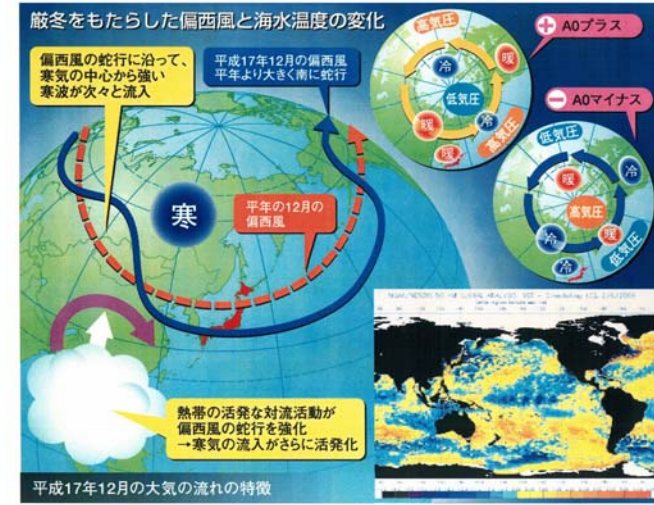# Global warming and Arctic Oscilation

Arctic Oscillation
Singular eigenmode theory

AO (DJF)   **Eigenmode**

Barotropic Height

Arctic Oscillation (DJF)   EOF-1   EVP-1   Standing eigenmode EVP-1

Barotropic Height
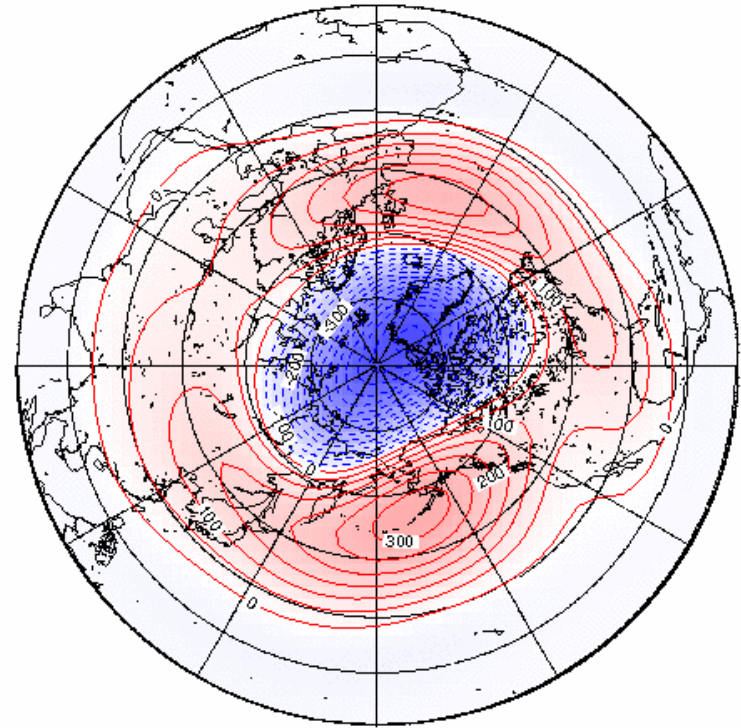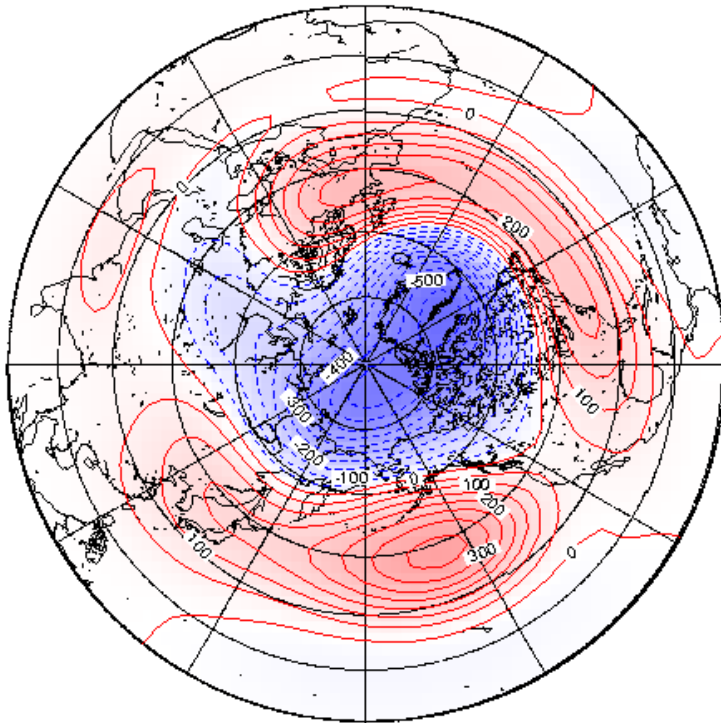
Predictions of the AO Index

Arctic Oscillation Index
Barotropic Component of the Atmosphere
Ensemble predctions from {2006110100}
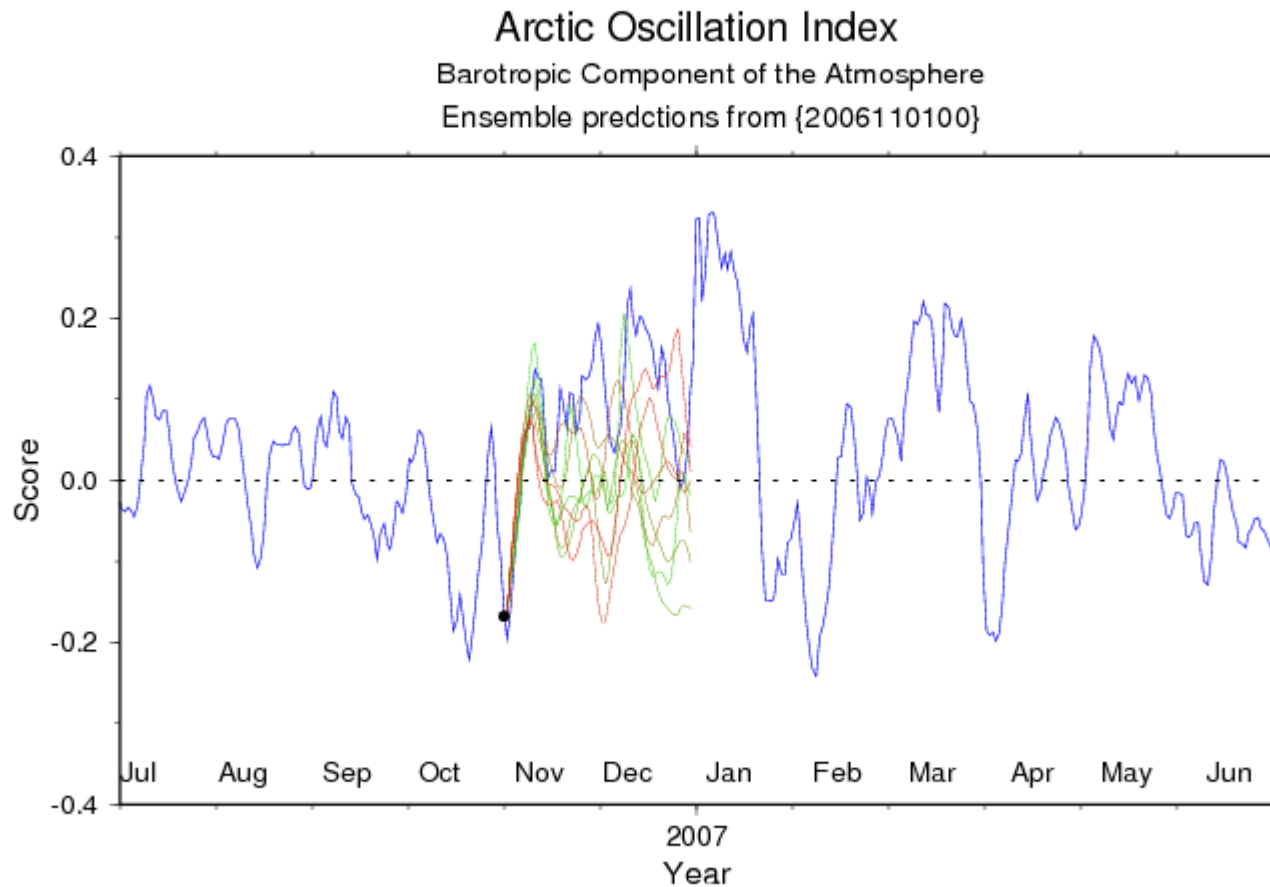
Ensemble Prediction by Stochastic Physics

PC Cluster Experiment
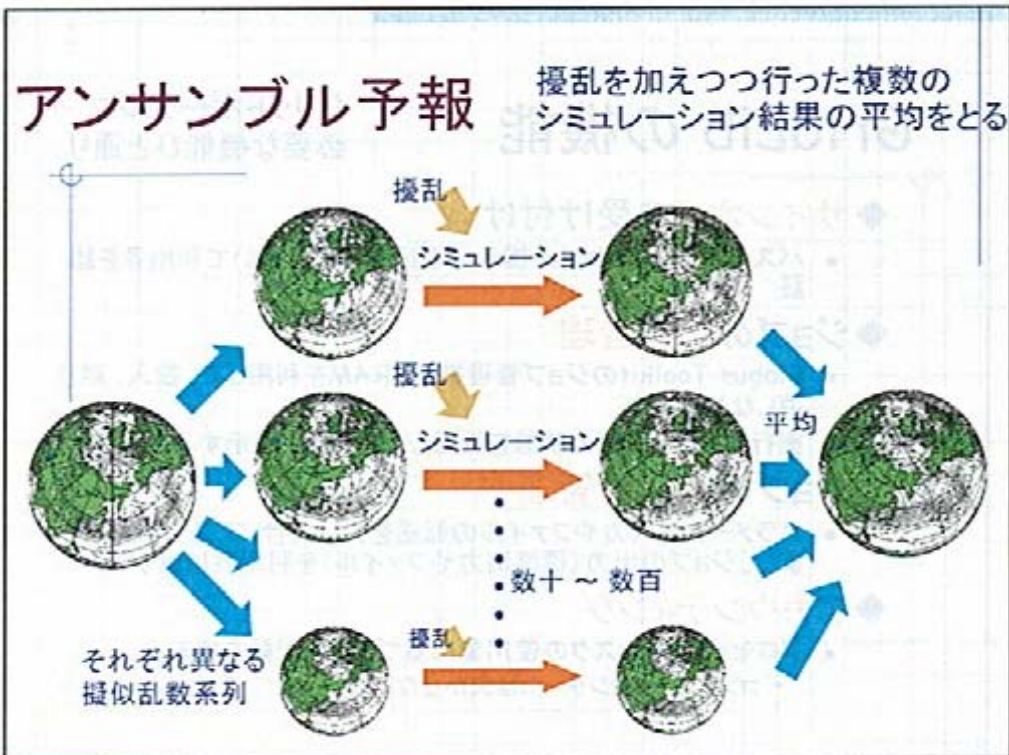
Barotropic S-Model
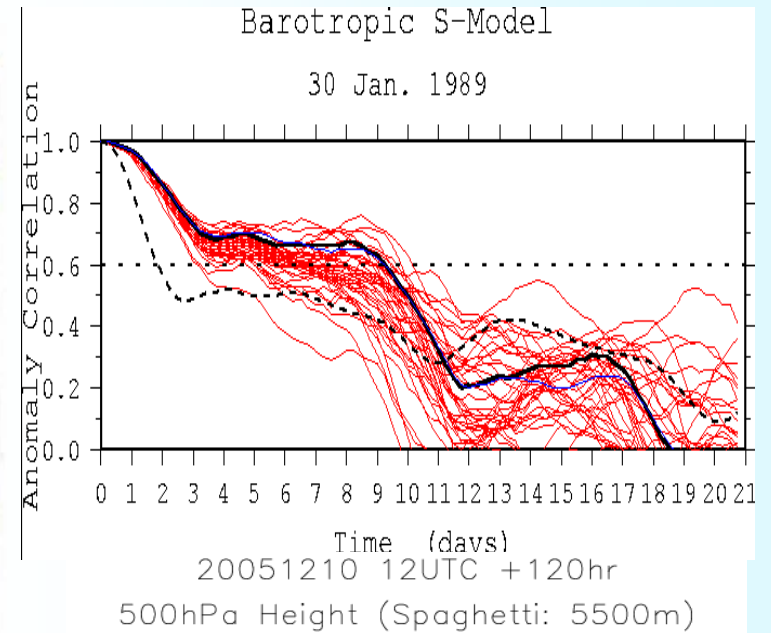
RMSE for EKF and EnKF
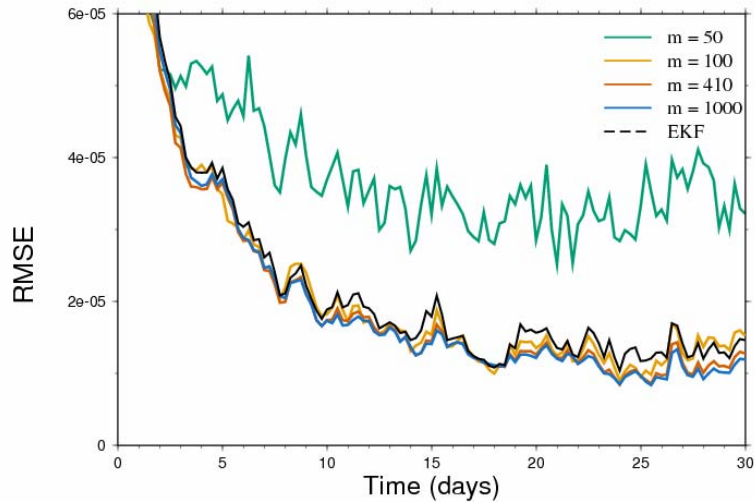
**Data Assimilation Test
By Kalman Filter and
Ensemble Kalman Filter**

**Barotropic S-Model
at University of Taukuba**

EnKF (m=1000), 12.6%
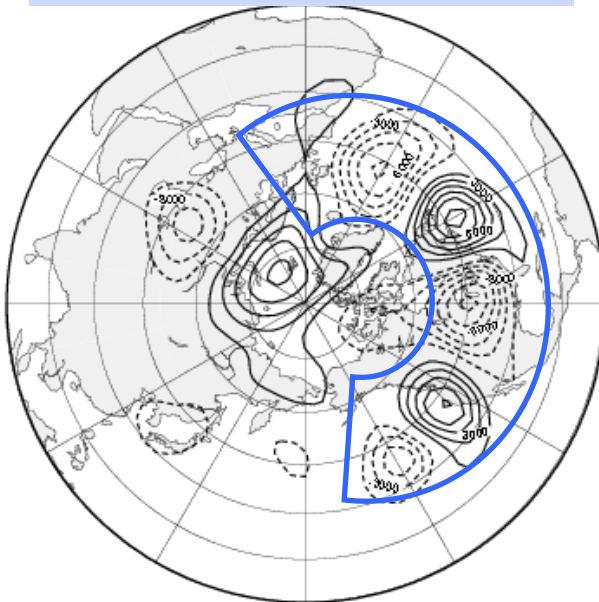
EKF (linear model), 8.8%
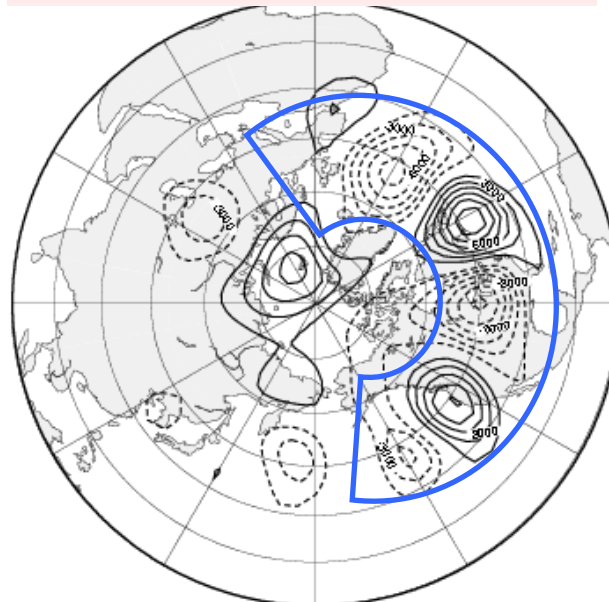
Collaborations

- **JMA**: Thorpex Ensemble prediction technique
- **FRCGC**: Arctic Oscillation studies
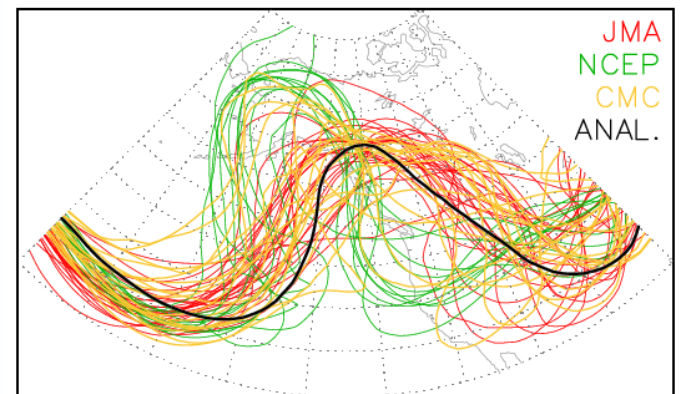- **IARC**: Global change connection to the Arctic
- **MRI**: Data assimilation and Kalman filter
- **CCSR**: NICAM by PACS-CS
- **NIPR**: Arctic process studies
- **Weather News**: Prediction of AO
- **Pukyong National University**: Ice dynamics

Realtime weather prediction sysytem

1. WRF-V2.2 with urban model

2. Analysis and assimilation

3. Initial data by theJMA/GPV data
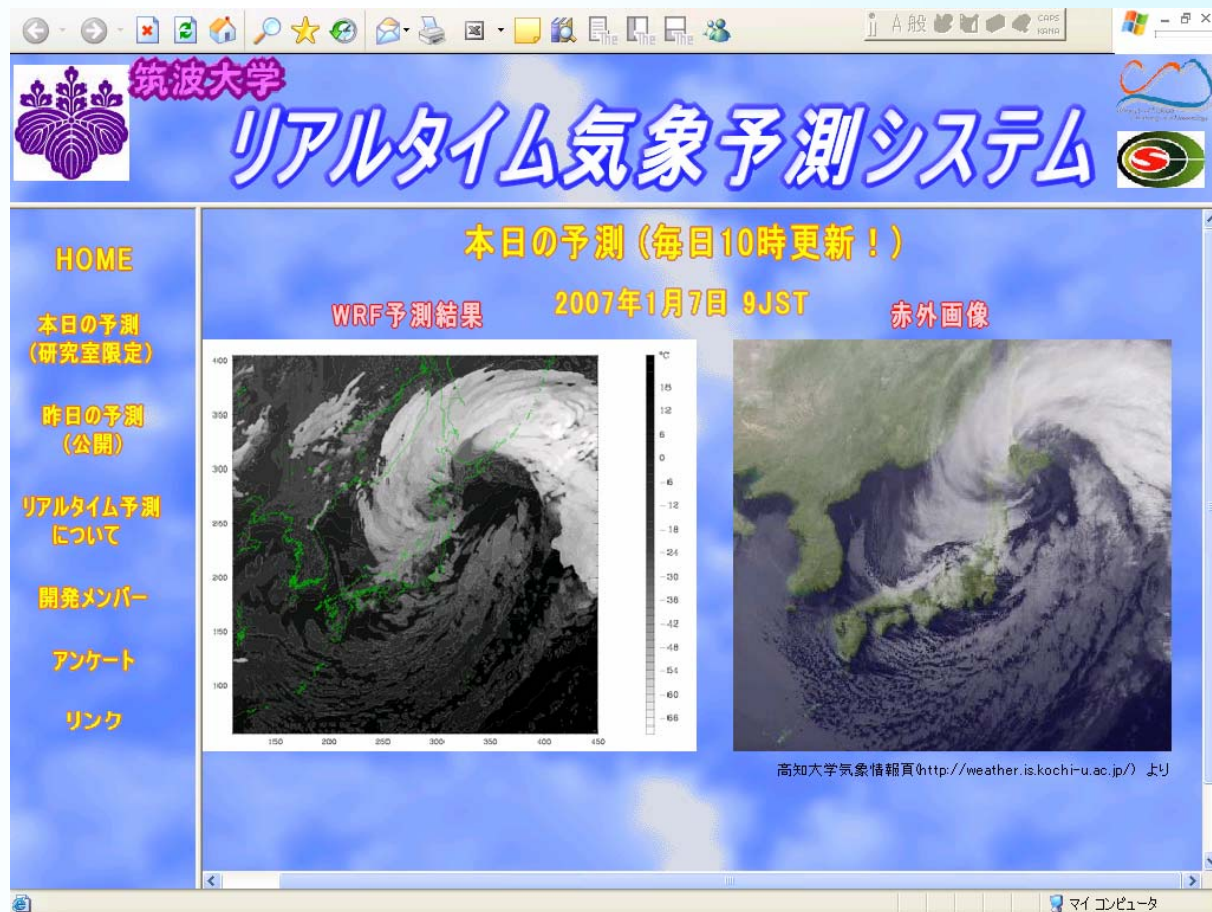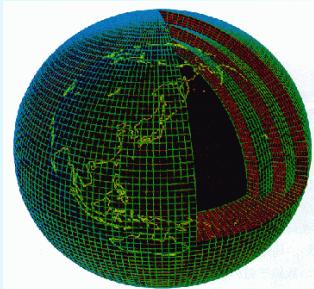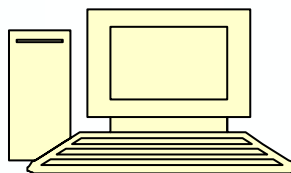
| JMA/GPV | WPS | WRF |
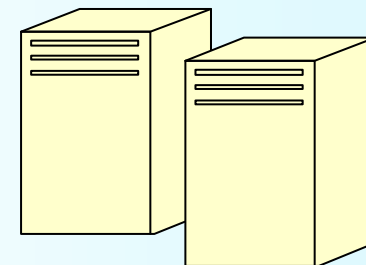
WRF simulation of Typhoon
(900Z-3-Sep-2007)
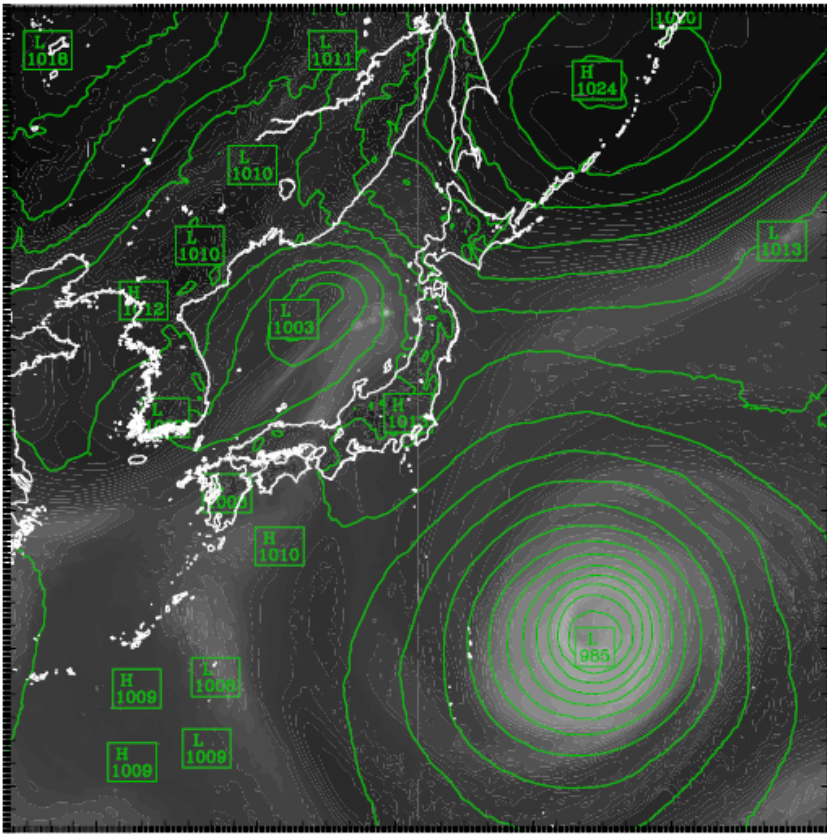
WRF with PACS-CS
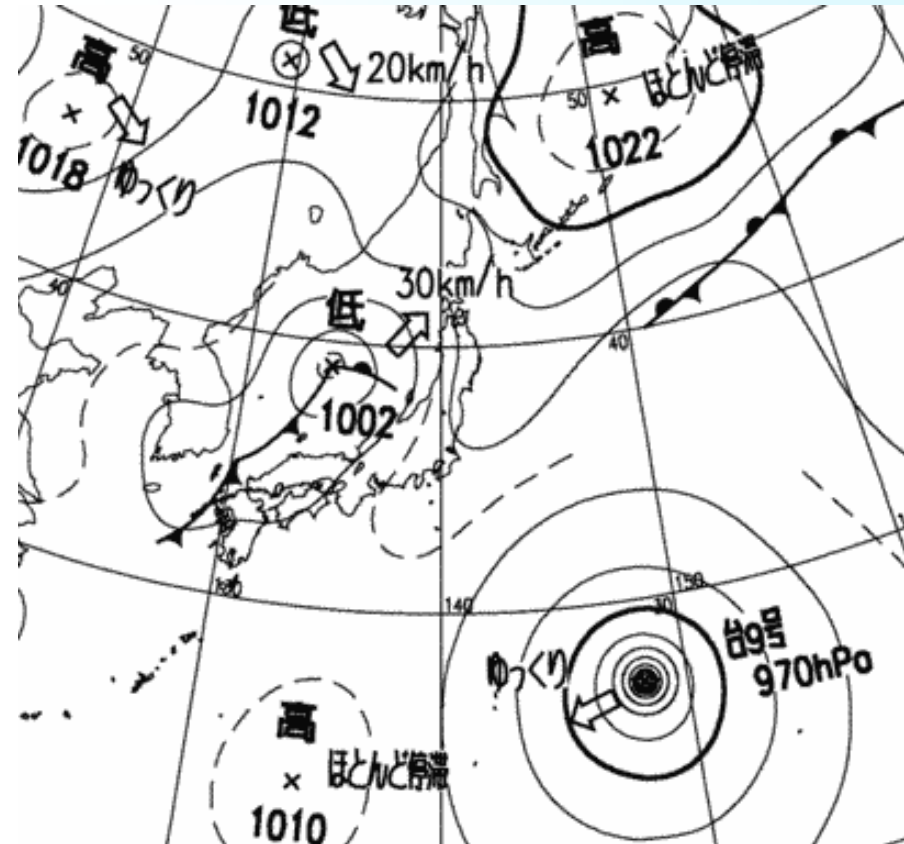
Weather map by JMA

Simulation of meso-scale heavy rain with WRF
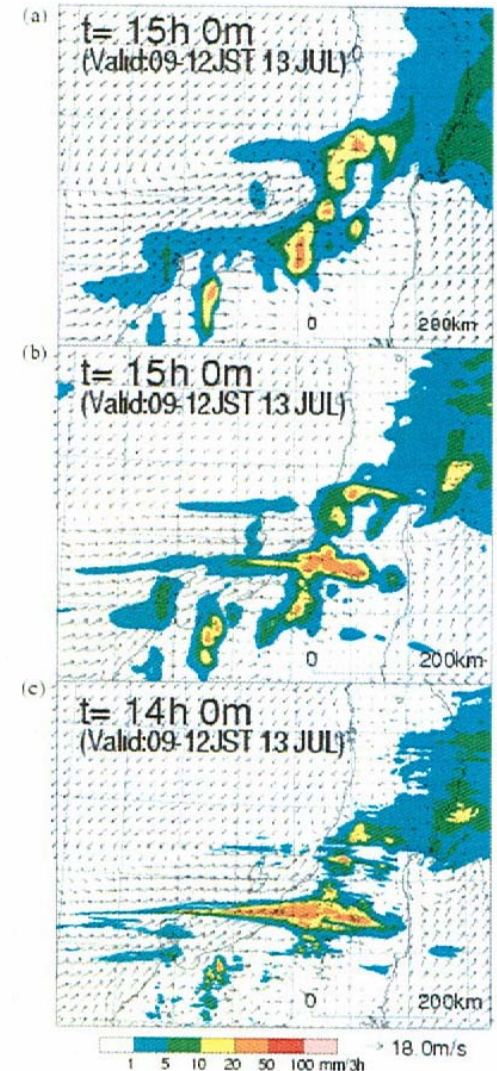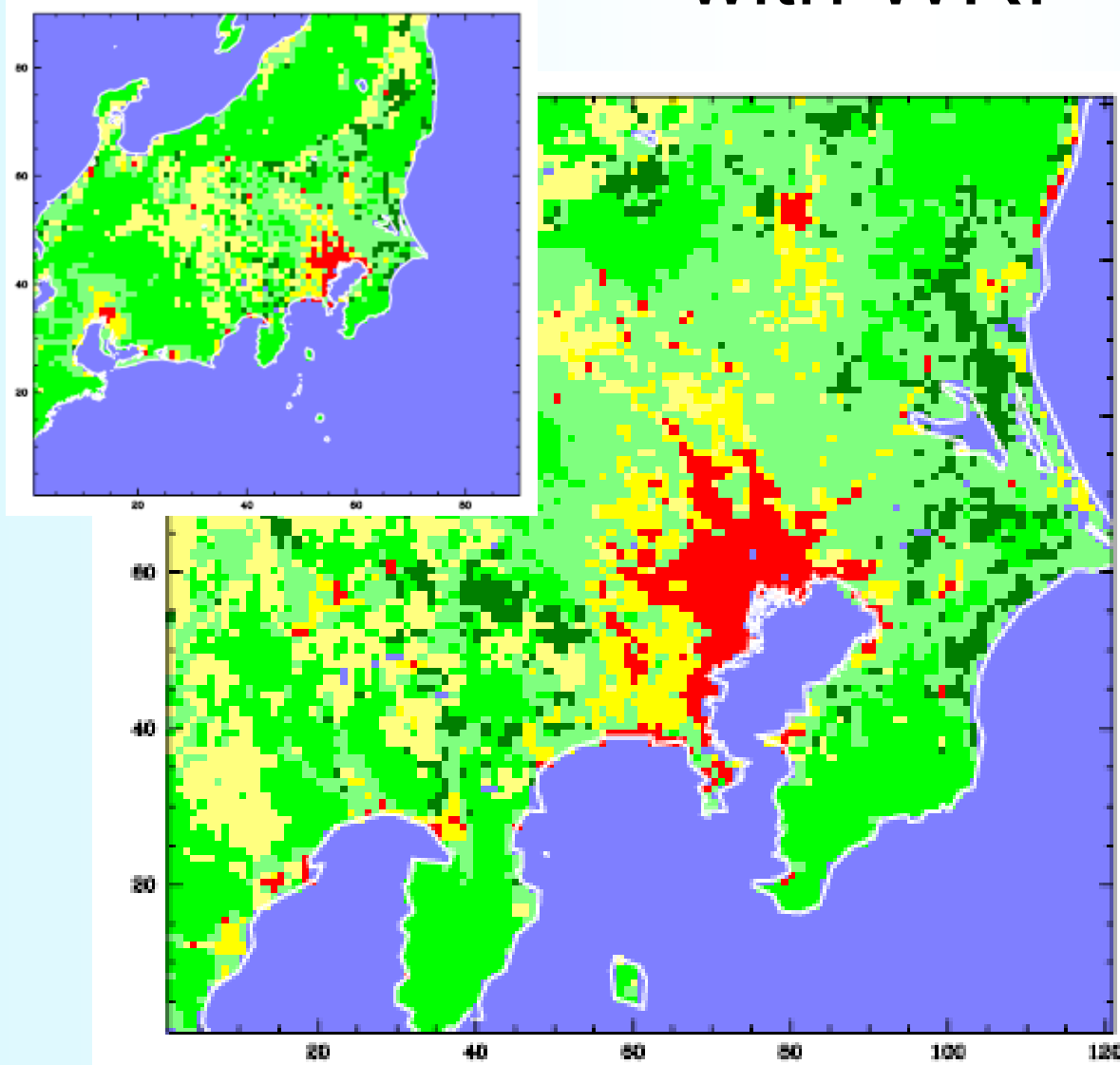
Extreme record hot in Aug. 2007
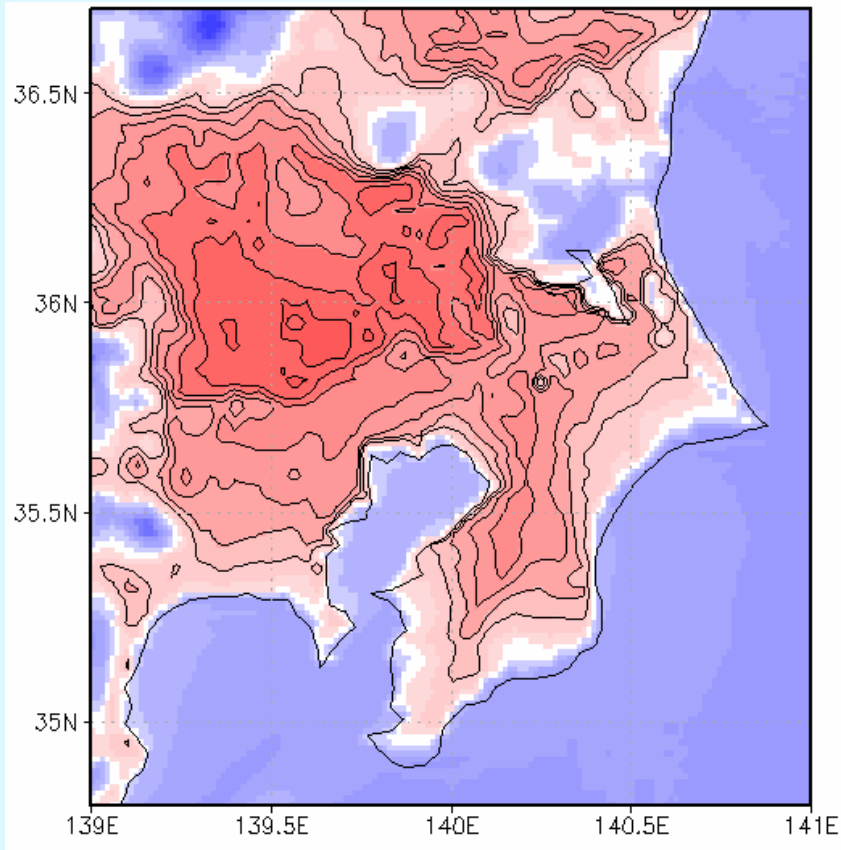
Surface air temperature
（WRF model simulation）
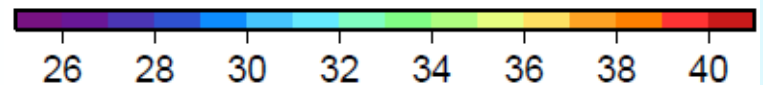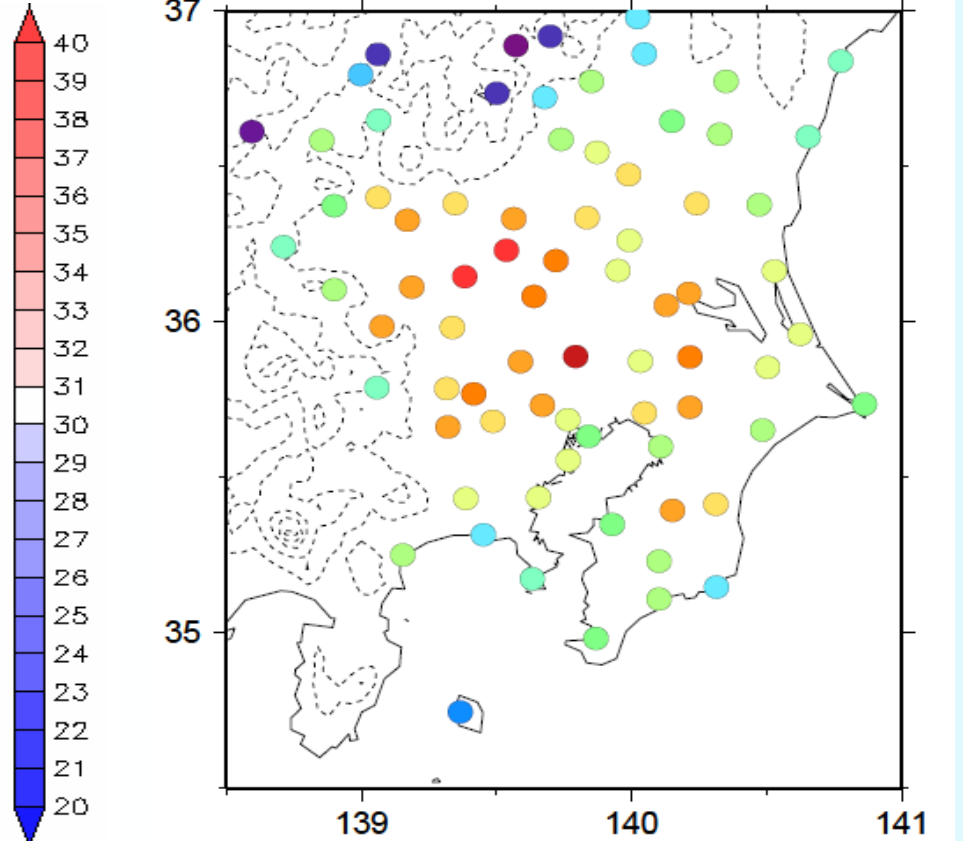
AMeDAS Observation

Urban climate and heat island

気象庁HPより
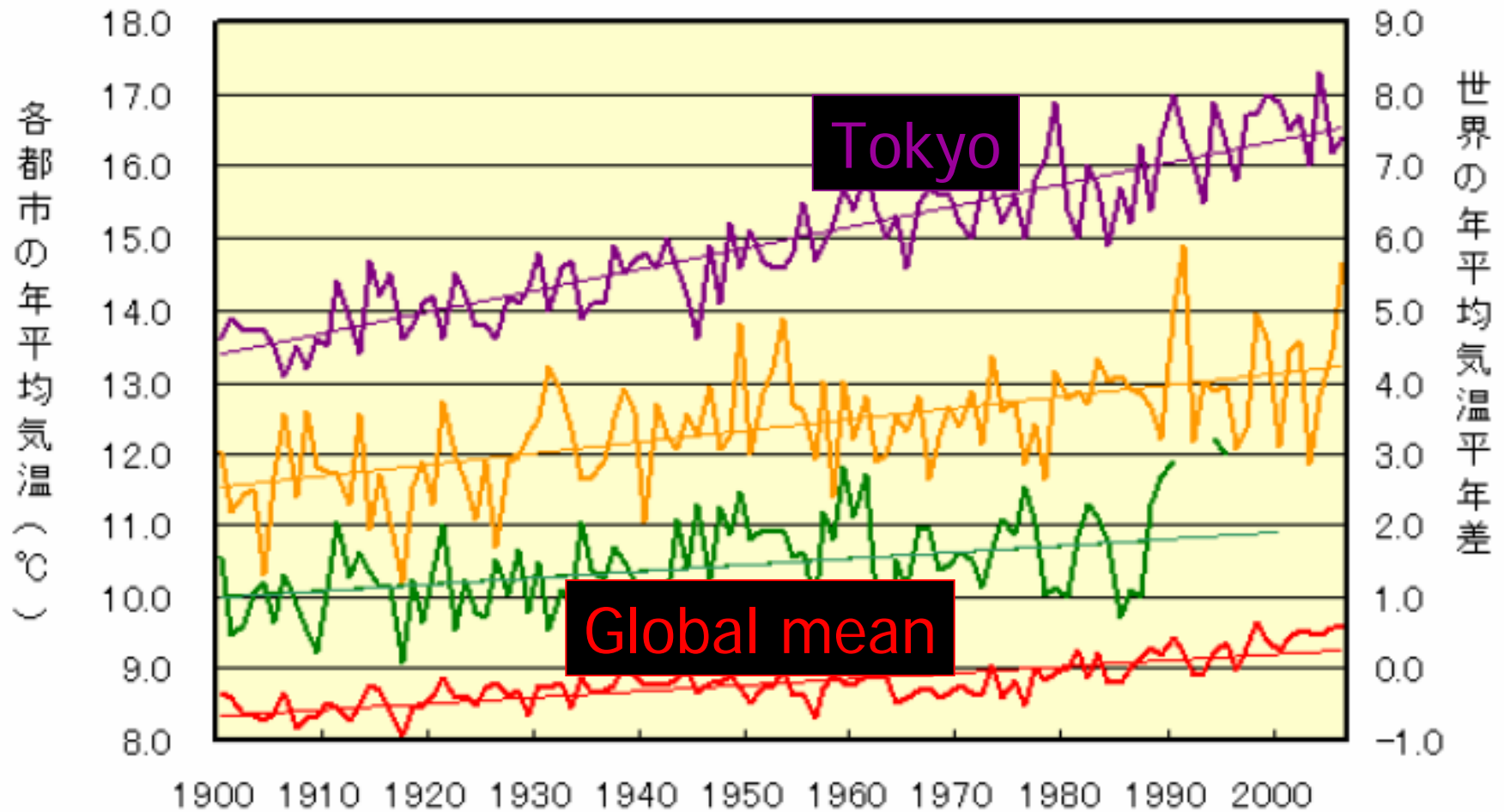
Urban effects on local clouds
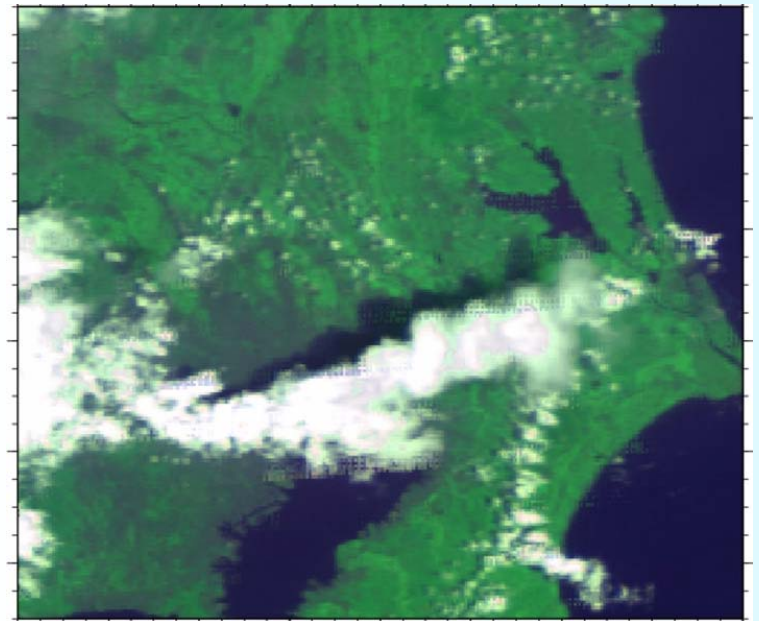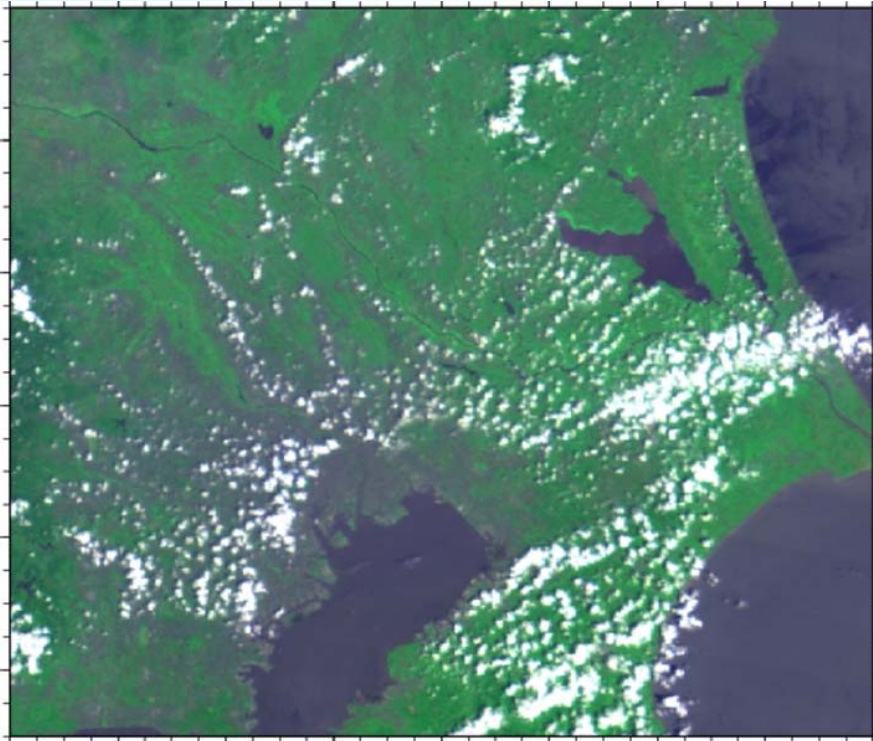
Collaborations with other Divisions

- **Division of Computational Informatics**
  => JMA/GPV Data archive project
- **Division of High Performance Computing Systems**
  => NICAM model prediction with PACS-CS
- **Division of Particle Physics and Astrophysics**
  => Seminars on fluid dynamics and radiation

Progress of Supercomputer

GFLOPS

=1PFLOPS

BlueGene/L

Earth Simulator

CP-PACS

PACS-CS

1PFLOPS
=1000TFLOPS

1 TFLOPS
=1000GFLOPS

QCD-PAX

CRAY-1

year

GPV/JMA Top Page

(資料3)

JRA-25 Archive
Japanese Re-Analysis 25 Years
Data by Japan Meteorological Agency
Contents Provided by the Center for Computational Scie...
University of Tsukuba

HOME
REGISTER
ARCHIVE
e-mail

About the archive

This Archive offers the state-of-the-art long-term reanalysis of global weather data in... provided by the Japan Meteorological Agency (JMA) and Central Research Institute... (CRIEPI). The data are called Japanese Re-Analysis 25 Years (JRA-25) starting from... update in realtime. The Archive is maintained by the Center for Computational Scien... for the purpose of scientific development of the weather and climate forecasting tech... posted here are the product by the CCS, University of Tsukuba, Japan

Files stored

In the Archive, there are two kinds of JRA-25 datasets: anl_p25 and anl_chipsi25. Th... meteorological variables of temperature, height, wind, or humidity, and the latter con... as vertical-p velocity, vorticity and divergence. The data are stored in monthly subdir... files are stored with the name (type.yyyymmddhh) designating the data type, (anl_p2... month, date, and hour (00 06 12 18 UTC). The dated subdirectories are combined in ... describing the year.

Notice: The data provided here is a low-resolution data (2.5 by 2.5 grids), and high-r... are available on request. Refer to the appropriate documents issued by JMA.

Further additions of weather and climate data are in preparation.

Sample Images
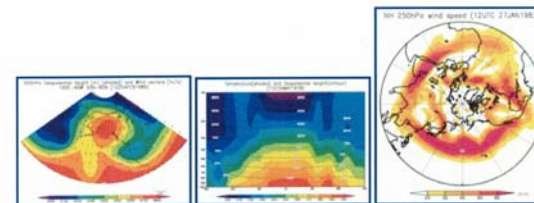
Restrictions and conditions

GPV/JMA Archive: Home

GPV/JMA Archive
Data by Japan Meteorological Agency
Contents Provided by the Center for Computational Sciences
University of Tsukuba

HOME
REGISTER
ARCHIVE
e-mail

About the archive

This Archive offers the daily operational weather forecasting data provided by the Japan Meteorological Agency (JMA). The data are called Grid Point Values (GPV). The Archive is maintained by the Center for Computational Sciences, University of Tsukuba, for the purpose of scientific development of the weather and climate forecasting technology. All weather maps posted here are the product by the CCS, University of Tsukuba, Japan

Files stored

In the Archive, there are six kinds of JMA/GPV data, i.e., global spectral model data (gsm_jma), regional spectral model data (rsm_jma), meso-scale non-hydrostatic model data (msm_jma), weekly ensemble forecast data (ensemble_week_jma), monthly ensemble forecast data (ensemble_month_jma), and seasonal ensemble forecast data (ensemble_3month_jma). Those GPV data are stored in subdirectories describing the date (yyyymmdd00) when the data are generated. The dated subdirectories are combined in the main directory describing the year.

Notice: Due to the system upgrade of JMA, the resolution and format of the GPV data have changed after March 1, 2006. Refer to the appropriate documents issued by JMA.

http://gpvjma.ccs.hpcc.jp/~gpvjma/index.html

Collaboration with Computational Informatics

http://gpvjma.ccs.hpcc.jp/~jra25/

4

2006/11/24

Product released by CCS

Realtime animations

Sea-level Pressure (hPa)

2005090512 + 00 hr (JMA/GPV/RSM)
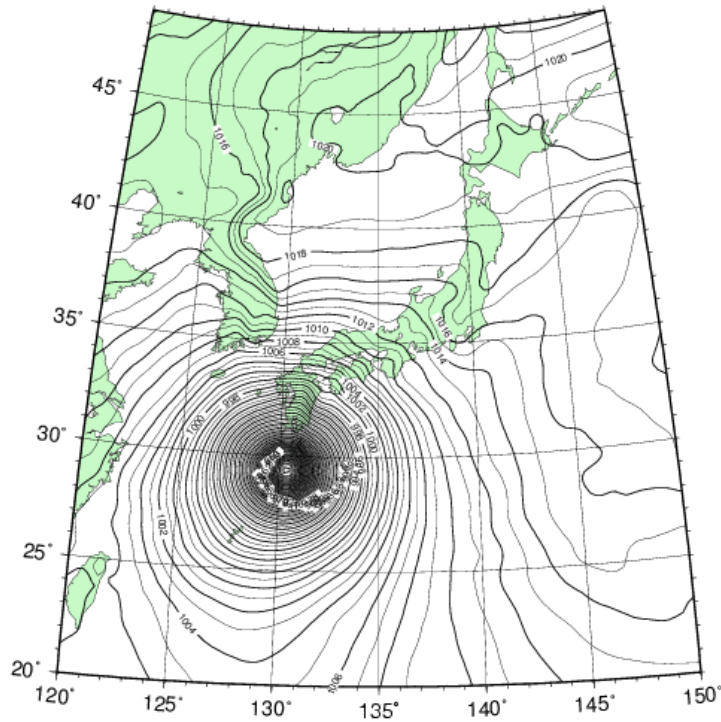
850 hPa Specific Humidity (g/kg)

2005090512 + 00 H JMA/GPV/RSM

NICAM

Collaboration with HPC Systems
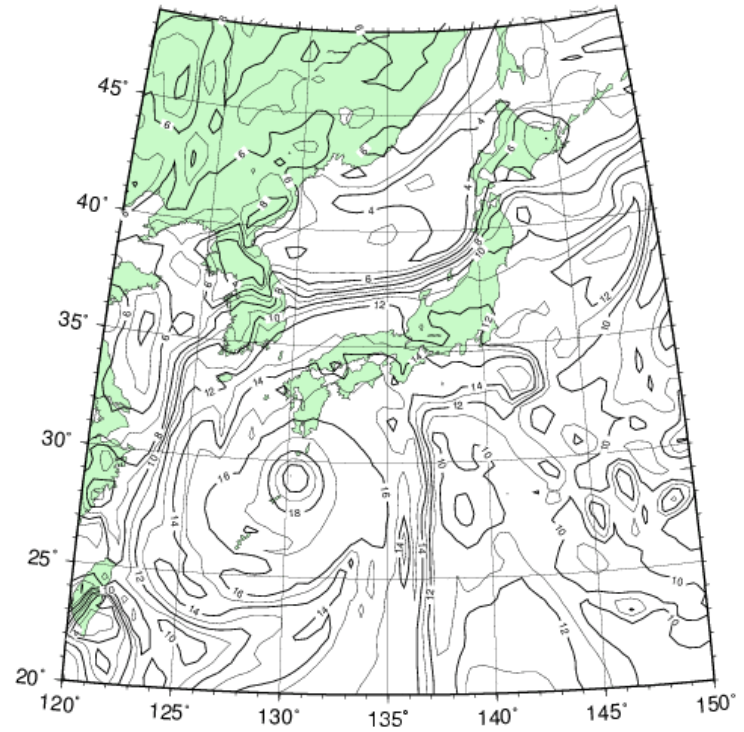
Glevel-0

by PACS-CS

Original Icosahedron

Satoh et al. CCSR
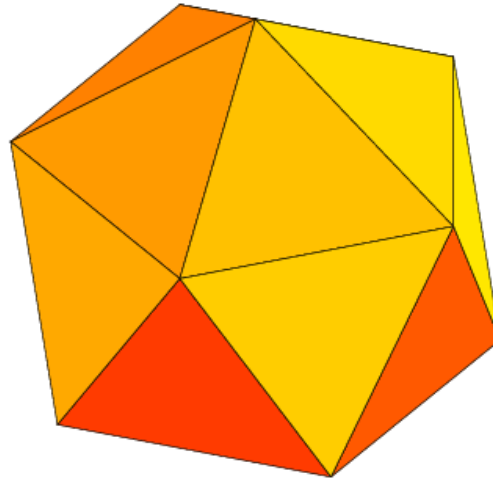
```
Glevel-5:  Δx=250km
Glevel-6:  Δx=120km
Glevel-7:  Δx= 60km
Glevel-8:  Δx= 28km
Glevel-9:  Δx= 14km
Glevel-10: Δx=  7km
Glevel-11: Δx=3.5km
```
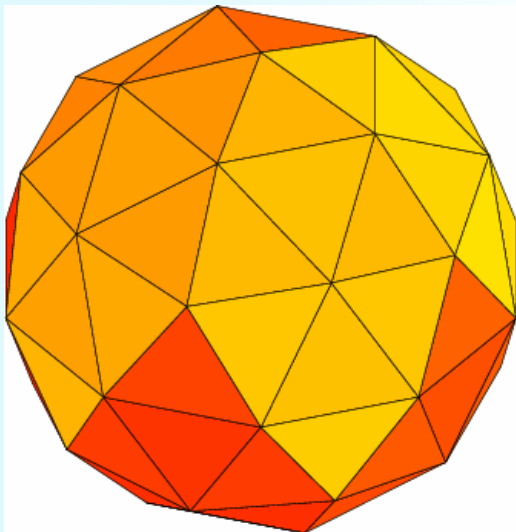
Glevel-1

Glevel-3
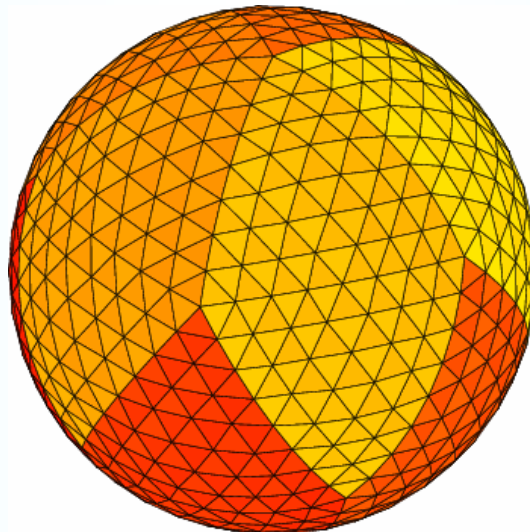
Glevel-5
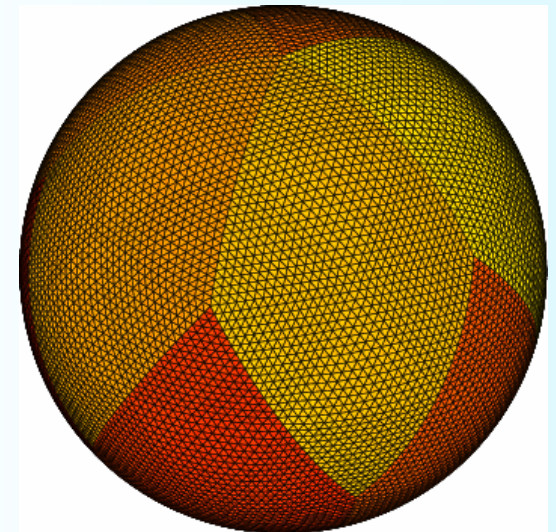
NICAM model run with PACS-CS

Run-#	g-level	r-level	node #	status
Run-01	250-km	0010-region	001-node	done
Run-02	250-km	0010-region	005-node	done
Run-03	250-km	0010-region	010-node	done
Run-04	250-km	0040-region	010-node	done
Run-05	250-km	0040-region	040-node	done
Run-06	250-km	0160-region	040-node	done
Run-07	250-km	0160-region	160-node	done
Run-08	250-km	2560-region	160-node	submitted
Run-09	250-km	2560-region	256-node	ready
Run-10	120-km	0160-region	160-node	submitted
Run-11	120-km	2560-region	256-node	ready

(by Satoh et al)
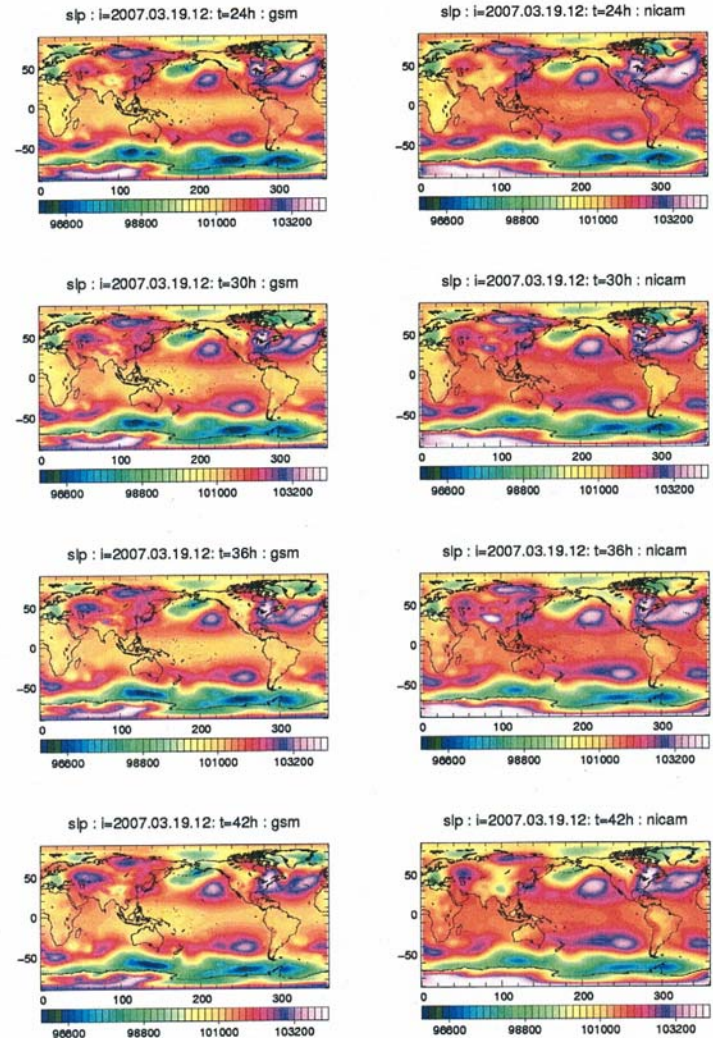
NICAM by PACS-CS
Run-07 250-km 0160-region 160-node

500 hPa Height

NICAM 2007102312Z+0HR
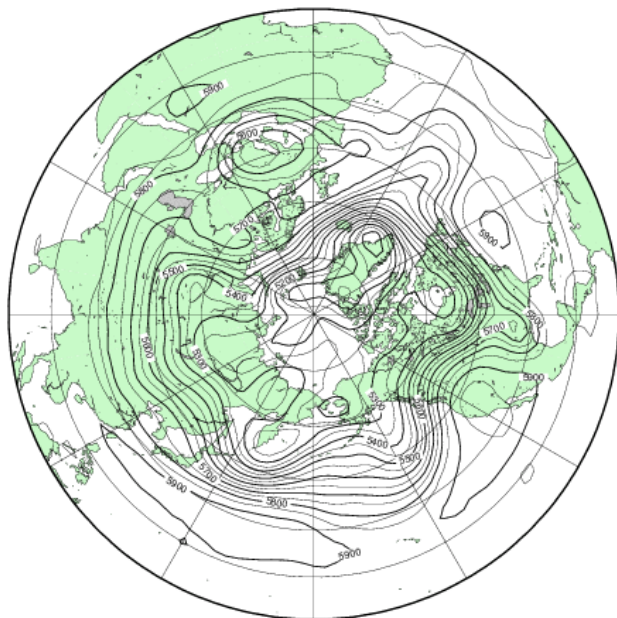
SLP

2007.03.21+000
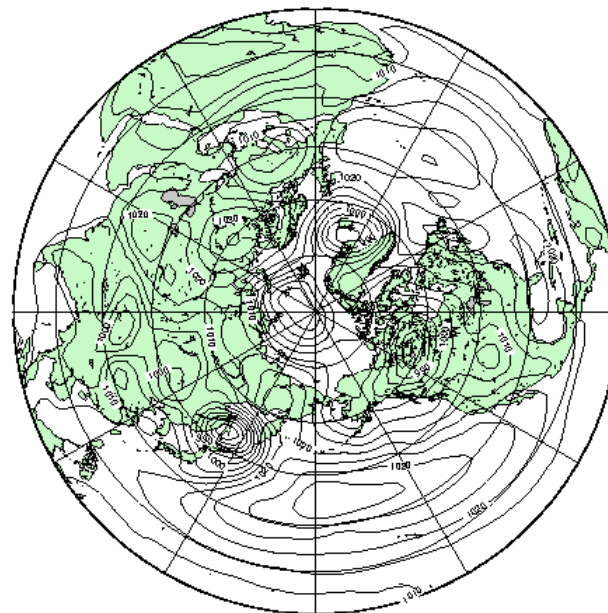
(CPU allocation: 730 hours/year)

Future Plan

1. Prediction model for the Arctic Oscillation
2. Ensemble Kalman filter using the barotropic S-model
3. Numerical experiments with NICAM
4. Urban climate simulation with the regional model WRF
5. Organize a regular session in Earth and Planet Conventions
6. Organize a special session in Meteorological Society of Japan
7. Organize an International Symposium on the Arctic Regions
8. Collaboration with National Institutes and IARC/UAF
9. Organize the Meteorological Research Consortium

END

Thanks !

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- 田中博 2006: 気象予測とカオス、日本信頼性学会誌、28, 481-488.
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- 田中博 2007: 地球学シリーズ、「地球環境学」(共同執筆)、(古今書院).
- 田中博 2007: 極域循環と日本の気候、「地球温暖化」(共同執筆)、(月刊海洋特集号).
- 田中博 2007:「偏西風の気象学」(成山堂).
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- Tanaka, H.L. S. Kato, I. Suzuki (2007) A trial of predicting the Arctic Oscillation index using the barotropic S-model. Proc. GCCA-7, Fairbanks Alaska
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原著論文査読付　7　著書　3　その他　5 Submitted　4

発表論文リスト
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- 日下博幸 (2006)　最新の気象モデルWRFを用いた平成16年新潟・福島豪雨の数値シミュレーション. 電力土木, No.324, p9-16.
- Tomita, T., **H. Kusaka**, R. Akiyoshi, and Y. Imasato (2007) Thermal and geometric controls on the rate of surface air temperature changes in a medium-size, mid-latitude city.　*Journal of Applied Meteorology.* In press.

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