



Institute of Meteorology, Hydrology and
Environment (IMHE)

Seasonal forecast in IMHE

Adaptation for Climate Change and Green Development in Mongolia
Chuo University, Tokyo Japan
13-15 January, 2015

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and Jamba TSOGT

Outline

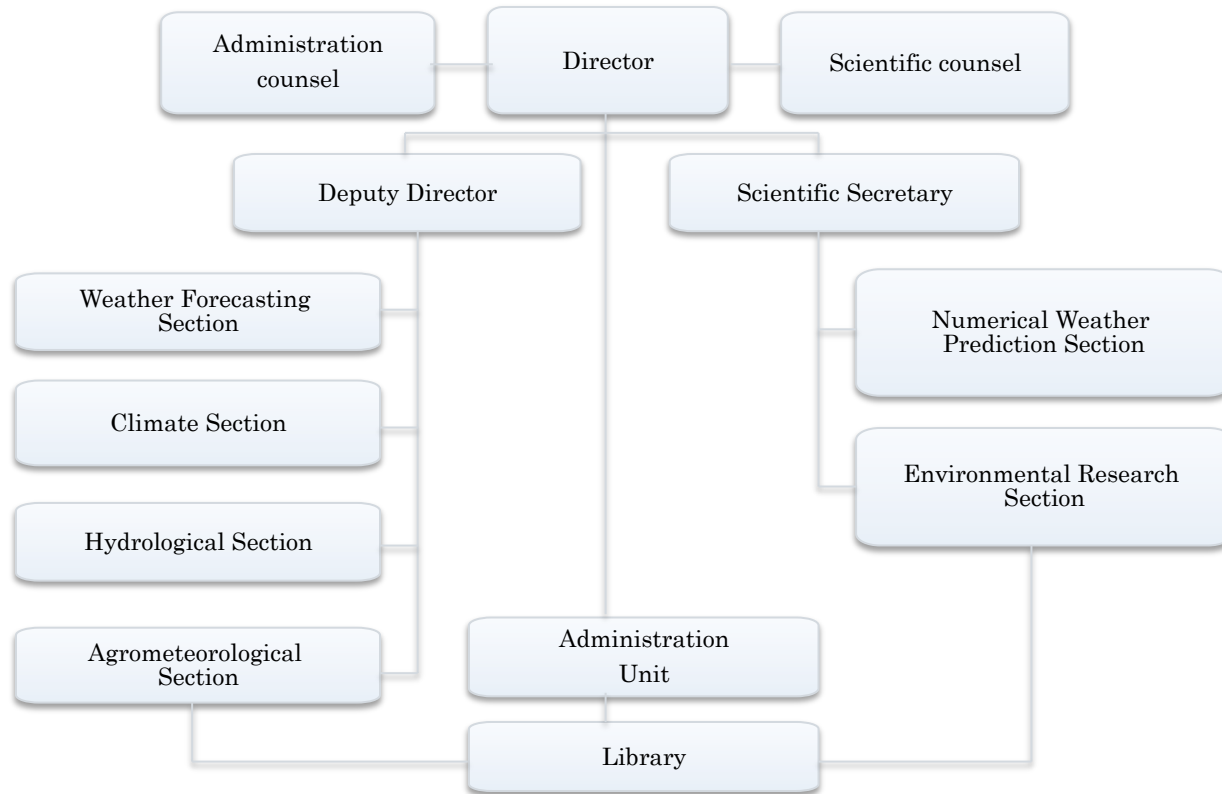
- Introduction
- Short and Medium Range forecast
- Monthly and Seasonal Forecast
- Challenge and Future Plan

Introduction: Organization

□ Main goal

- To predict weather, climate, hydrology and environment and as well as assess their current and past
- To provide all above information to the public, government and non-governmental organization
- To carry out research regarding above mentioned activities

□ Structure



Totally 91 staffs.

Among them, 23 are researchers

Introduction: Observation and Monitoring System

Observation network:

Stations

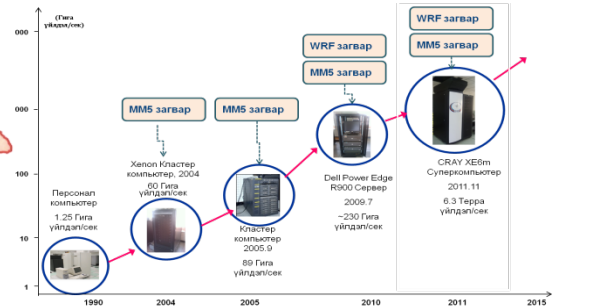
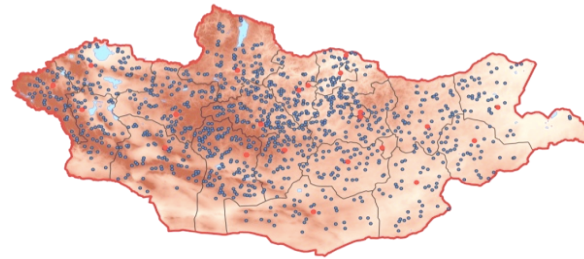
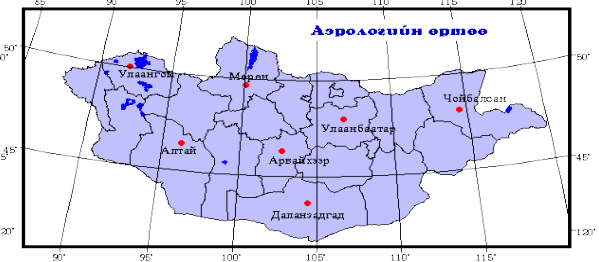
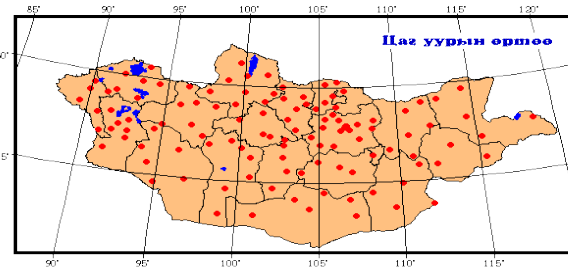
- Цаг уурын-135
- Аэрологийн-6
- Агро цаг уурын-2
- Допплерын радар-1
- Лидар-3
- Шороон шуурга-9

Posts:

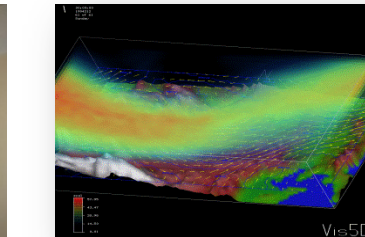
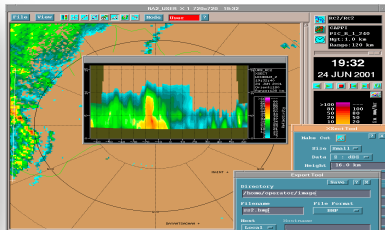
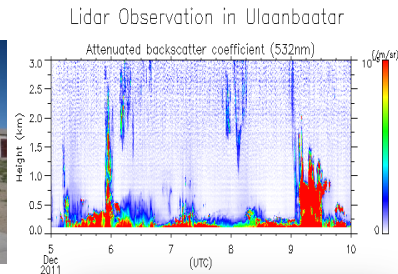
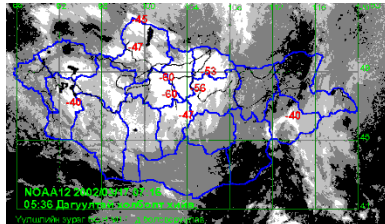
- Агро цаг уурын -198
- Зоо цаг уурын-7
- Усны -134
- Агаарын чанарын -22

Satellite-2

ОУ болон бүсийн төвүүдийн мэдээ



Equipment and faculties :



Forecast : Short and medium range

Operational models for short and mid range weather forecast

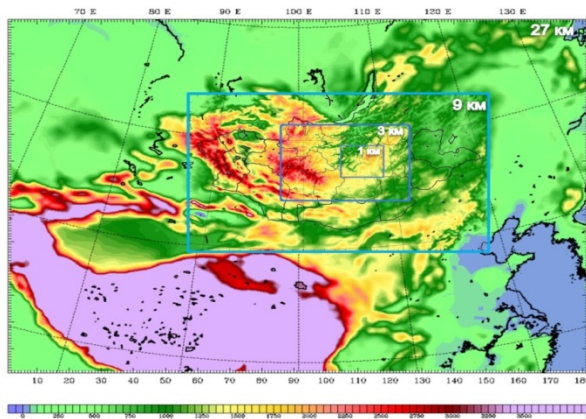
Dynamic models

No	Model name	Purpose	Initial and boundary data (resolution)	Resolution (vertical layers)	Run Length (output time step)	Running at
1	WRF	Weather forecast	UM global model (~25km)	27 km (35)	144 hours (3h)	00&12 UTC
				9 km (35)	144 hours (3h)	
				3 km (35)	72 hours (3h)	
				1 km (35)	36 hours (1h)	
2	MM5	Weather forecast	UM global model (~25km)	9 km (35)	144 hours (3h)	00&12 UTC
				3 km (35)	72 hours (3h)	
				1 km (35)	72 hours (3h)	
				3	ADAM2	
3 km (35)	72 hours (3h)					
1 km (35)	72 hours (3h)					
4	CALPUFF	Air pollution forecast	WRF regional model (1 km)			9 km (35)
				3 km (35)	72 hours (3h)	
				1 km (35)	72 hours (3h)	
				1 km (35)	48 hours (1h)	

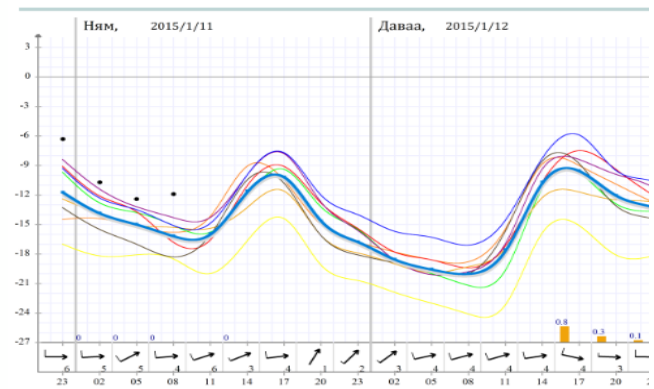
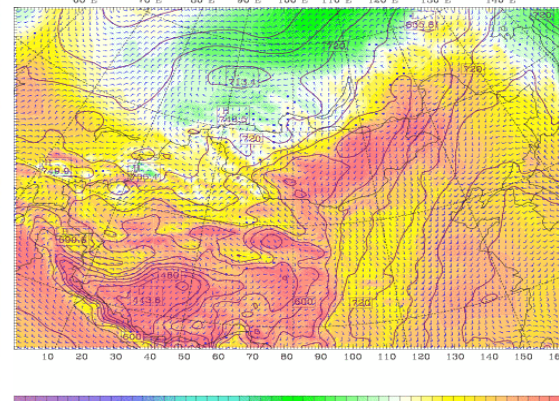
Statistic models

No	Main technique	Predictor variable from (resolution)	Predicted variable (output time step)
1	Kalman Filter, KF	ECMWF (250 km)	Tmax & Tmin (12h)
2	Model output statistics (MOS)	ECMWF (250 km)	Tmax (12h)
3	Neural network	ECMWF (250 km)	Precipitation (12h)
4	Neural network	ECMWF (250 km)	Wind (12h)
5	Perfect prog method (PPM)	MM5-UM (9 km)	Tmax & Tmin (12h)
6	Perfect prog method (PPM)	MM5-GFS (9km)	Tmax & Tmin (12h)

Model domain and output

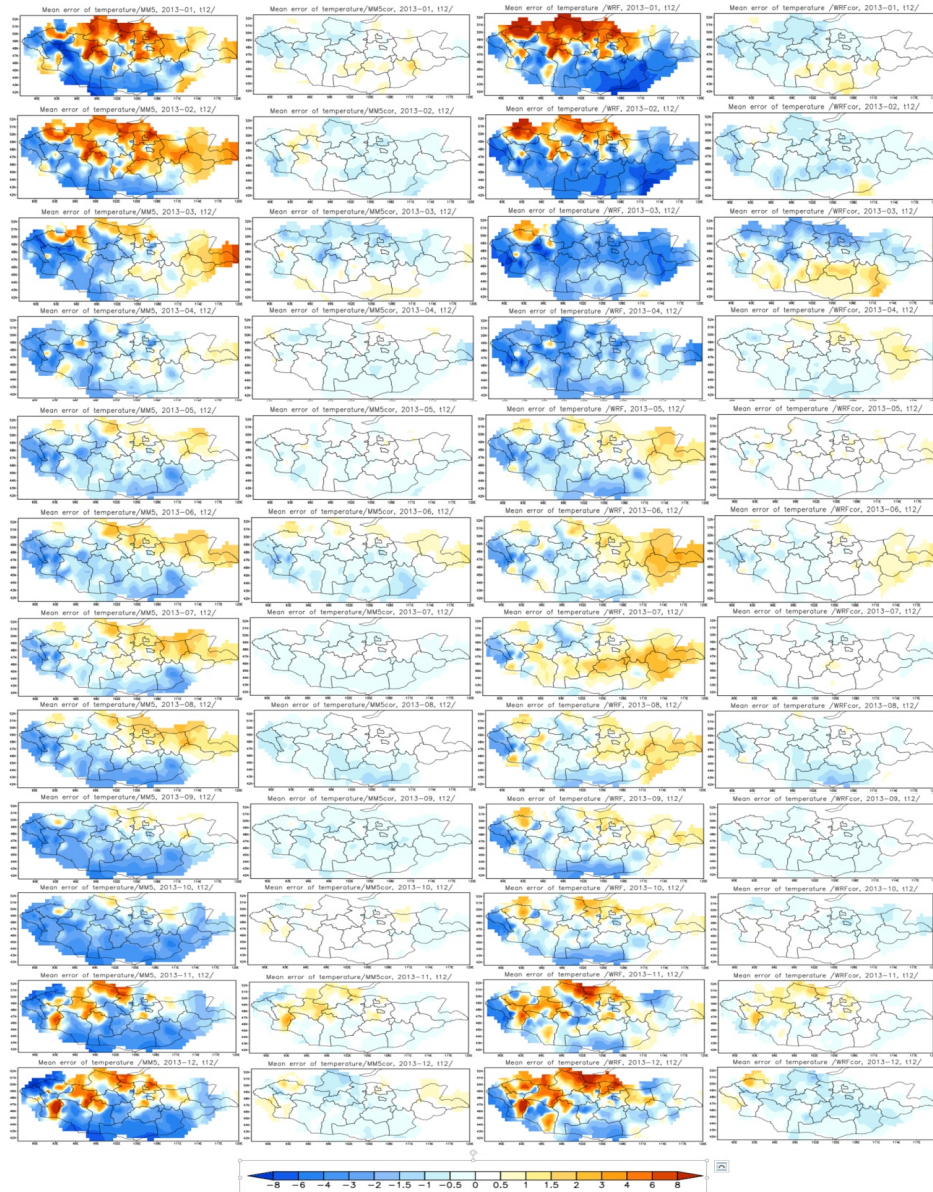


Dataset: R1 RIP: wind9-30 Init: 0000 UTC Wed 21 Jul 04
 Pest: 0.00 Valid: 0000 UTC Wed 21 Jul 04 (0900 LST Wed 21 Jul 04)



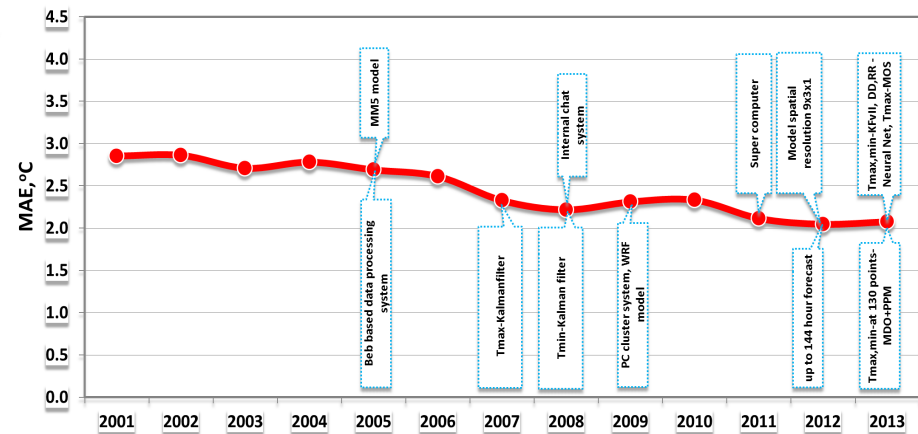
Forecast : Short and medium range

Spatial pattern of temperature bias of regional MM5 and WRF model in 144h forecast, °C (2013)



- Both models have warm bias in cold season and cold bias in warm season
- Statistic model excludes bias
- Mean error against 135 meteorological stations is less than 2.0 °C

Inter annual change mean error

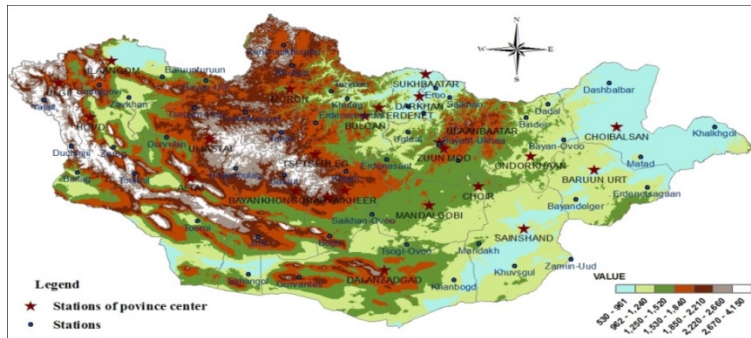


Forecast : Monthly and Seasonal

Monthly and seasonal statistic models

- Local Climate Model has lead time of 6 months (Namkhai., 1988).
- Statistical model named as “Extreme” has also lead time of 6 months (Jigmeddorj., 1994).
- Statistical downscaling of Tokyo Climate Center (TCC), GCM has lead time of 1 month. (G.Bayasgalan, 2009)
- Statistical downscaling of APCC, GCM has lead time of 1-3 months (P.Gomboluudev, 2009)

Stations used in monthly and seasonal forecast (filled colors show topography)

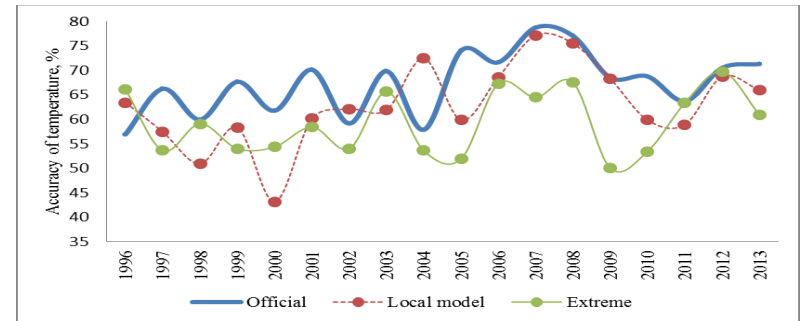


Definition of the categories used in monthly and seasonal forecast, 1981-2010

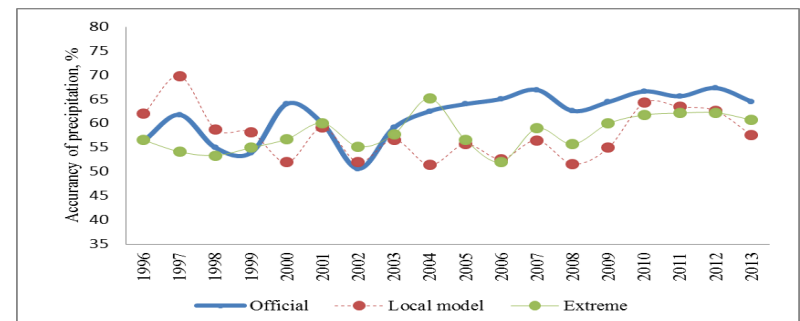
Category	Temperature /°C/, T	Precipitation /%/, P
Above norm	$T > +1$	$P > 80$
Near norm	$-1 < T < +1$	$50 < P < 80$
Below norm	$T < -1$	$P < 50$

Seasonal models accuracy

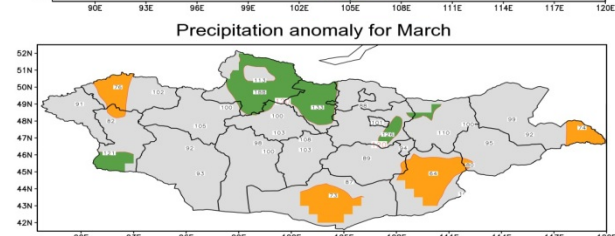
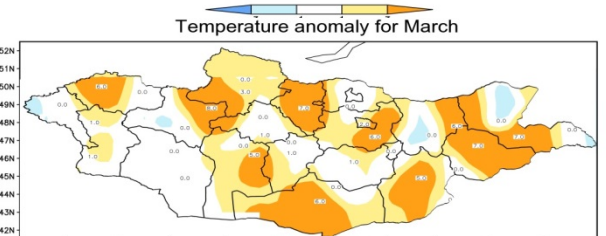
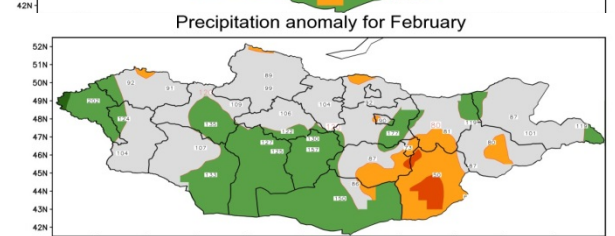
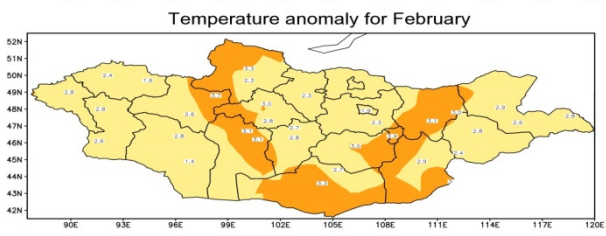
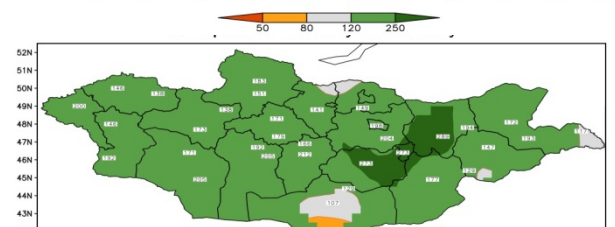
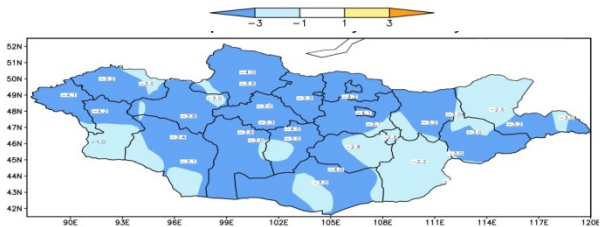
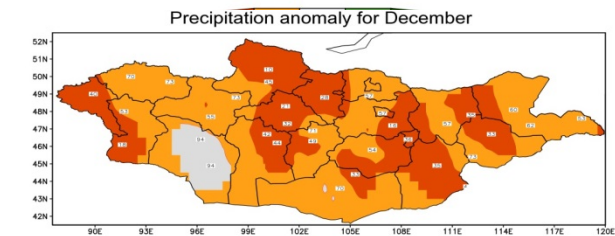
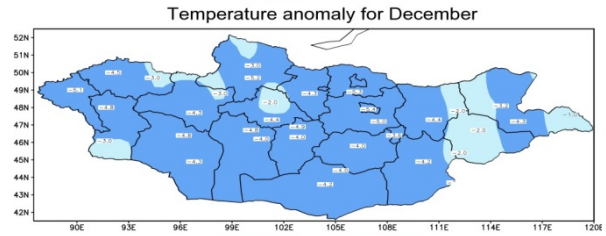
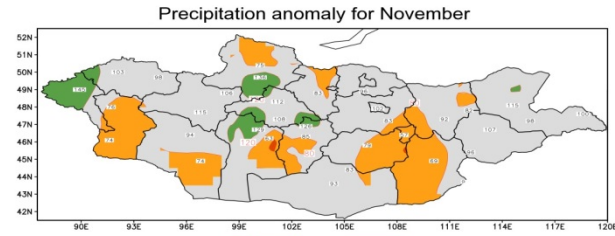
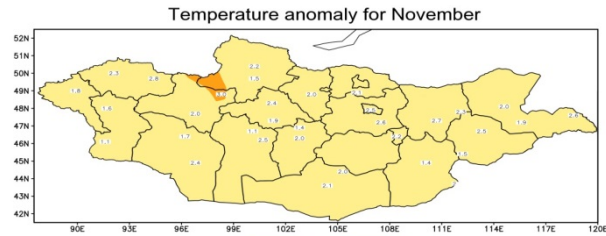
a) temperature



b) precipitation



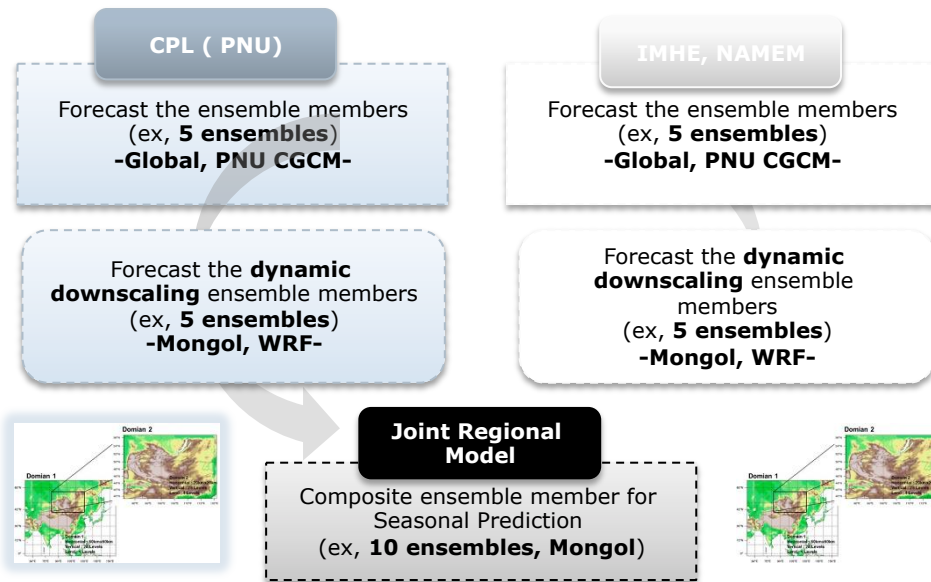
Forecast : Example of seasonal forecast



Challenge and Future Plan

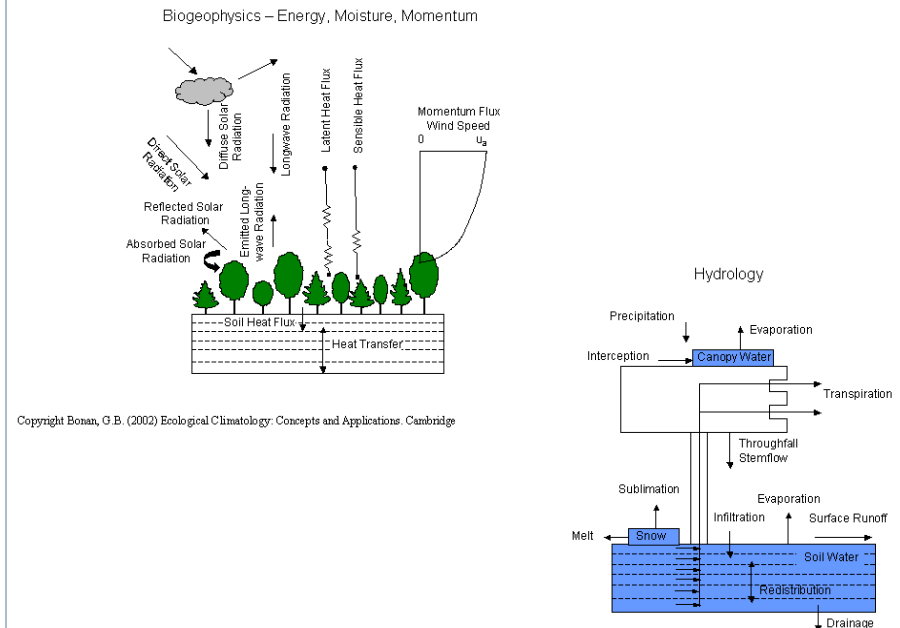
- Accuracy of statistical model is getting low, because of change of climate system and interaction due to green house gas forcing
- Therefore, we need to perform Global climate model in near future and Earth system model in far future
- Currently, we are limited a power of computing and lack of storage device

Coupled AOGCM



Source: Joong-Bae Ahn, 2014

Earth System Model



Thank you for your attention