

Overview of Climate Services in Indonesia

Ardhasena Sopaheluwakan

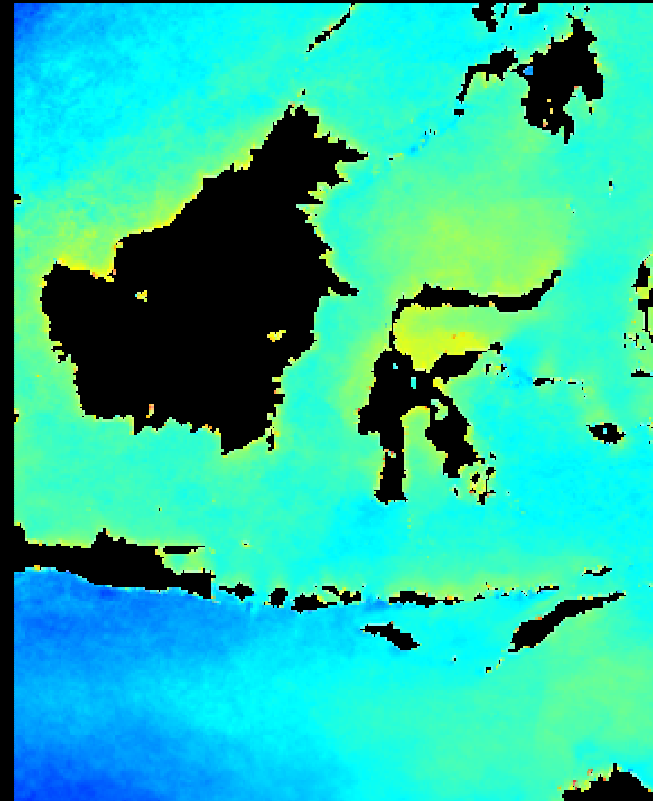


BMKG

Presented at the 2011 WMO RA-V Regional Seminar. Honiara, Solomon Islands, 2 November 2011

Outline

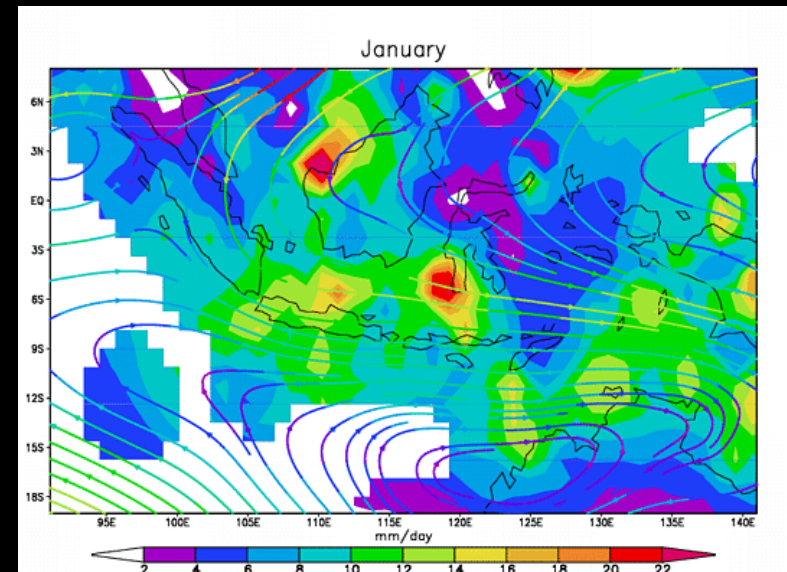
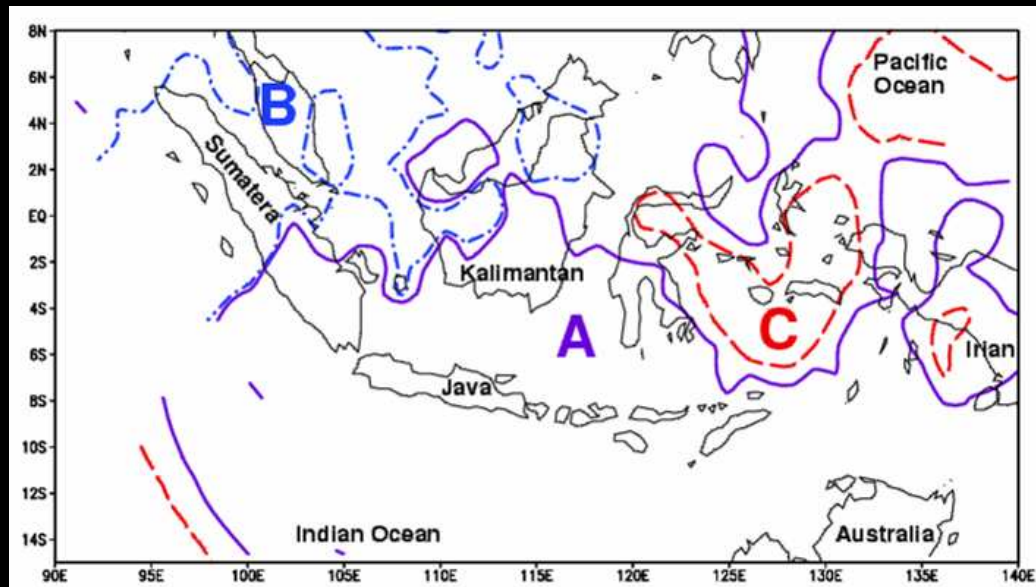
- Climatological settings
- Current capacities for climate services
- Current status of climate services



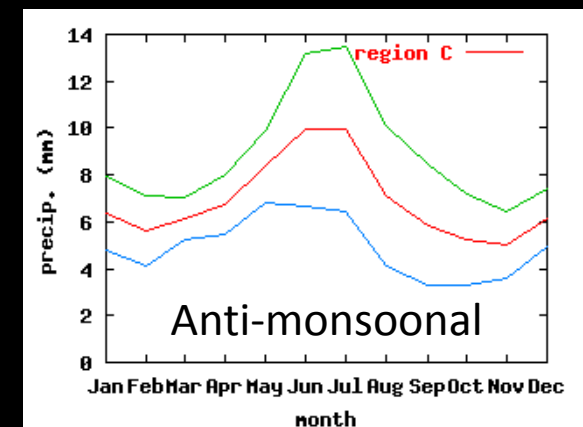
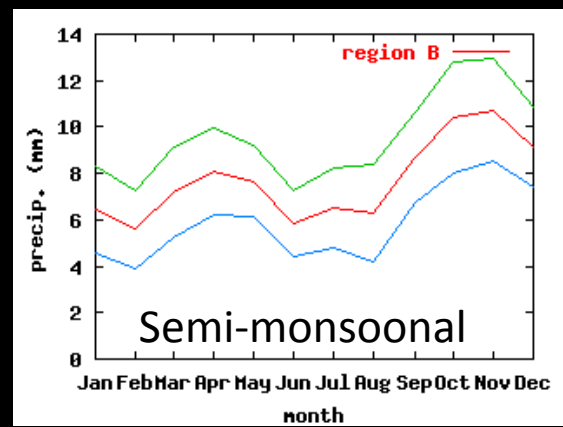
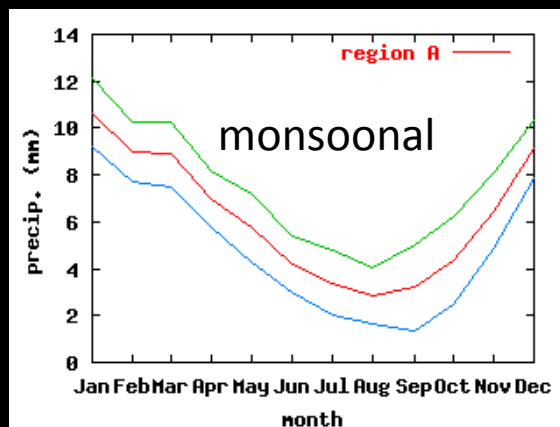
Climatological settings

Climatology of regional rainfall

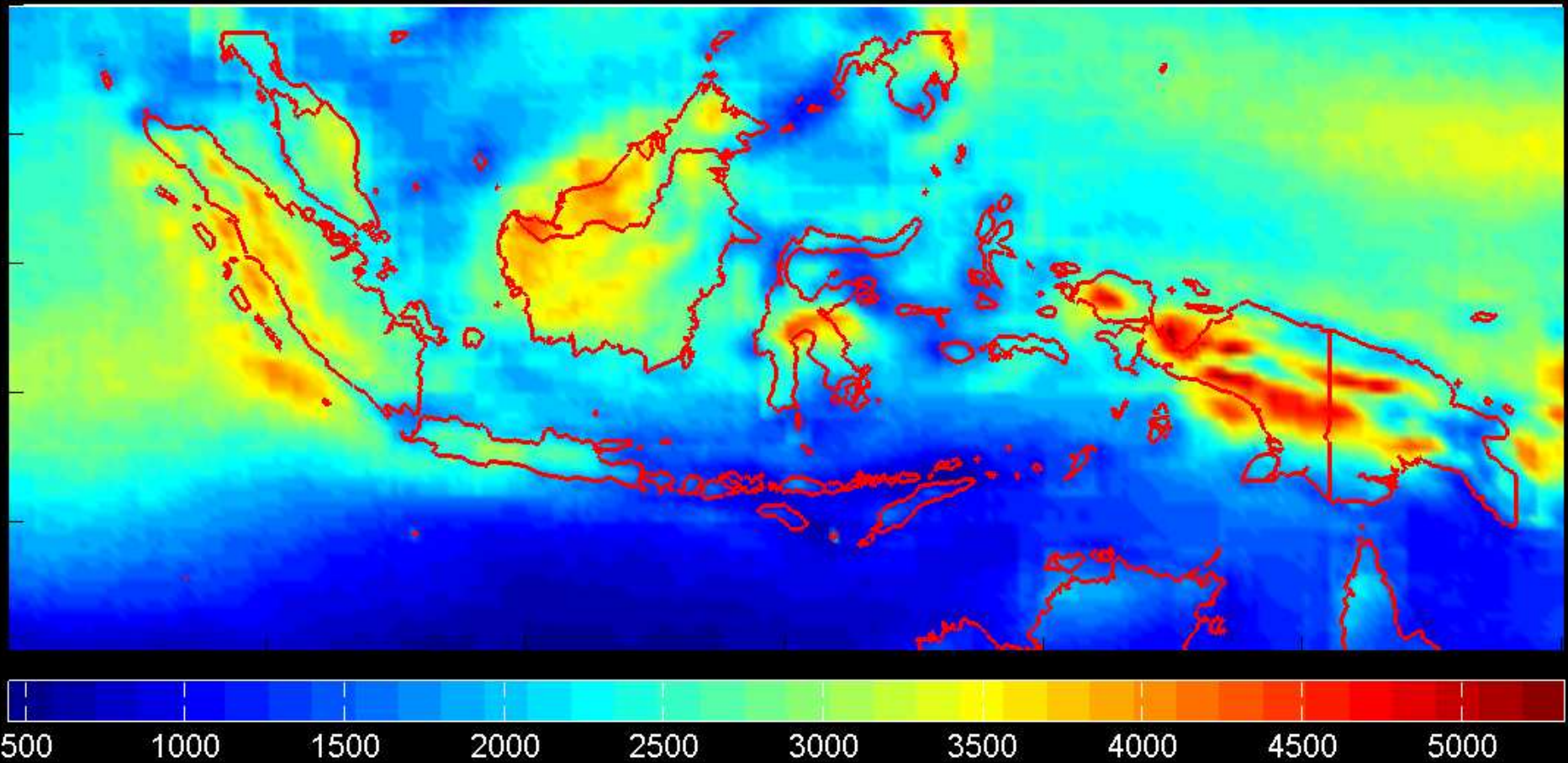
- Mainly monsoonal
- Three distinct rainfall climate regions



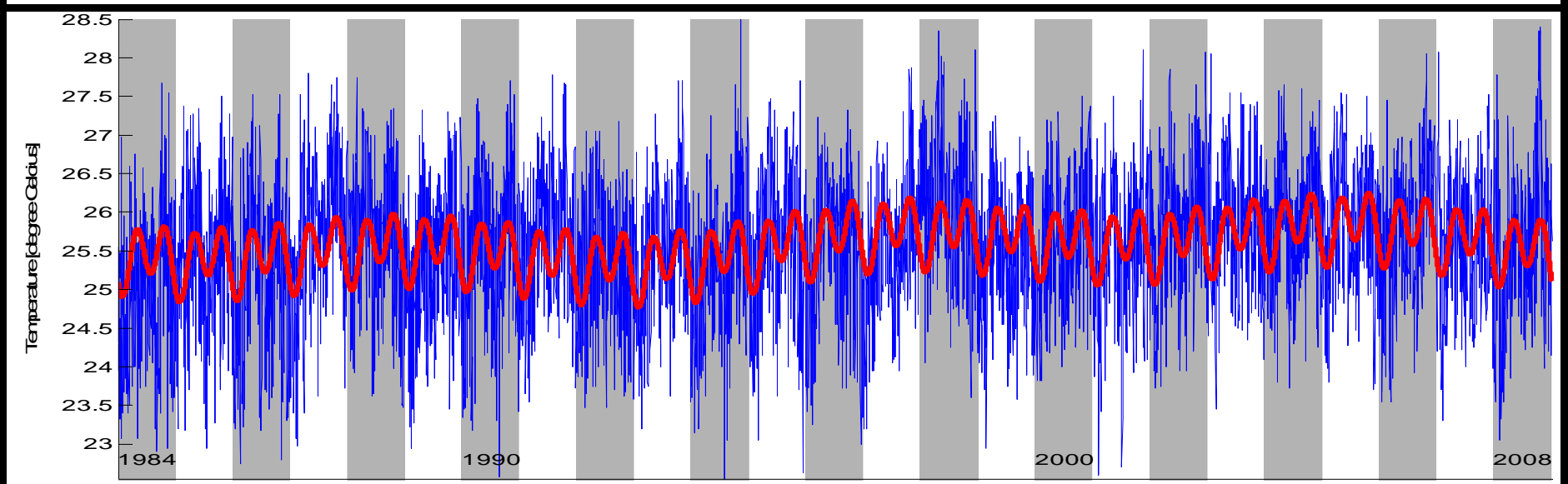
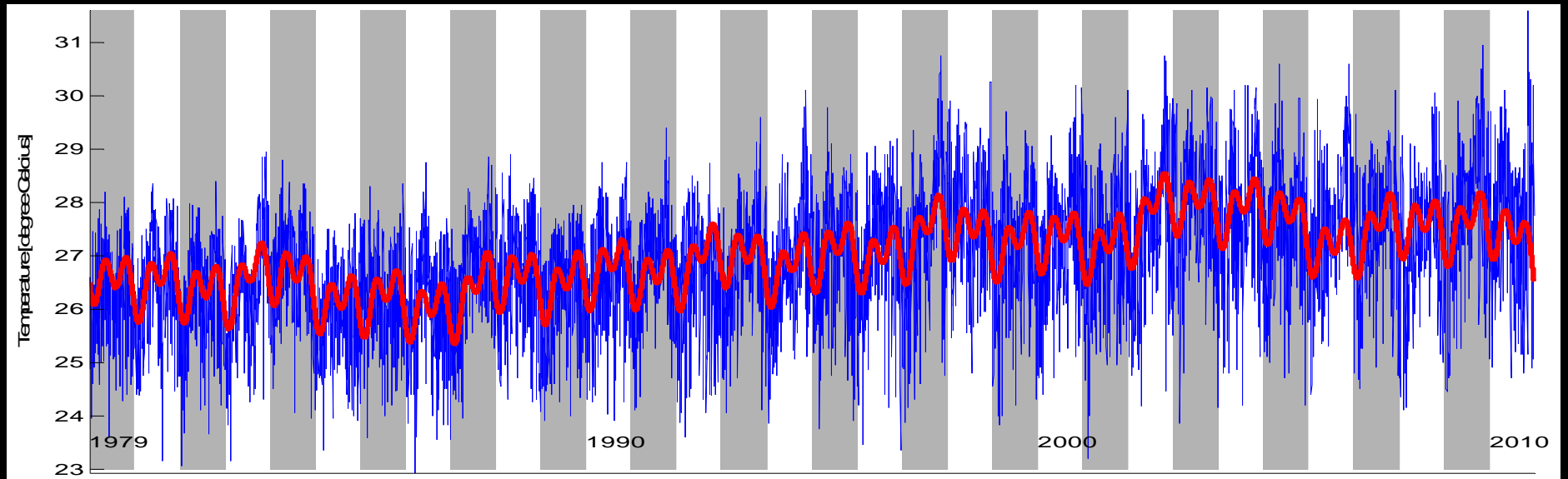
Aldrian and Susanto 2003



Yearly rainfall

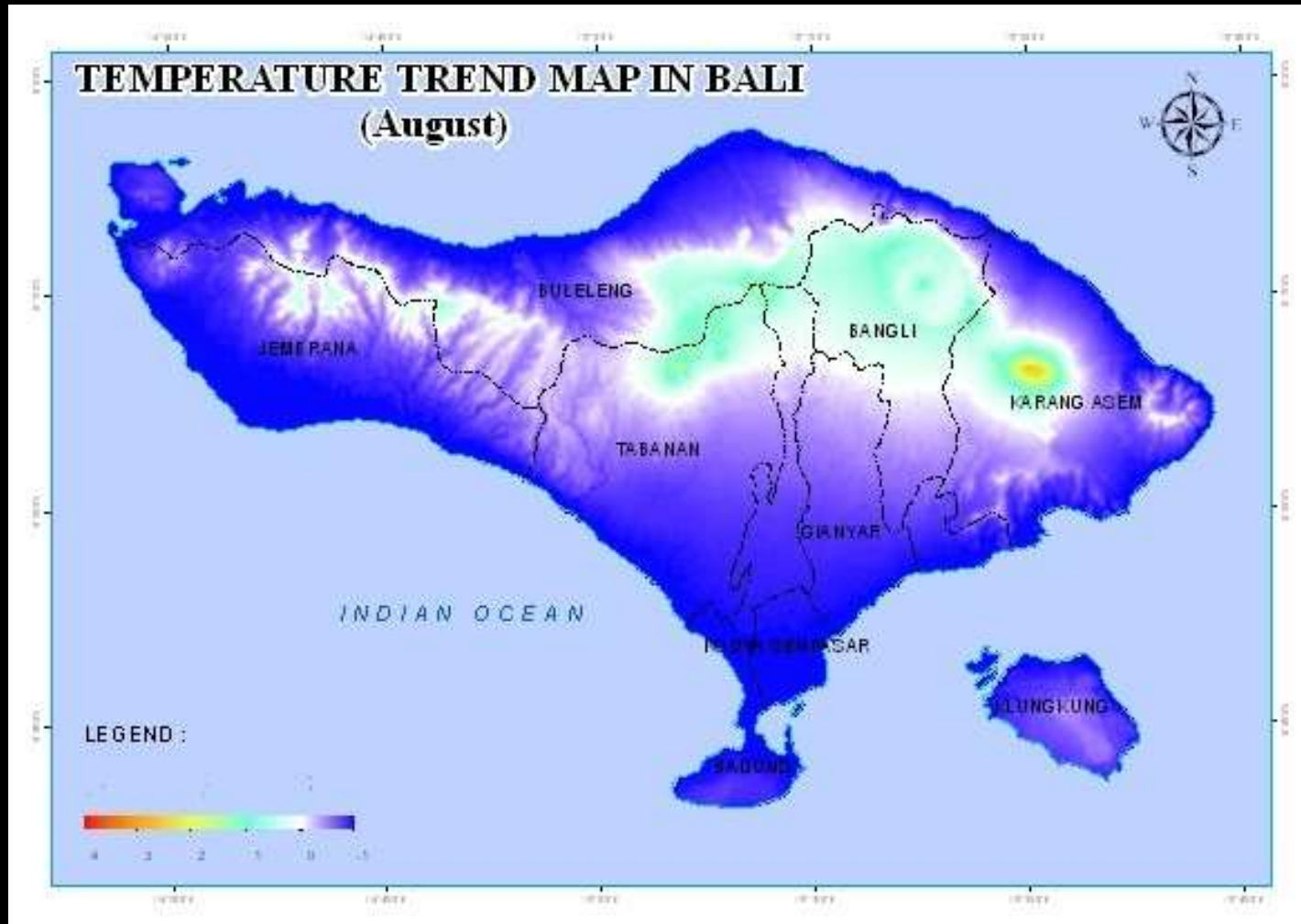


Long term trends – avrg. land temperature



Top: Pondok Betung – Jakarta ; Bottom: Darmaga – Bogor

Trend maps – average temperature



Other (major) islands are in progress ...



Major users sectors of climate services

- Agriculture
- Forestry
- Health
- Water resources
- Energy
- Fisheries
- Transportation
- Tourism



Current capacities for climate services

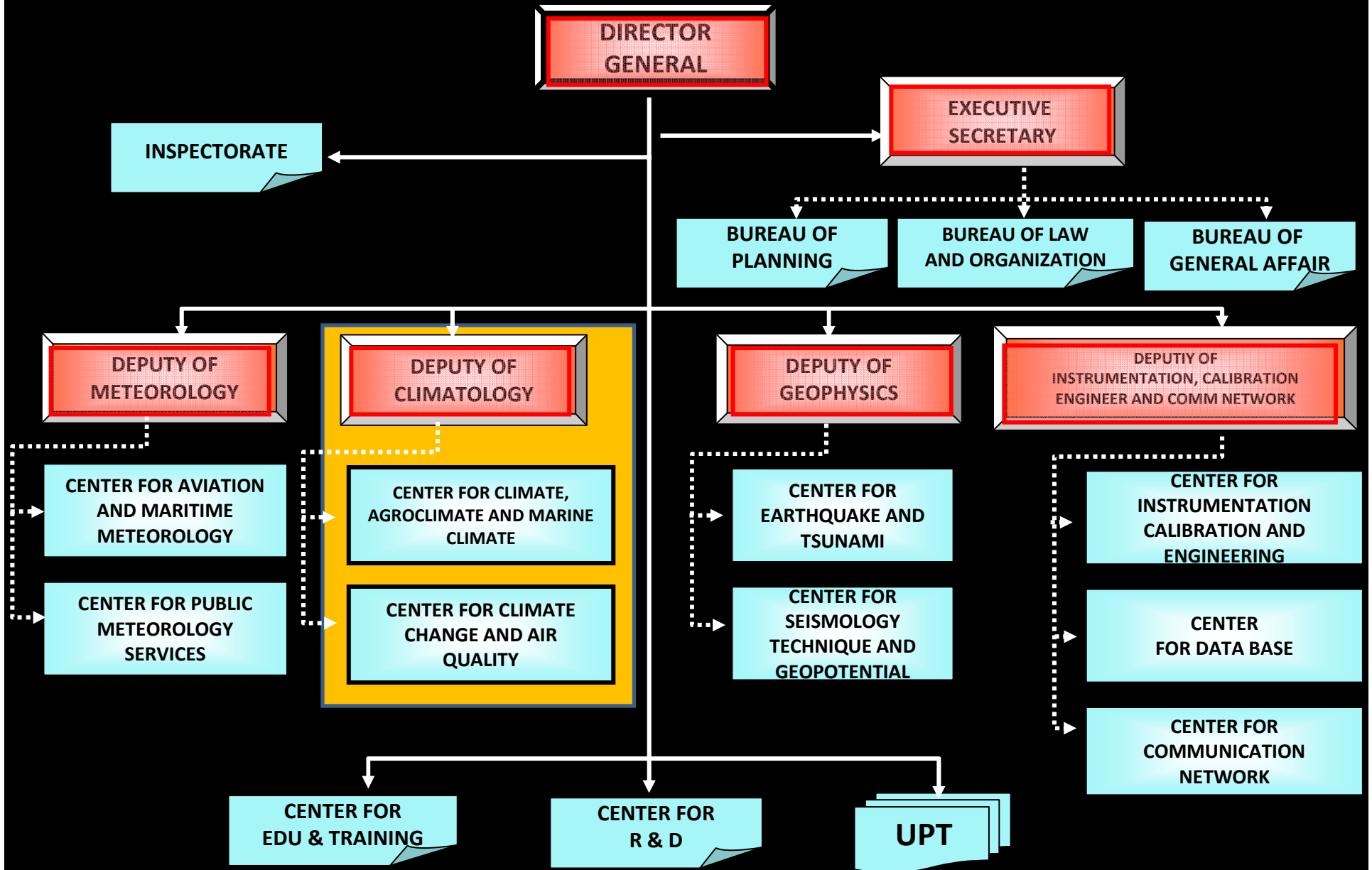
NATIONAL LAW NO. 31/2009 ON METEOROLOGY, CLIMATOLOGY, AND GEOPHYSICS

SEQUENCE OF CHAPTERS

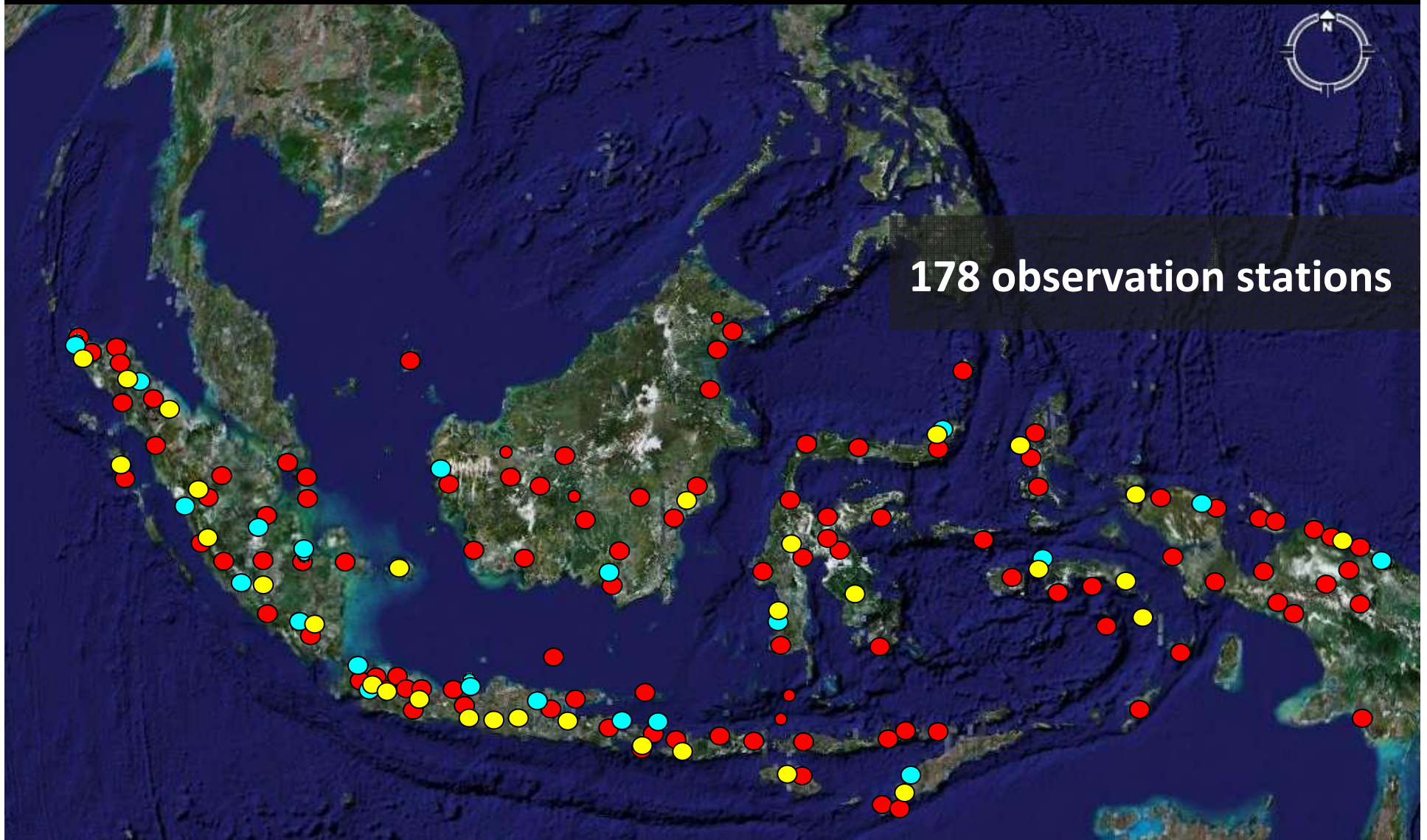
CHAPTER X	CLIMATE CHANGE ✓
CHAPTER XI	INTERNATIONAL COOPERATION
CHAPTER XII	RESEARCH, ENGINEERING, AND DEVELOPMENT ✓
CHAPTER XIII	HUMAN RESOURCES
CHAPTER XIV	RIGHTS AND PARTICIPATION OF THE PEOPLE
CHAPTER XV	PENAL PROVISIONS
CHAPTER XVI	TRANSITIONAL PROVISIONS
CHAPTER XVII	CLOSING PROVISIONS



Organizational structure of BMKG



Observational Networks – BMKG stations



● Meteorological stations (120)
Global Atmosphere Watch (1)

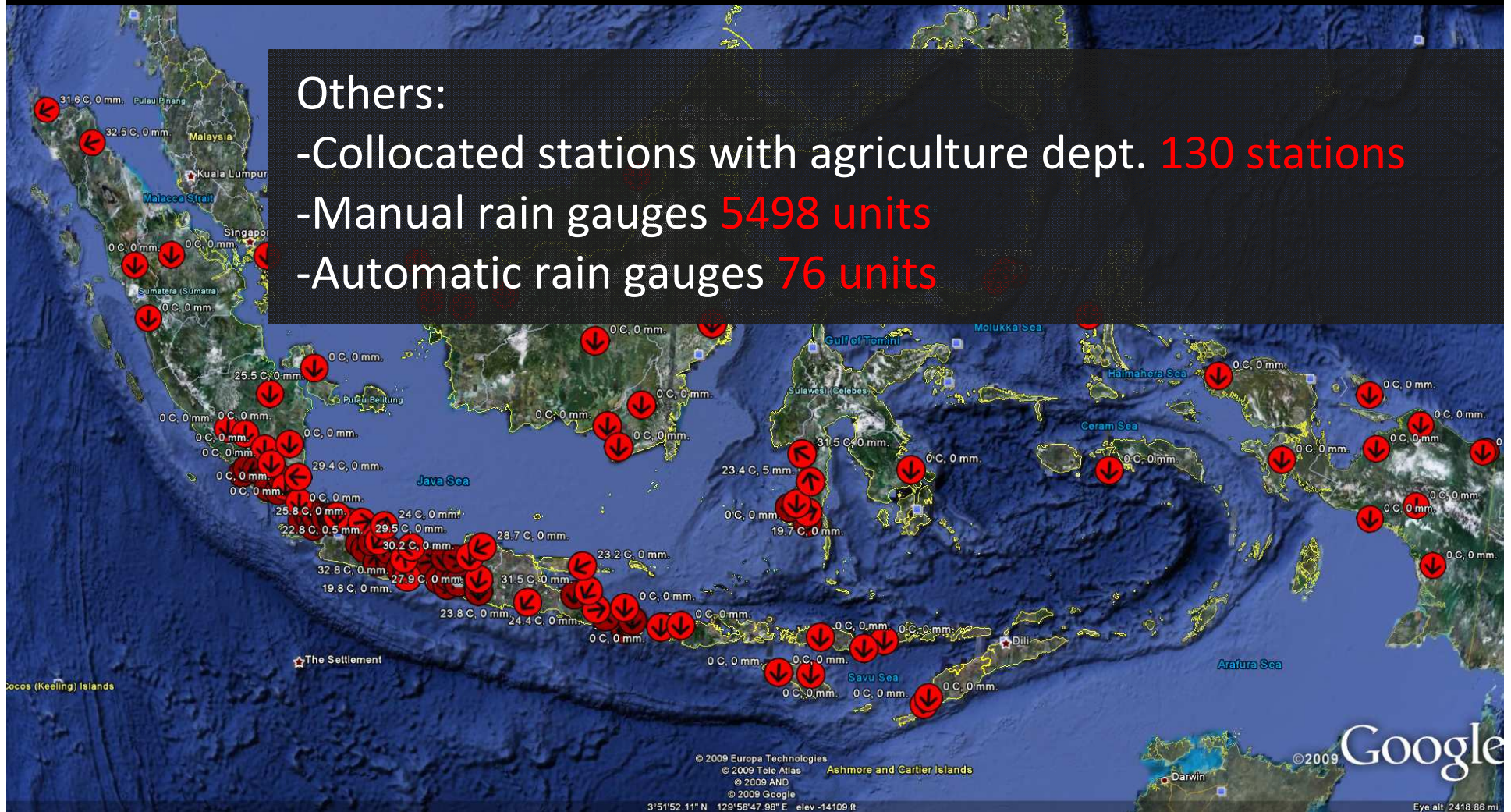
● Geophysical stations (31)
Regional offices (5)

● Climatological stations (21)

Observational Networks – Automatic Weather Stations **157 units**

Others:

- Collocated stations with agriculture dept. **130 stations**
- Manual rain gauges **5498 units**
- Automatic rain gauges **76 units**



Current status of climate services

Data access & dissemination – web based

BMKG - Peta dan Tabel Sinoptik

Peta dan Tabel Sinoptik
Badan Meteorologi, Klimatologi, dan Geofisika

Peta Sinoptik Tabel Sinoptik Data Historis

Lihat Data Sinoptik:
 Per jam Harian Bulanan

Data Harian

STASIUN
 Jakarta (Bmg)

INTERVAL WAKTU
 Tahun Bulan Hari
 Mulai: 2011 01 01
 Berhenti: 2011 01 31

VARIABEL

- Visibilitas Maks Visibilitas Min
- Visibilitas Rata-rata Kec Angin Maks
- Kec Angin Min Kec Angin Rata-rata
- Arah Angin Rata-rata Angin U Maks
- Angin U Min Angin U Rata-rata
- Angin V Maks Angin V Min
- Angin V Rata-rata Temperatur Maks
- Temperatur Min Temperatur Rata-rata
- Titik Embun Maks Titik Embun Min

Download CSV: Otomatis Nama File Baru

ID Stasiun : 96745 Lintang : -6.183
 Nama Stasiun : Jakarta (Bmg) Bujur : 106.83
 Wilayah/Tipe : Jawa

No.	Waktu/Tanggal	Visibilitas Maks (km)	Visibilitas Min (km)	Visibilitas Rata-rata (km)	Kec Angin Maks (m/s)	Kec Angin Min (m/s)	Kec Angin Rata-rata (m/s)	Arah Angin Rata-rata (°)	Angin U Maks (m/s)	Angin U Min (m/s)	Angin U Rata-rata (m/s)	Angin V Maks (m/s)	Angin V Min (m/s)	Angin V Rata-rata (m/s)	Temperatur Maks (°C)	Temperatur Min (°C)	Temperatur Rata-rata (°C)	Titik Embun Maks (mm)	Titik Embun Min (mm)	Titik Embun Rata-rata (mm)
1	2011-01-01	10.0	6.0	7.8	3.6	0.0	2.2	208.0	3.1	-2.1	1.1	1.1	0.0	0.3	29.6	25.6	27.6	2.0	0.0	1.0
2	2011-01-02	9.0	7.0	7.6	3.6	0.0	1.5	139.0	3.6	-0.5	1.1	1.1	0.0	0.3	31.4	25.4	28.4	2.0	0.0	1.0
3	2011-01-03	9.0	6.0	7.1	4.1	1.5	2.7	264.0	4.1	1.5	2.7	1.1	0.0	0.3	29.2	24.2	26.7	2.0	0.0	1.0
4	2011-01-04	10.0	6.0	7.6	3.1	0.0	1.9	251.0	2.9	0.0	1.7	0.4	-1.8	-0.5	31.4	25.4	28.4	2.0	0.0	1.0
5	2011-01-05	10.0	5.0	7.0	3.6	0.0	1.7	169.0	3.6	0.0	1.7	0.0	0.0	0.0	29.2	24.2	26.7	2.0	0.0	1.0
6	2011-01-06	10.0	5.0	7.6	2.6	0.0	1.4	170.0	2.6	0.0	1.4	0.4	-0.4	-0.0	32.4	24.6	28.5	2.0	0.0	1.0
7	2011-01-07	8.0	5.0	6.8	4.1	0.0	1.7	165.0	4.1	0.0	1.7	1.0	-1.2	0.1	29.2	25.0	27.1	2.0	0.0	1.0
8	2011-01-08	8.0	4.0	6.3	3.1	0.0	1.0	101.0	3.1	0.0	1.0	0.0	0.0	0.0	28.6	25.4	27.0	2.0	0.0	1.0
9	2011-01-09	9.0	6.0	6.8	4.1	0.0	3.0	243.0	4.1	0.0	3.0	0.6	-1.2	-0.4	30.4	23.4	26.9	2.0	0.0	1.0
10	2011-01-10	10.0	5.0	7.5	5.1	0.0	3.3	241.0	5.1	0.0	3.2	0.7	-0.9	-0.2	30.6	24.0	27.3	2.0	0.0	1.0
11	2011-01-11	10.0	6.0	7.5	4.1	0.0	2.6	240.0	4.1	0.0	2.5	0.5	-0.7	-0.2	30.8	25.8	28.3	2.0	0.0	1.0
12	2011-01-12	9.0	6.0	7.1	4.1	0.0	2.4	201.0	4.1	0.0	2.4	0.7	-0.7	-0.0	29.4	25.6	27.5	2.0	0.0	1.0
13	2011-01-13	9.0	4.5	6.7	5.1	1.5	3.7	271.0	4.6	1.5	3.5	2.6	-1.1	0.2	31.0	26.1	28.5	2.0	0.0	1.0
14	2011-01-14	10.0	6.0	7.6	3.1	0.0	2.1	238.0	3.1	0.0	2.1	0.0	-0.4	-0.1	29.8	26.2	28.0	2.0	0.0	1.0
15	2011-01-15	9.0	5.0	7.0	5.1	1.5	2.6	275.0	4.8	1.5	2.6	0.4	-1.8	-0.4	29.6	25.0	27.3	2.0	0.0	1.0
16	2011-01-16	9.0	6.0	6.9	4.1	0.0	1.5	173.0	4.1	0.0	1.5	0.0	-1.2	-0.2	27.4	25.4	26.4	2.0	0.0	1.0
17	2011-01-17	10.0	5.0	7.5	6.7	0.0	2.0	148.0	6.7	0.0	1.5	0.0	-3.6	-0.5	29.4	25.0	27.2	2.0	0.0	1.0
18	2011-01-18	9.0	5.0	6.9	3.1	0.0	0.9	84.0	2.9	0.0	0.8	0.0	-1.5	-0.4	28.6	24.9	26.7	2.0	0.0	1.0

Recently developed, web based data access (3hourly, daily, monthly)



Data access & dissemination – web based



Peta Sinoptik Tabel Sinoptik Data Historis

Lihat Data Sinoptik:



Data Harian

STASIUN

Jakarta (Bmg)

INTERVAL WAKTU

Tahun Bulan Hari
 Mulai 2003 01 01
 Berhenti 2011 10 30

VARIABEL

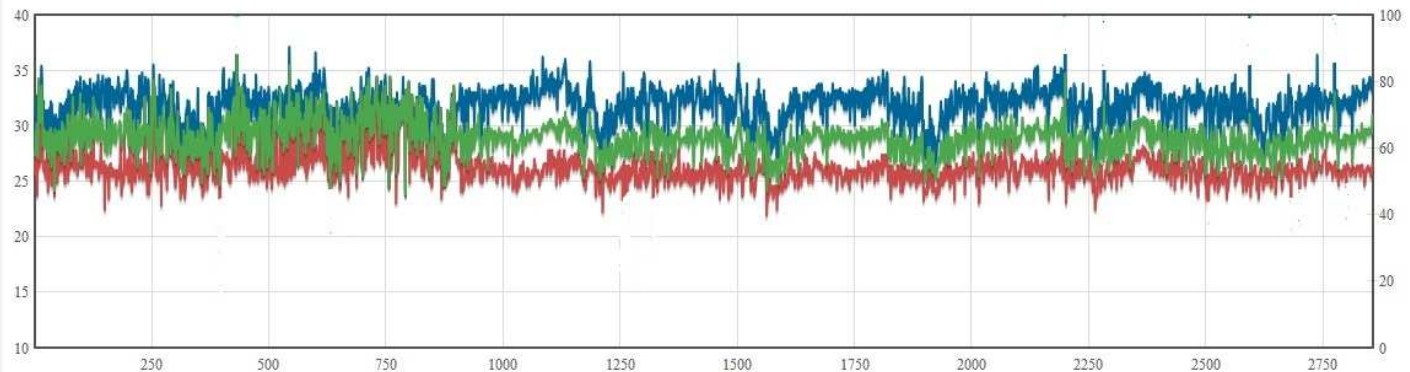
Pilih Semua Hapus Semua

- Visibilitas Maks
- Visibilitas Rata-rata
- Kec Angin Maks
- Kec Angin Min
- Kec Angin Rata-rata
- Arah Angin Rata-rata
- Angin U Maks
- Angin U Min
- Angin U Rata-rata
- Angin V Maks
- Angin V Min
- Angin V Rata-rata
- Temperatur Maks
- Temperatur Min
- Temperatur Rata-rata
- Titik Embun Maks
- Titik Embun Min
- Titik Embun Rata-rata
- Tekanan Maks
- Tekanan Rata-rata
- Tekanan Min
- Tekanan Rata-rata
- SLP Maks
- SLP Min
- SLP Rata-rata
- Curah Hujan Maks
- Curah Hujan Min
- Curah Hujan Total

Submit

Download CSV: Otomatis Nama File Baru

OK



ID Stasiun : 96745 Lintang : -6.1833
 Nama Stasiun : Jakarta (Bmg) Bujur : 106.8333
 Wilayah/ Tipe : Jawa

No.	Waktu/Tanggal	Temperatur Maks (°C)	Temperatur Min (°C)	Temperatur Rata-rata (°C)
1	2003-01-01	27.0	23.0	27.0
2	2003-01-02	30.0	25.0	27.3
3	2003-01-03	32.0	27.0	29.5
4	2003-01-06	30.0	25.0	27.5
5	2003-01-07	32.0	25.0	30.2
6	2003-01-08	32.0	23.0	29.0
7	2003-01-09	32.0	27.0	29.0
8	2003-01-10	27.0	27.0	27.0
9	2003-01-12	34.0	34.0	34.0
10	2003-01-13	32.0	26.0	30.0
11	2003-01-14	33.0	28.0	31.0
12	2003-01-15	32.0	26.0	30.0
13	2003-01-16	32.0	31.0	32.0
14	2003-01-17	32.0	26.0	30.0
15	2003-01-19	35.0	31.0	33.6
16	2003-01-20	38.0	31.0	32.3
17	2003-01-21	32.0	30.0	31.0
18	2003-01-22	29.0	27.0	28.0

Example for daily average, minimum and maximum temperature

Option to show graphs of the selected variable

Data access & dissemination – web based



Peta Sinoptik Tabel Sinoptik Data Historis

Lihat Data Sinoptik:



Data Harian

STASIUN

Jakarta (Bmg)

INTERVAL WAKTU

Tahun Bulan Hari
Mulai 2003 01 01
Berhenti 2011 10 30

VARIABEL

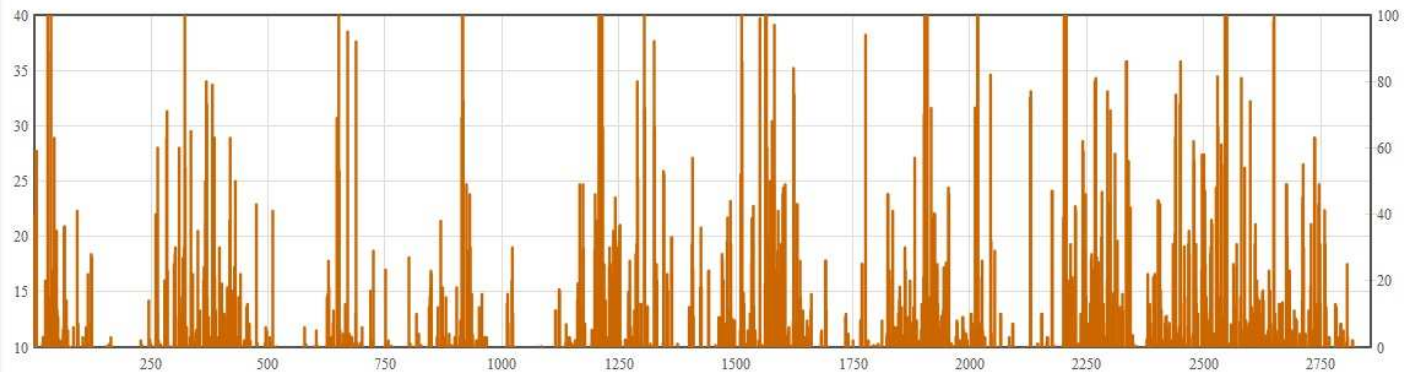
Pilih Semua Hapus Semua

- Visibilitas Maks
- Visibilitas Rata-rata
- Kec Angin Min
- Arah Angin Rata-rata
- Angin U Min
- Angin V Maks
- Angin V Rata-rata
- Temperatur Min
- Titik Embun Maks
- Titik Embun Rata-rata
- Tekanan Min
- SLP Maks
- SLP Rata-rata
- Curah Hujan Min
- Visibilitas Min
- Kec Angin Maks
- Kec Angin Rata-rata
- Angin U Maks
- Angin U Rata-rata
- Angin V Min
- Temperatur Maks
- Temperatur Rata-rata
- Tekanan Maks
- Tekanan Rata-rata
- SLP Min
- Curah Hujan Maks
- Curah Hujan Total

Submit

Download CSV: Otomatis Nama File Baru

OK



ID Stasiun : 96745 Lintang : -6.1833
Nama Stasiun : Jakarta (Bmg) Bujur : 106.8333
Wilayah/ Tipe : Jawa

No.	Waktu/Tanggal	Curah Hujan Total (mm)
1	2003-01-01	0.0
2	2003-01-02	40.0
3	2003-01-03	20.0
4	2003-01-06	59.0
5	2003-01-07	59.0
6	2003-01-08	0.0
7	2003-01-09	0.0
8	2003-01-10	0.0
9	2003-01-12	0.0
10	2003-01-13	0.0
11	2003-01-14	0.0
12	2003-01-15	0.0
13	2003-01-16	0.0
14	2003-01-17	0.0
15	2003-01-19	0.0
16	2003-01-20	0.0
17	2003-01-21	0.0

Example for daily rainfall measurements

Data access & dissemination – web based

BMKG - Peta dan Tabel Sinoptik

Peta dan Tabel Sinoptik
Badan Meteorologi, Klimatologi, dan Geofisika

Peta Sinoptik Tabel Sinoptik Data Historis

Currently in development phase

'Pseudo' real time display of observation data

Copyrights © 2011 Badan Meteorologi, Klimatologi, dan Geofisika
Best viewed by Mozilla Firefox with 1280x760 px screen resolution
Powered by MySQL, PHP, GoogleMap

Data access & dissemination – web based

Peta dan Tabel Sinoptik
Badan Meteorologi, Klimatologi, dan Geofisika

Peta Sinoptik Tabel Sinoptik Data Historis

Kec. Angin Temperatur Titik Embun Tekanan SLP Int. Hujan

Stasiun Palangkaraya

ID Stasiun : 96655 Lintang : -1.0000
Wilayah/Tipe : Kalimantan Bujur : 114.0000

Perjam		Harian			Bulanan				
Waktu	I (mm/jam)	Waktu	I Max	I Min	I Ave	Waktu	I Max	I Min	I Ave
12/09/11 12:00	0.0	12/09/11	0.0	0.0	0.0	09/11	53.0	0.0	126.2
12/09/11 09:00	0.0	11/09/11	0.0	0.0	0.0	08/11	9.0	0.0	39.9
12/09/11 06:00	0.0	10/09/11	0.5	0.5	0.5	07/11	70.0	0.0	233.5

Example of data from observation station

Copyrights © 2011 Badan Meteorologi, Klimatologi, dan Geofisika
Best viewed by Mozilla Firefox with 1280x760 px screen resolution
Powered by MySQL, PHP, GoogleMap

Data peta ©2011 Europa Technologies, GBRMF

Historical data digitation – with KNMI



BMKG



Home |

Digitisasi

Digitisasi Data Historis (DiDaH) is a two-year project (2010-2012) to digitize historical climate data from Indonesia over the period 1850-present. Didah is a joint project of the Indonesian Meteorological and Climatological Agency (BMKG) and the Netherlands Meteorological Institute (KNMI).

The main deliverables of Didah are:

1. Digitized data (plus metadata)
2. Website on indices of extremes for the region
3. Capacity building (workshops, exchange of scientists).

DARE
DATA REscue from the colonial era,
some data dating back to late 18th
century

BATAVIA OBSERVATORY.



Routine products (1)

- Forecast of rainy and dry season onset
- Forecast of monthly rainfall (up to 3 month lead time)
- Soil moisture information
- Agroclimate suitability map
- ENSO & IOD indices forecast
- Short range Sea Surface Temperature forecast



Routine products (2)

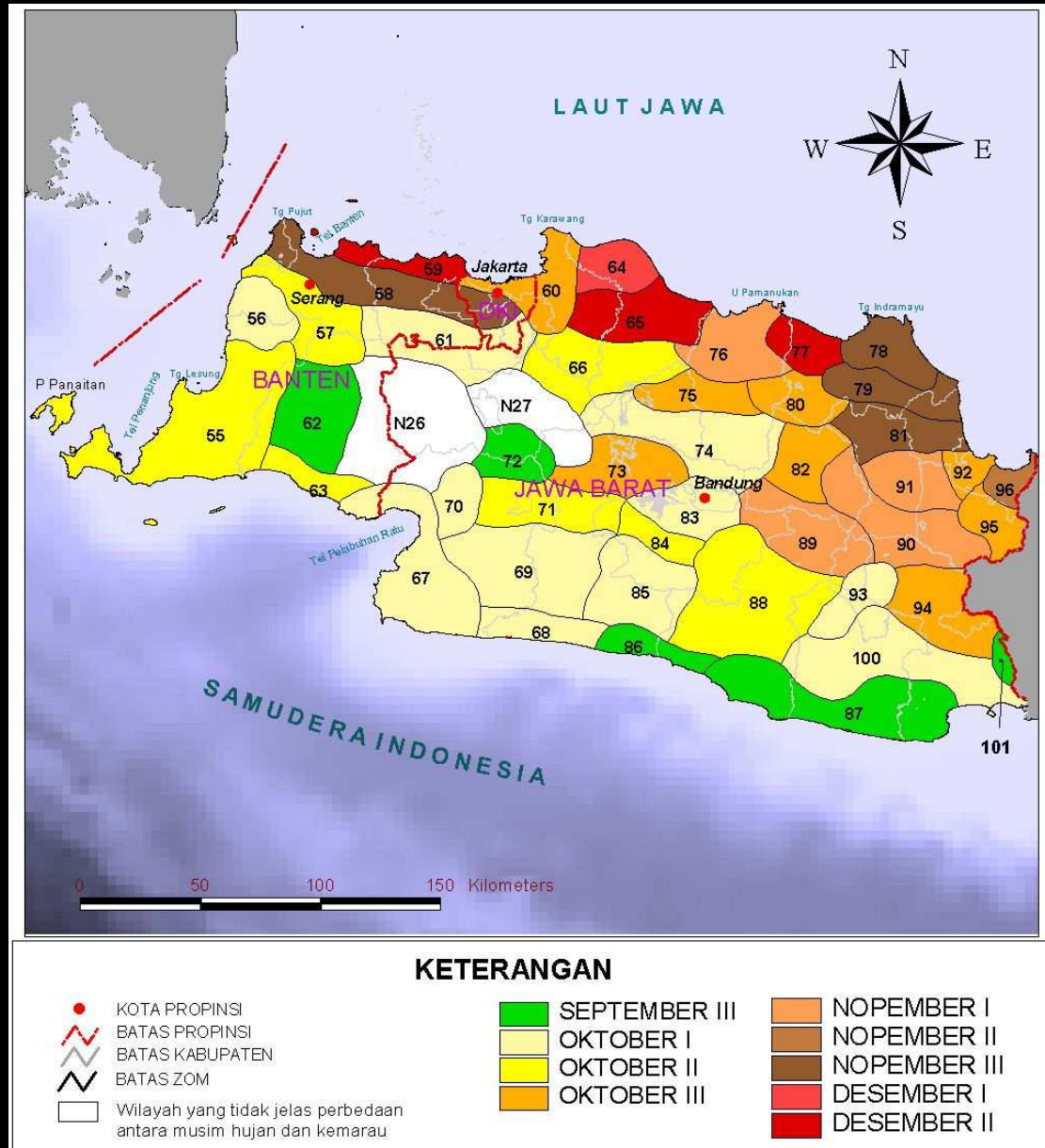
- *Return period map of maximum rainfall*
- *Climatology of rainfall, temperature, wind*
- *Climatology of rainy and dry season onset*
- *Maps of shifts of rainy and dry season onset*
- *Vulnerability map to drought for rice producing provinces*
- *Climate Field School for farmers in crop producing provinces*
- ...



Forecast of rainy season onset

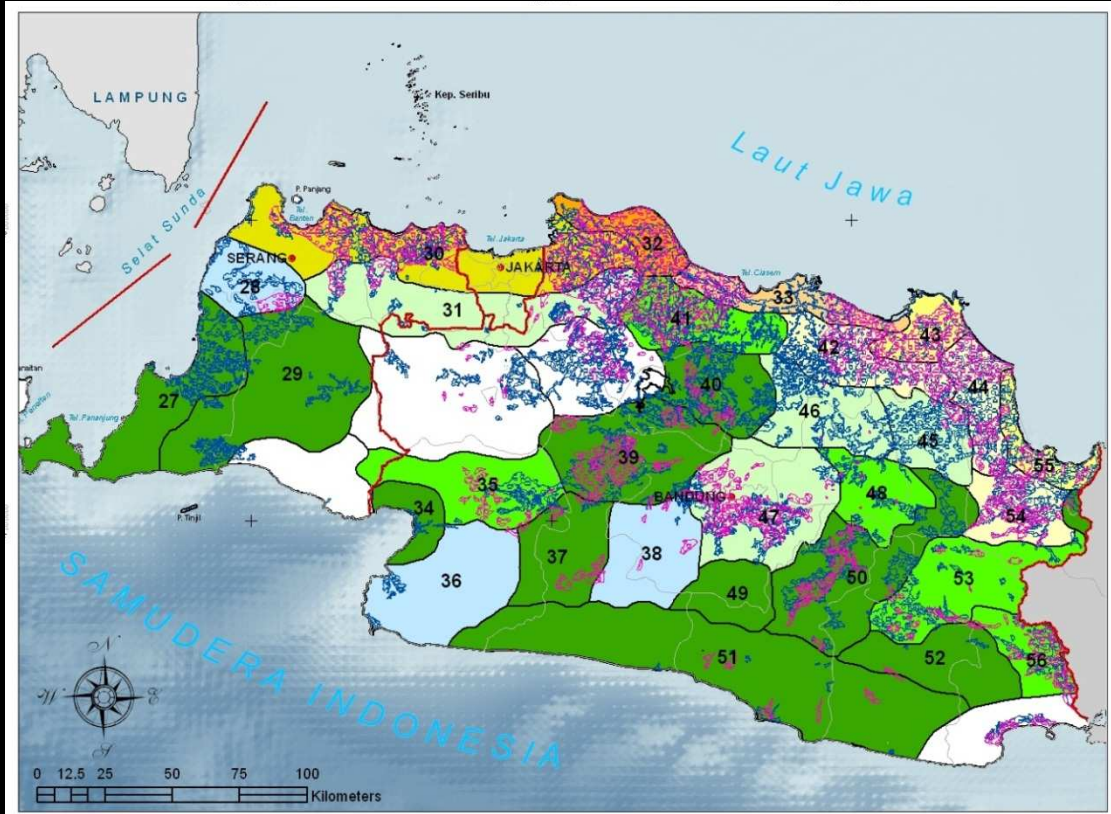
Released yearly on September

Example: onset of rainy season 2011



Forecast of dry season onset

Released yearly on March

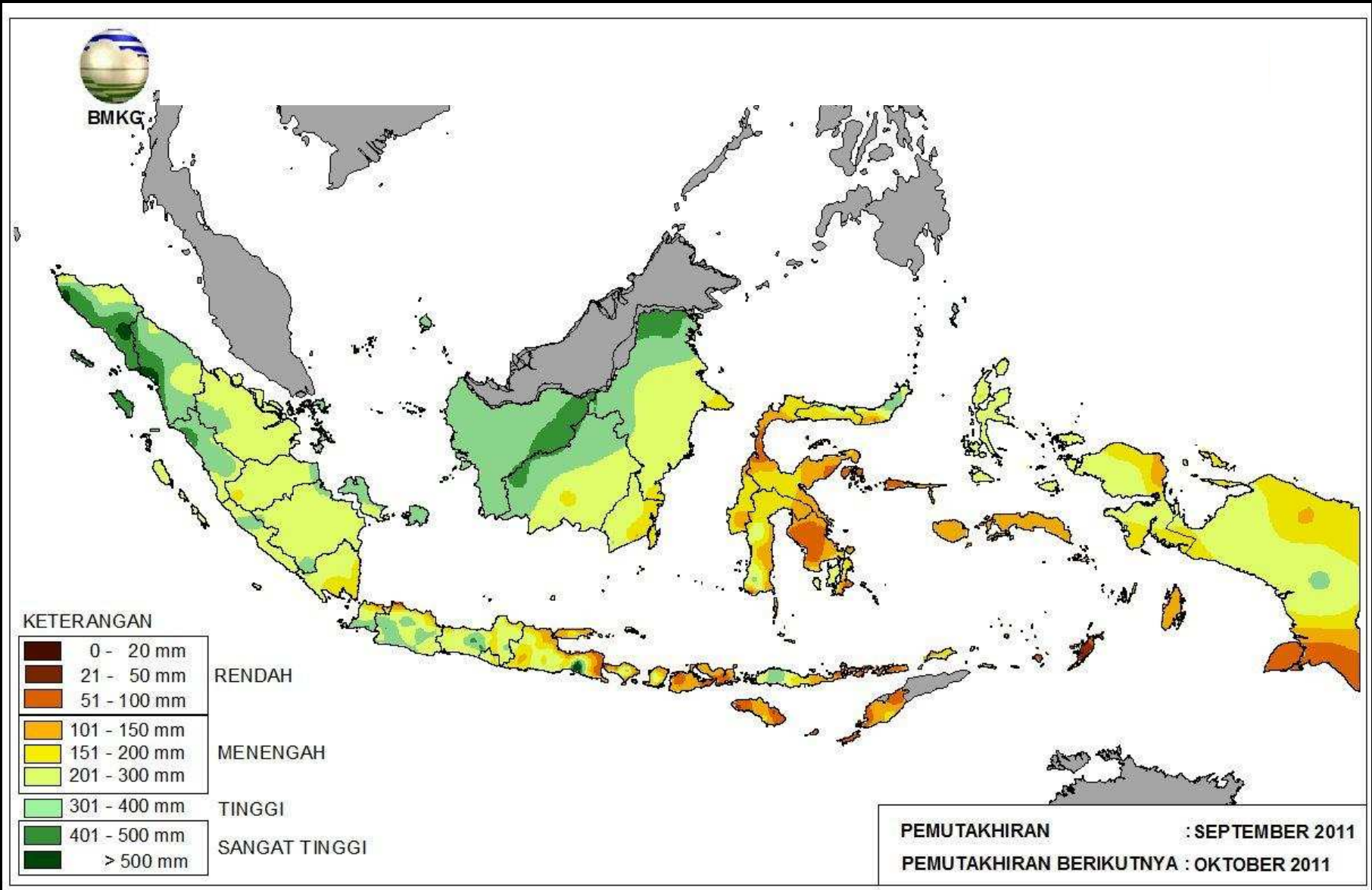


KETERANGAN

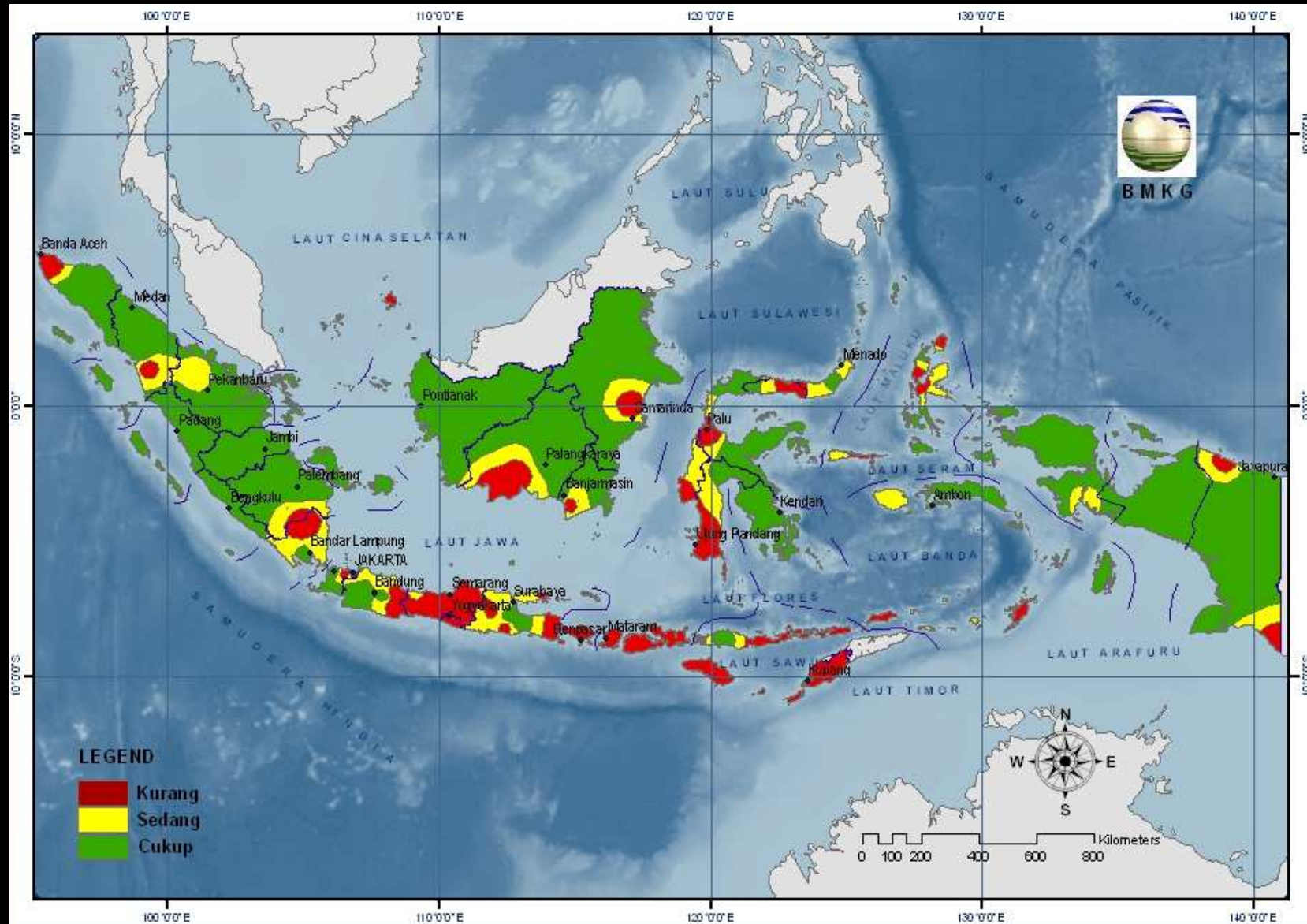
- Kota Propinsi
 - Batas Propinsi
 - Batas ZOM
 - Batas Kabupaten
 - ▨ Sawah Non Irigasi
 - ▨ Sawah Irigasi
 - Wilayah yang tidak jelas perbedaan antara musim hujan dan kemarau
- | | | | |
|-------------|-----------|------------|----------|
| ■ APRIL II | ■ MEI I | ■ JUNI I | ■ JULI I |
| ■ APRIL III | ■ MEI II | ■ JUNI II | |
| | ■ MEI III | ■ JUNI III | |

Example: onset of dry season 2011

Forecast of monthly rainfall for November 2011



Soil moisture information



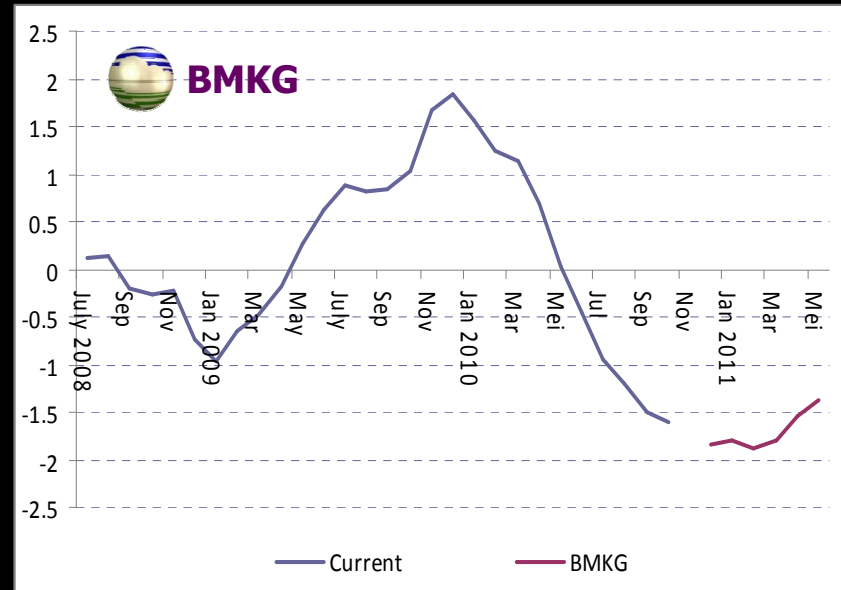
Agriculture suitability map



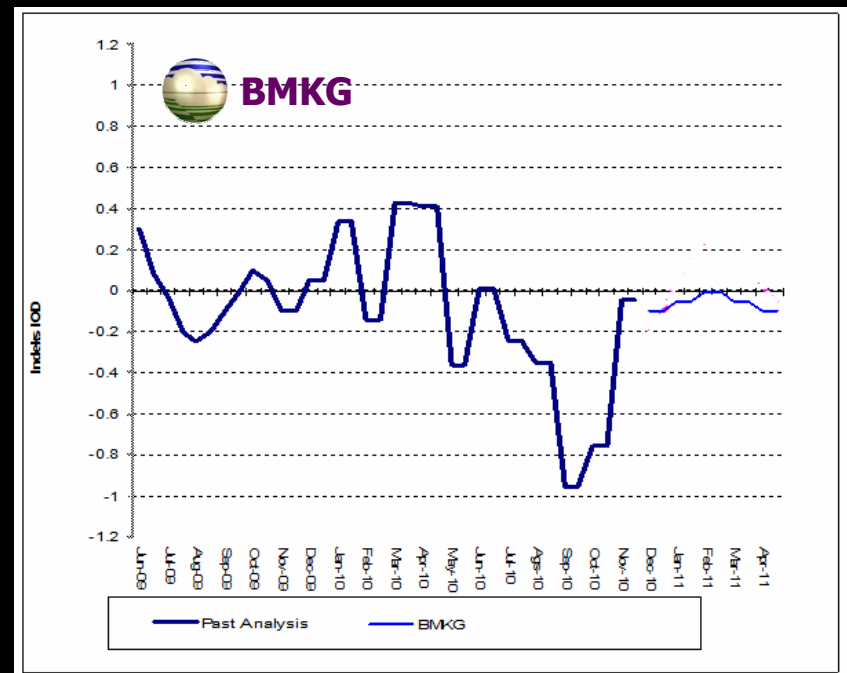
Climatic suitability for paddy

<p>TINGKAT KESESUAIAN AGROKLIMAT UNTUK TANAMAN PADI JAWA BARAT, BANTEN DAN DKI JAKARTA</p>  <p>BMG BADAN METEOROLOGI DAN GEOFISIKA www.bmg.go.id</p>	<p>KETERANGAN</p> <ul style="list-style-type: none"> ● Kota Propinsi ○ Kota Kabupaten — Batas Propinsi — Batas Kabupaten — Sungai ■ Danau 	<p>TINGKAT KESESUAIAN</p> <ul style="list-style-type: none"> ■ Kesesuaian Tinggi ■ Kesesuaian Sedang ■ Kesesuaian Rendah ■ Tidak Sesuai 	 <p>SKALA 1 : 1.000.000</p>  <p>Sumber : 1. Data parameter iklim P. Jawa Tahun 1971 - 2005 : BMG 2. Peta RBI Skala 1 : 25.000 : BAKOSURTANAL 3. Peta Sistem Lahan Skala 1 : 250.000 : BAKOSURTANAL</p>
---	--	--	---

Nino 3.4 index forecast



IOD index forecast



Monthly SST forecast

- Data from Terra/Moderate Resolution Imaging Spectroradiometer (**MODIS**), IR band
- Coverage: **Feb, 2000 - present**
- Spatial resolution: **9km**
- Time series / statistical based forecasting



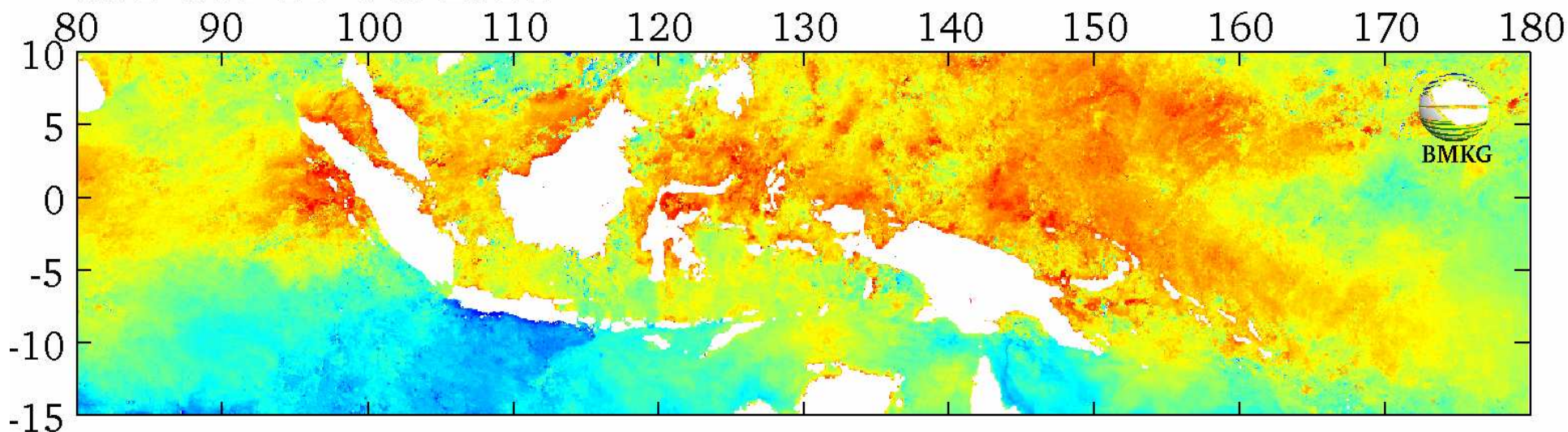
Implementation

- Updated weekly
- The forecast code is implemented in a computing **cluster** environment:
- **Forecast** up to 1 month lead time
- **SST anomaly**
- Automatic **image & Google earth KMZ** generation
- Automatic dissemination through **email** and **web**

Badan Meteorologi Klimatologi dan Geofisika

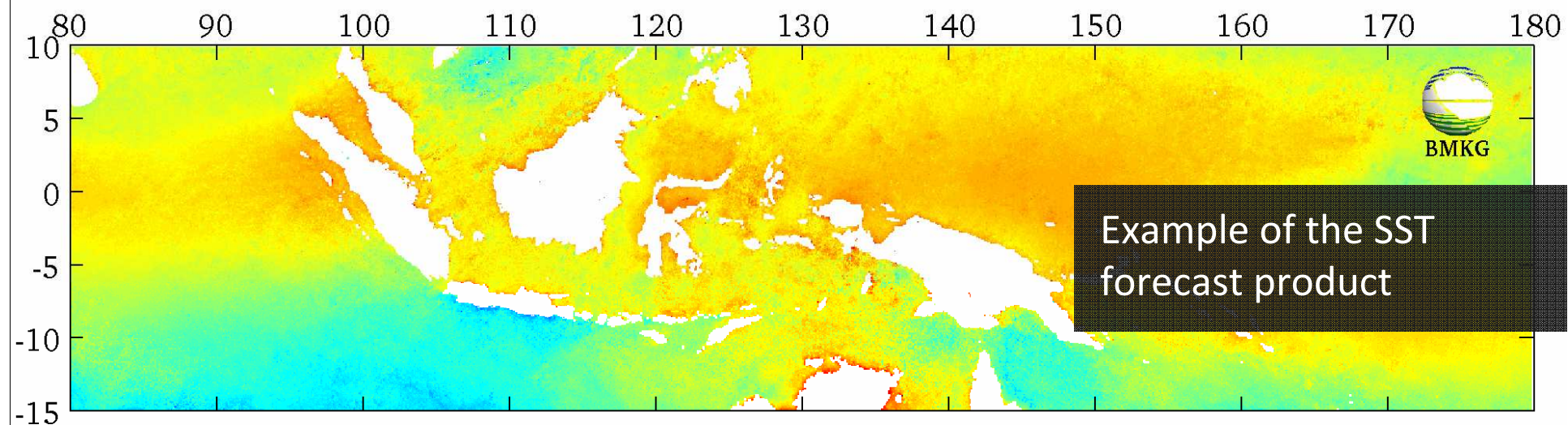


SST Obs 15-Oct-2011

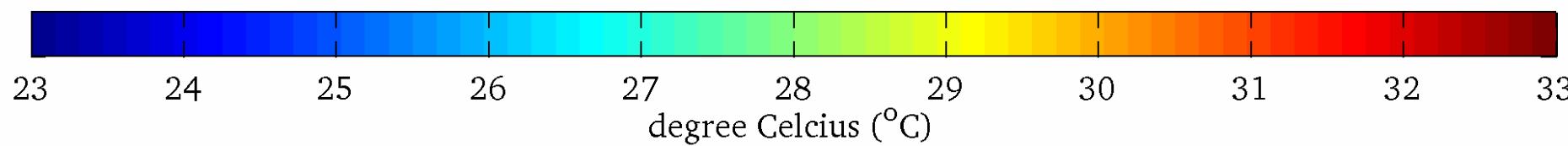


SST Forecast 16-Nov-2011

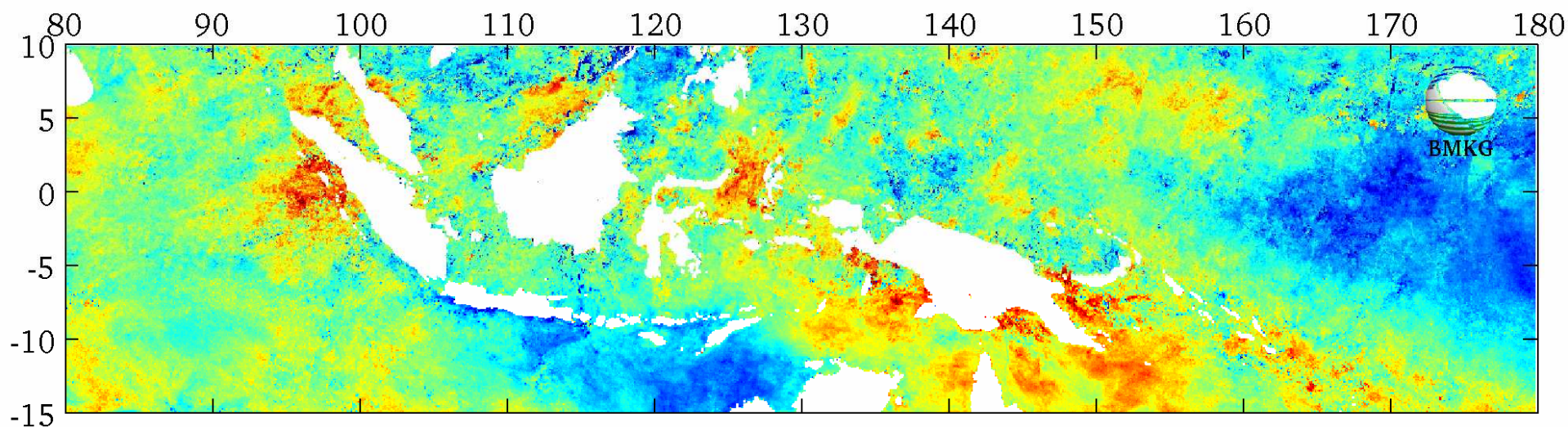
Release 15-Oct-2011



Example of the SST forecast product



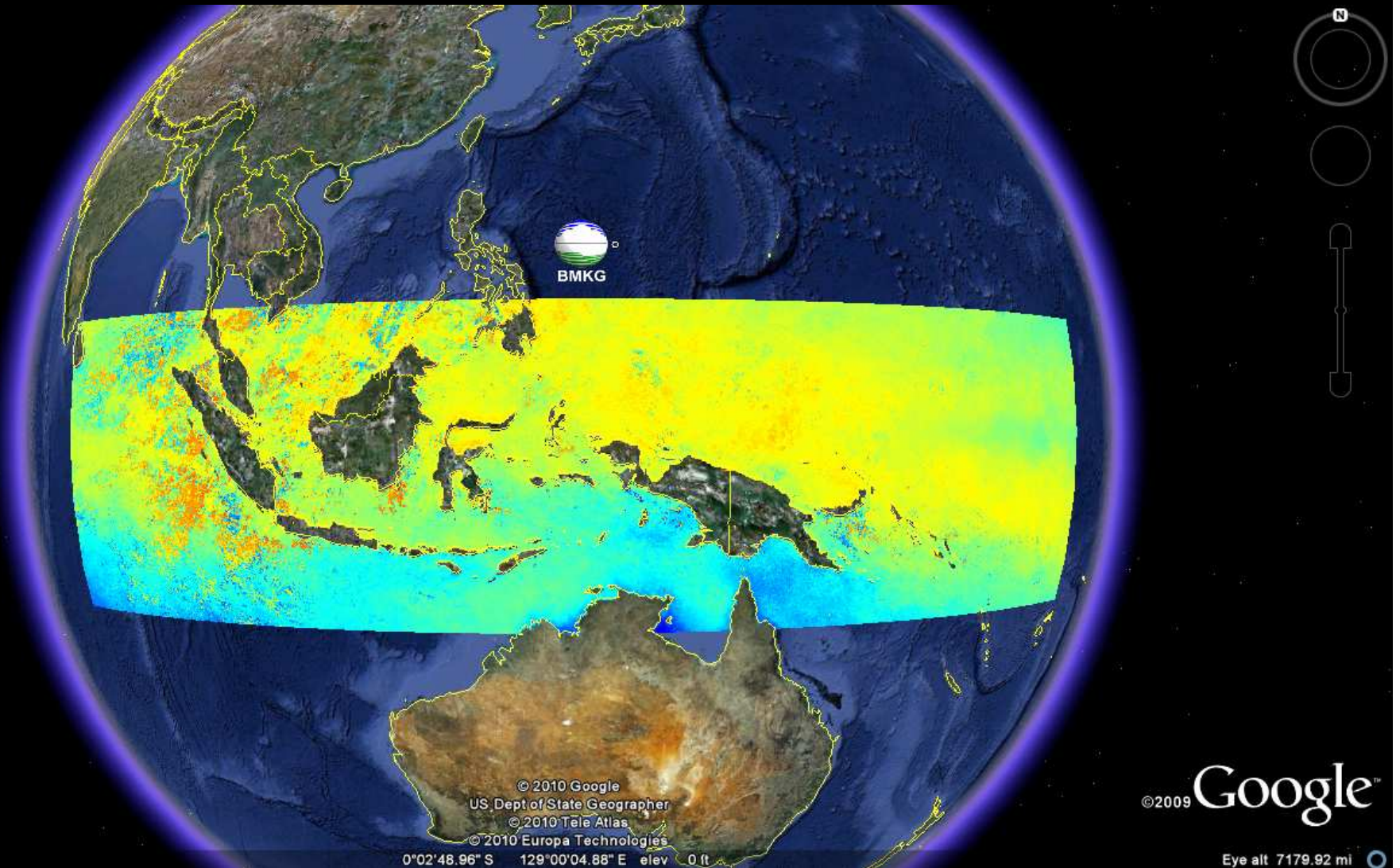
SST Anom 15-Oct-2011



Anomaly relative to 2000 - 2009



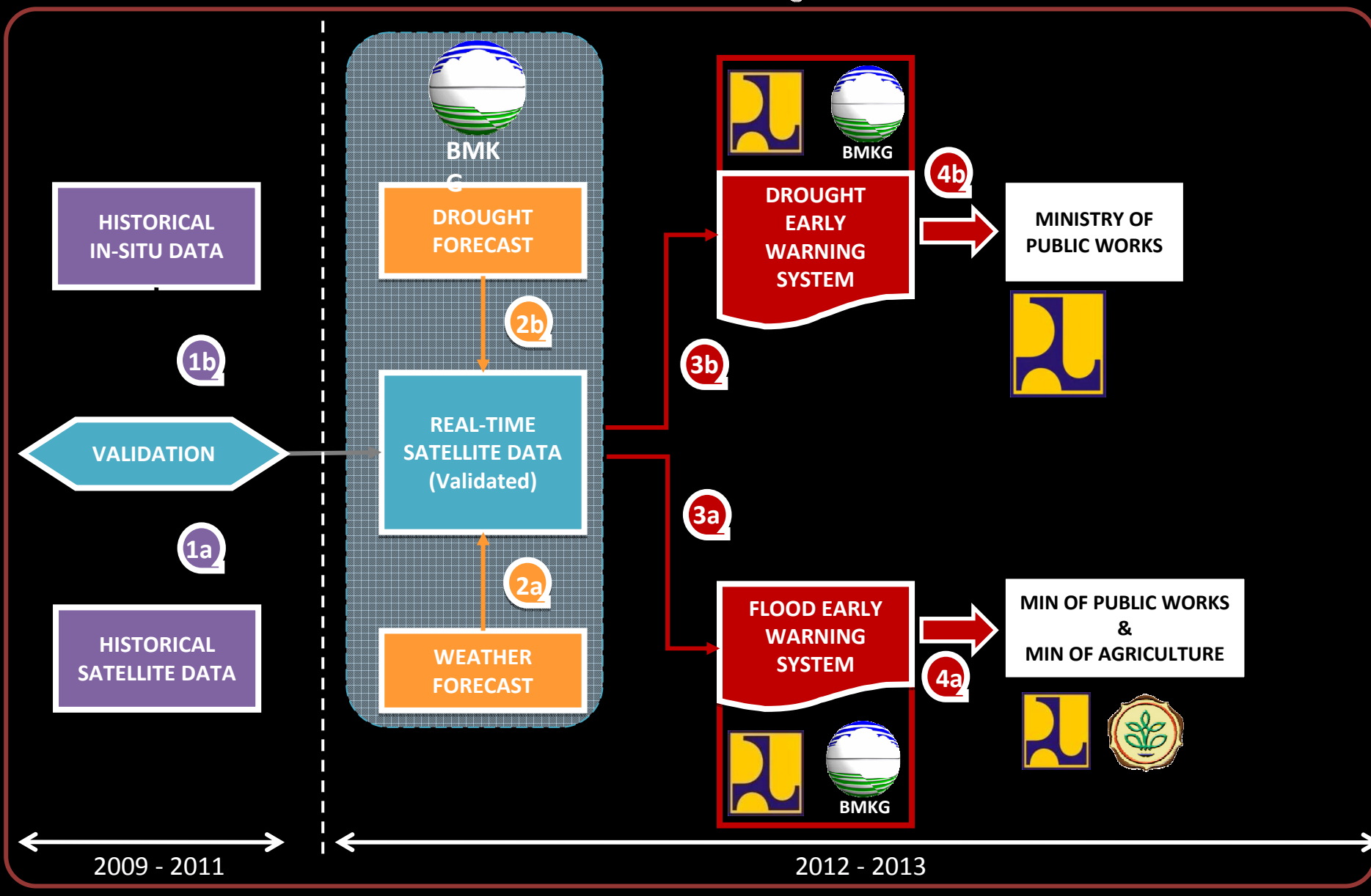
SST image in Google Earth





DROUGHT EARLY WARNING SYSTEM

Under development



Needs

- Ocean observations
- Operational coupled ocean & regional atmosphere model (weather and climate)
- Capacity building for downscaling techniques
- Capacity building for tailoring climate information to users
- ...



Thank you for your attention

...

Dr. Ardhasena Sopaheluwakan
Center for Climate Change and Air Quality
Agency for Meteorology Climatology and Geophysics
ardhasena@bmet.go.id

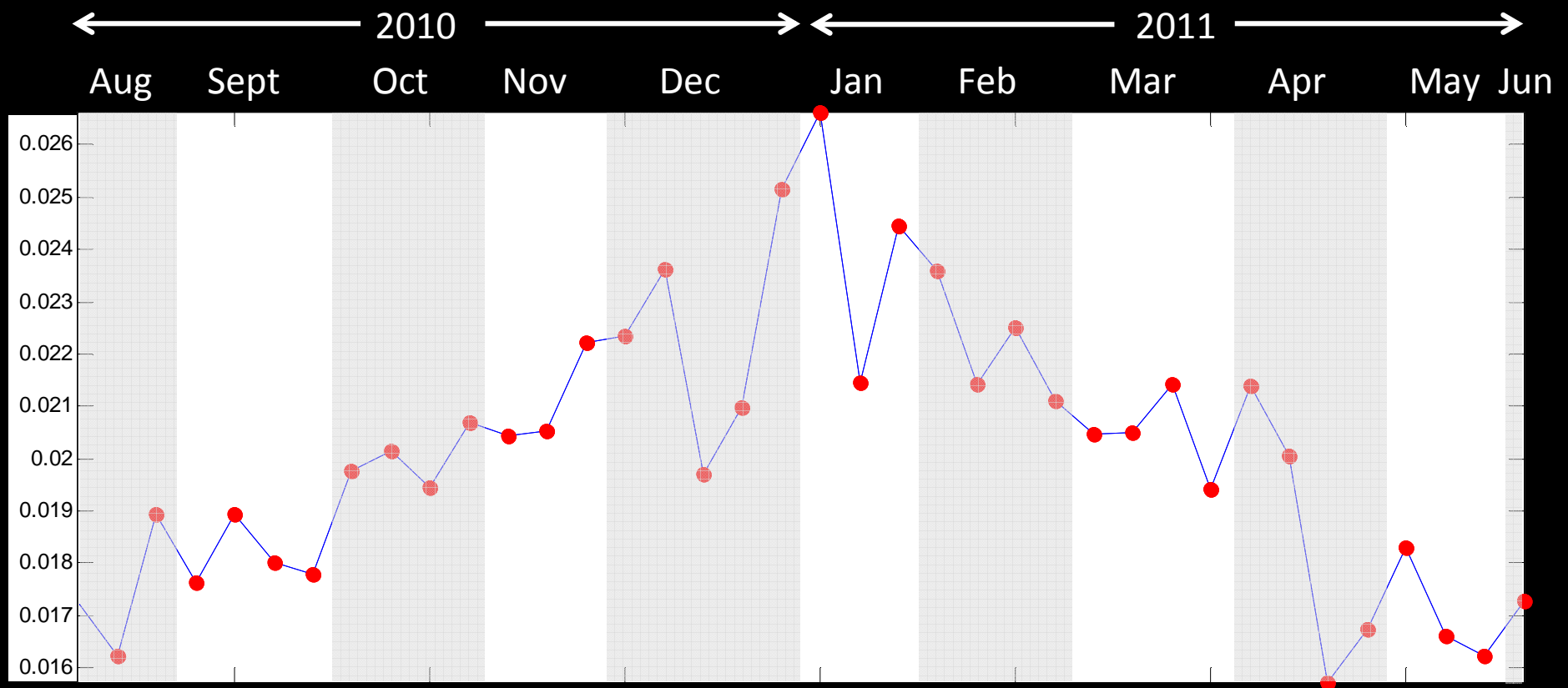
Badan Meteorologi Klimatologi dan Geofisika



Error analysis

- Normalized (non-dimensional) absolute error (norm. L^1 error).

$$E = \frac{\iint_{\Omega} |SST_{obs}(x, y) - SST_{for}(x, y)| d\Omega}{\iint_{\Omega} SST_{obs}(x, y) d\Omega}$$



Average normalized error between 1.5% - 2.5%



2010 ...

- High rainfall rate over Indonesia throughout the year
- Floods even in the normal dry period
- High SST anomaly $> 1^{\circ}\text{C}$
- WMO: Record high average land and sea surface temperature



Data access & dissemination – web based



Observational Networks – Automatic Weather Stations **159 units**



Others:

- Co-hosted stations with agriculture dept. **130 stations**
- Manual rain gauges **5498 units**
- Automatic rain gauges

