Use of ClimatView and Statistical analysis

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1. GCOS network and CLIMAT report

2. ClimatView -JMA's Database of CLIMAT reports-

3. Statistical research on El Nino impact by using Excel

Use of ClimatView and Statistical analysis

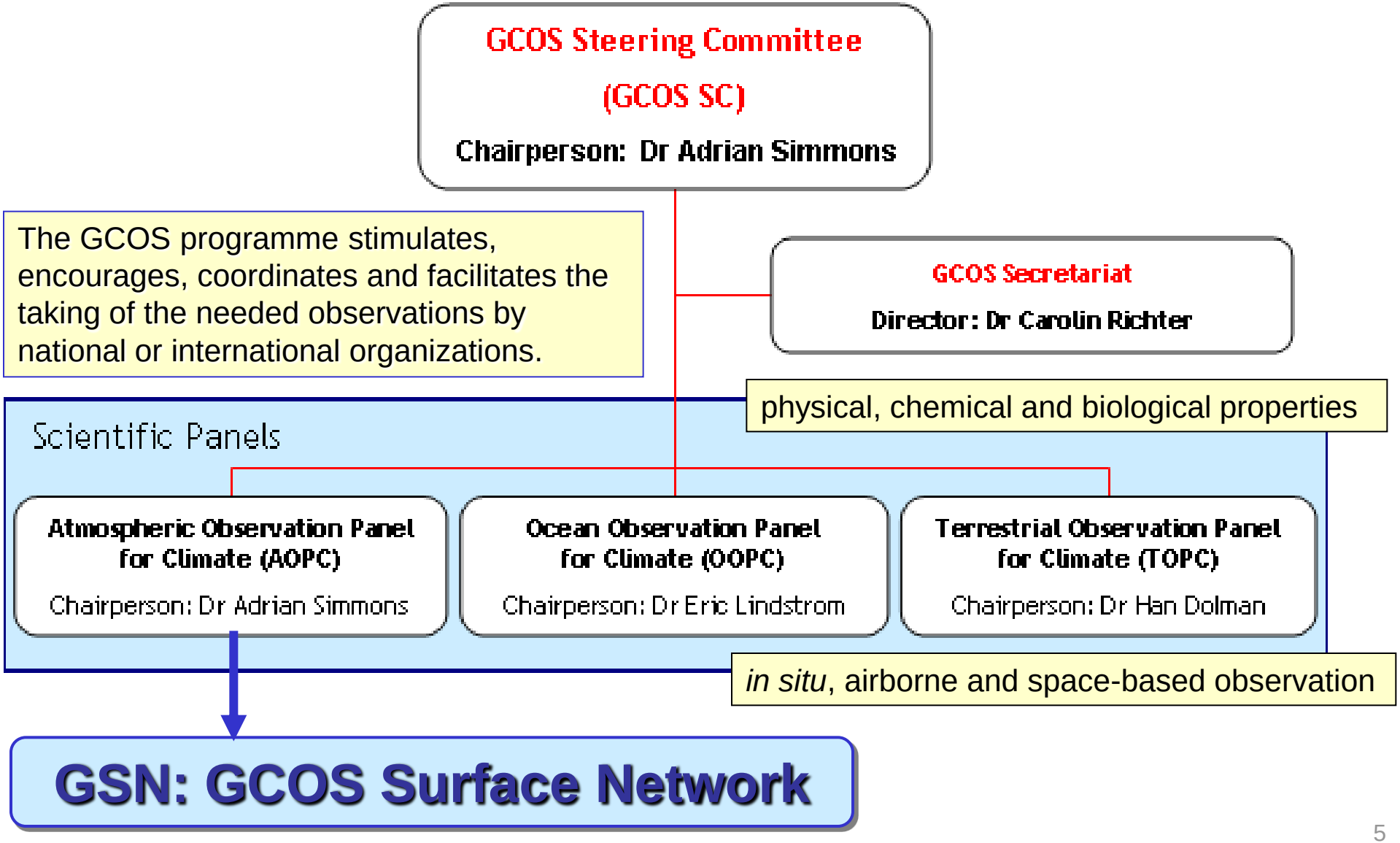
1-1: GCOS network

What is GCOS ?

- GCOS (Global Climate Observing System) was established in 1992 by WMO,UNESCO,UNEP and ICSU to ensure that the climate observation data are obtained and made available to all potential users.
- GCOS is intended to meet the needs for
  # Climate system monitoring, climate change detection
  # Research toward improved understanding, modeling and prediction of climate system

http://www.wmo.int/pages/prog/gcos/index.php

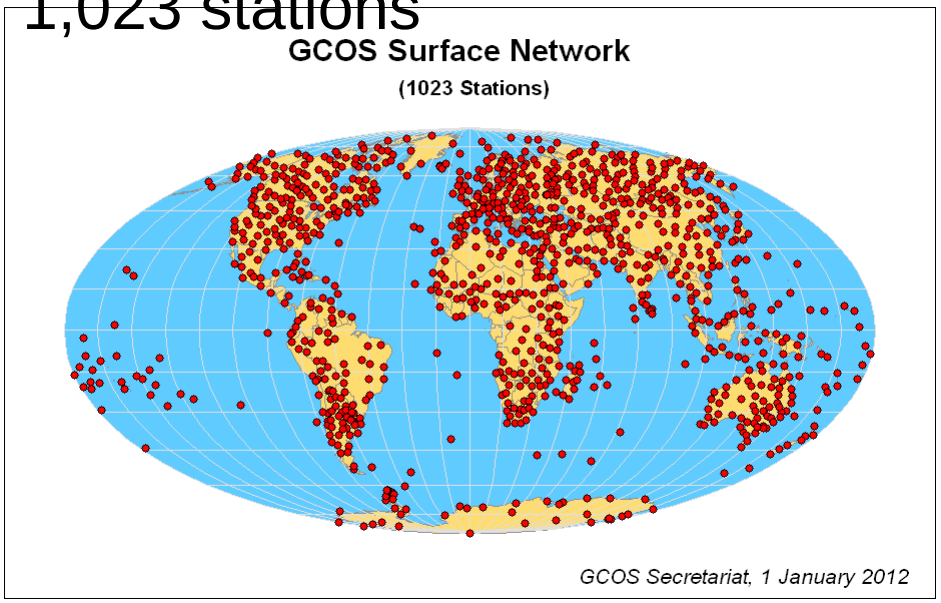
Structure of GCOS



GSN selection

- Initial Selection (1996): 940 stations from 8,653 WMO stations
- Current status (1, January, 2012): 1,023 stations

approved by NMHS



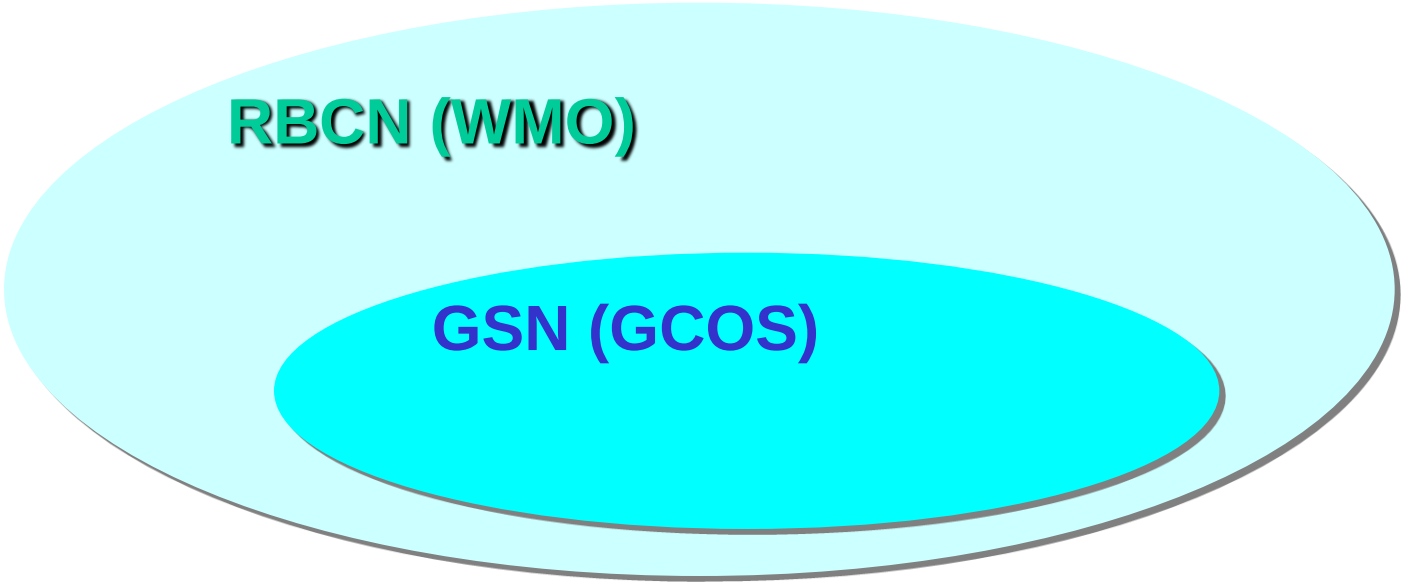
http://www.wmo.int/pages/prog/gcos/documents/GSN_map_2012.png

- **Criteria of GSN station**
  - * Historical record for at least 20 years
  - * Homogeneous (no or little moving)
  - * Population (not urbanized)
  - * Submission of CLIMAT report monthly meteorological bulletin of surface climate data
  - * The NMHS can accept with regard to continuity.

- RBCN and GSN -

➢**RBCN**: **Regional Basic Climatological Network** is necessary to provide a good representation of climate on the regional scale, in addition to global scale (about 3,000 CLIMAT stations).

➢**GSN**: **GCOS Surface Network** is minimum configuration for global climate monitoring (about 1,000 CLIMAT stations).



- Role of GSNMC and CBSLC -

GSN Monitoring Centres

To monitor the performance of the CLIMAT reports from GSN stations (JMA,DWD)

Since 1999

http://www.gsnmc.dwd.de/

CBS Lead Centres for GCOS

To contact with NMHSs about missing CLIMAT reports on the basis of GSNMC monitoring results (9 centres over the world)

CBS: Commission for Basic Systems (WMO)

CBSLCs was established in 2007

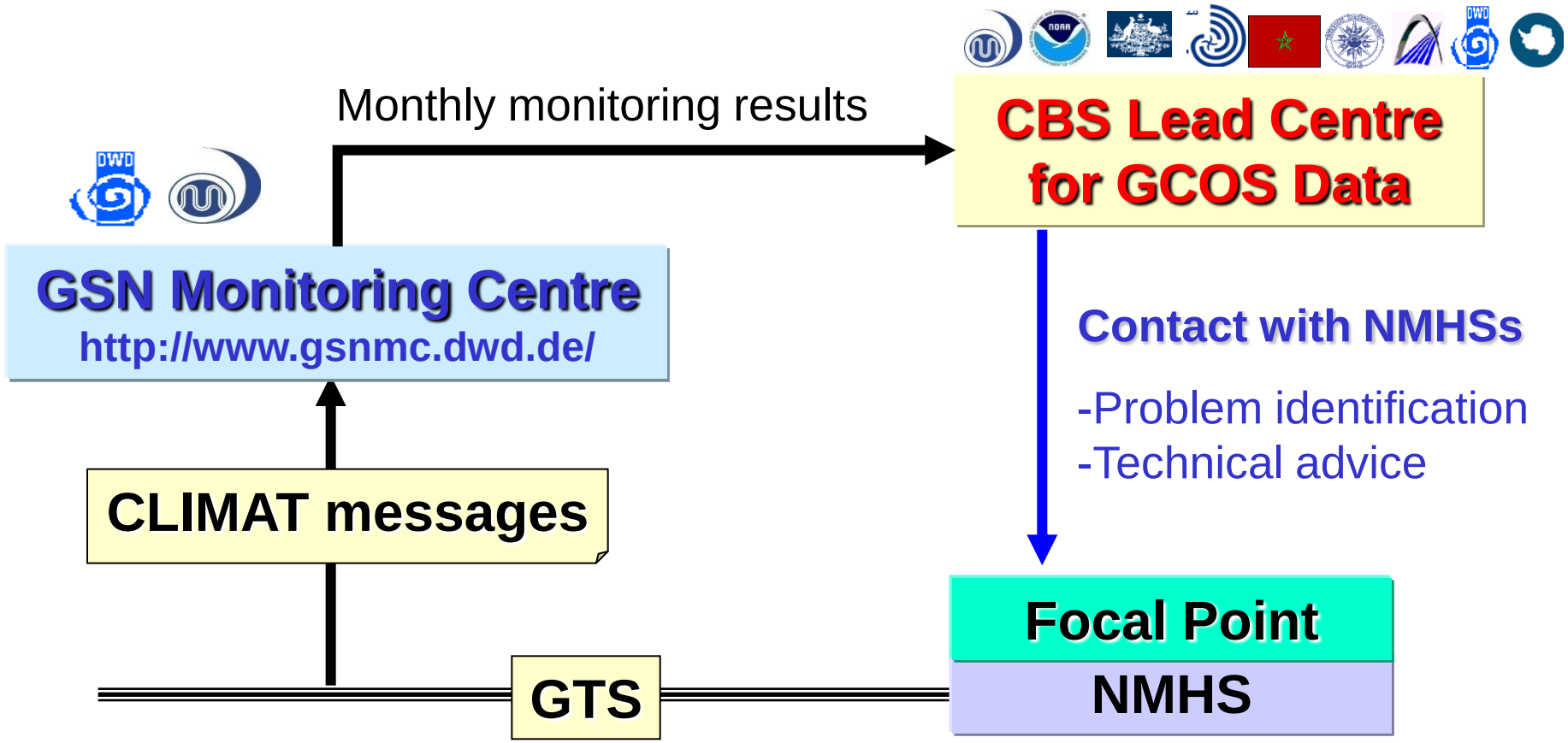
- CBS Lead Centres and FPs -

- RA I northern parts: **Morocco**
- RA I southern parts: **Mozambique**
- RA II eastern parts + SE Asia: **Japan**
- RA II western parts: **Iran**
- RA III: **Chile**
- RA IV + Hawaiian Islands: **NCDC/NOAA**
- RA V except for SE Asia: **Australia**
- RA VI: **Germany**
- Antarctica: **British Antarctic Survey**

- Focal point for GCOS and climate data
  http://www.wmo.int/pages/prog/gcos/index.php?name=CBSLeadCentres

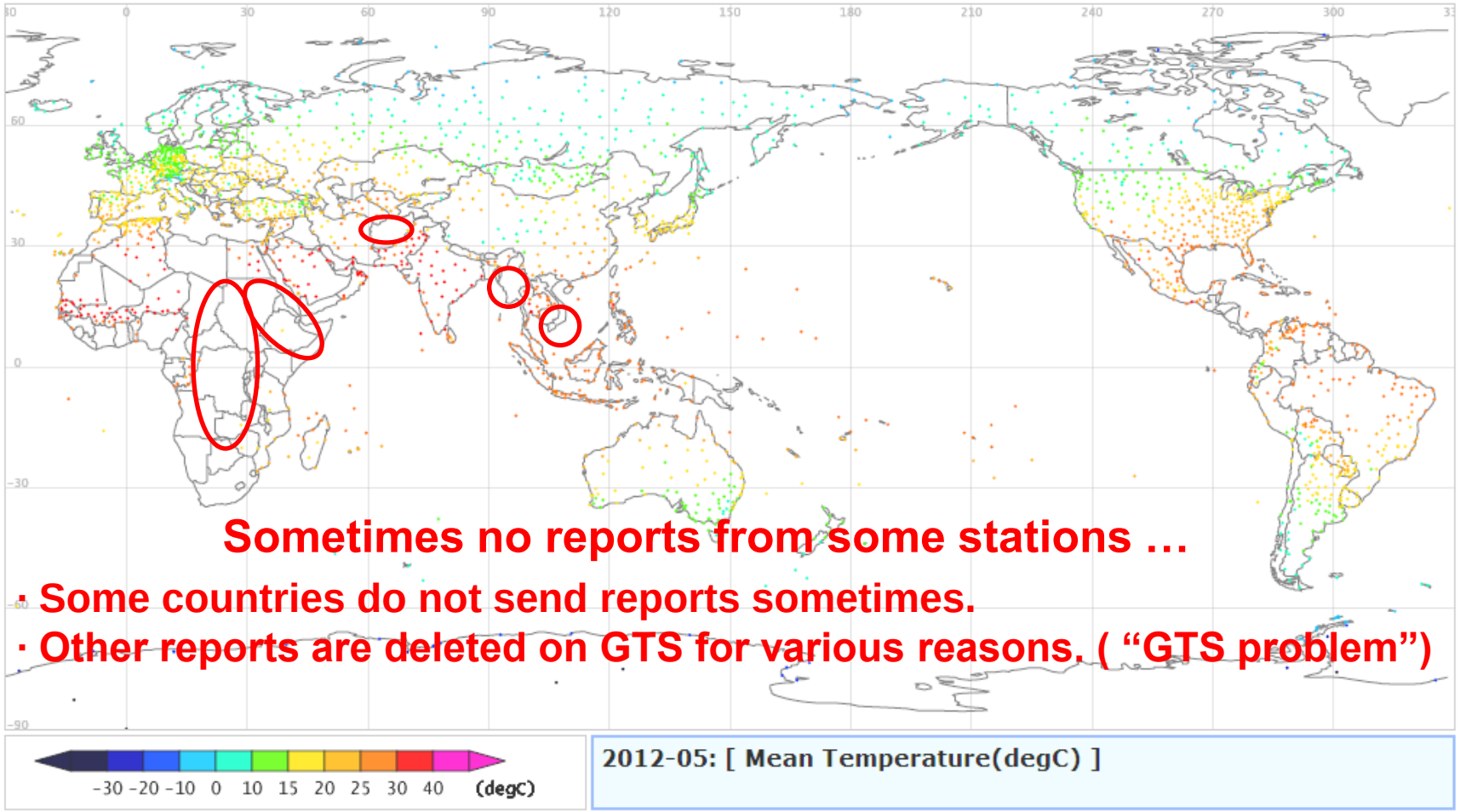
-Relationship between GSNMC and CBSLC-

Based on the monitoring results of GSNMC, CBSLCs aim to improve the quantity and quality of GSN-CLIMAT over the GTS by contacting with the FP in each NMHS.



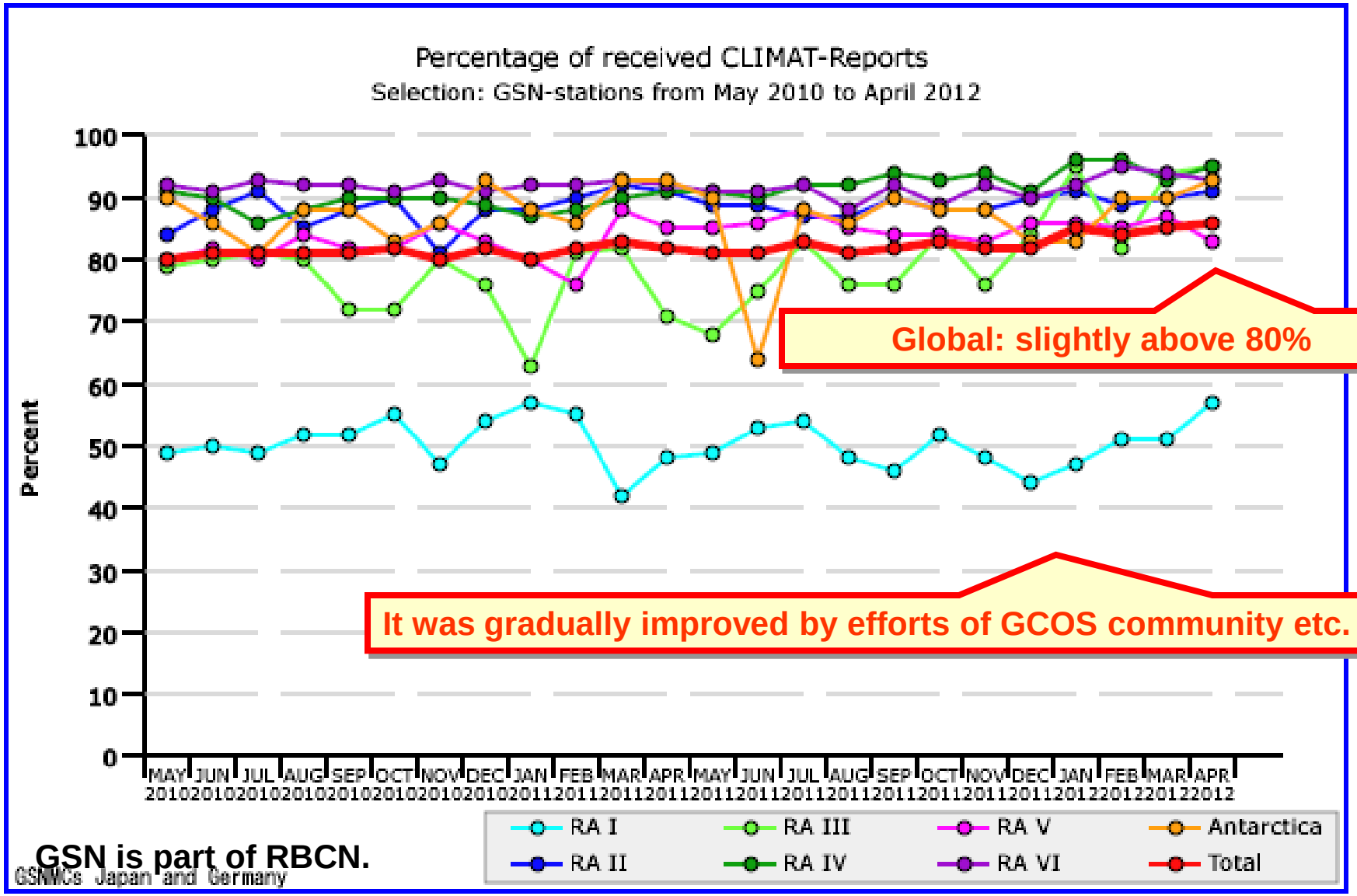
Extension of their work to include RBCN stations (from 2010)

- CLIMAT reports for temperature in May 2012 -



All the CLIMAT reports are necessary for overall monitoring of the world climate!

- percentage of received CLIMAT reports -



Percentage of received RBCN-CLIMAT reports is still about 70%.

Use of ClimatView and Statistical analysis

1-2: CLIMAT reports

CLIMAT message

Table 1: Section-based structure and description of the contents of a FM 71-XII CLIMAT Report.

Section Number	Section Identifier	Contents
0	-	Code name (CLIMAT) and location of observation point in time (month and year) and space (station number). **This Section is mandatory.**
1	111	Monthly averaged meteorological values (pressure, temperature etc.) for the month and station referred to in Section 0, including number of days with missing data for the respective value. **This Section is mandatory.**
2	222	Normal climatological values for the month and station referred to in Section 0, averaged for the respective month over a defined reference period (usually 30 years, at least 10 years), including number of years with missing data for the respective month and value. **This Section is optional and shall only be reported if the reference period was changed, for the twelve months following that change.**
3	333	Number of days with parameters beyond certain thresholds for the month and station referred to in Section 0. **This Section is optional.**
4	444	Extreme values and frequency of thunderstorms and hail for the month and station referred to in Section 0. **This Section is optional.**
		End Identifier "=" to indicate the end of the Report, placed after the last Section of the Report without a space. **The End Identifier is mandatory.**

GCOS–127_CLIMAT_EN.pdf

http://www.wmo.int/pages/prog/gcos/Publications/GCOS-127_EN.pdf (Page 3)

Example: CLIMAT bulletin

CSJP03 RJTD 030000

Date&time inserted on the GTS

Header part of bulletin

Area

Center originating the message

01-19:Global distribution

CLIMAT 07006

July 2006

Section 0

Area and station No.

25.6° C

165mm

47662 111 10038 20080 30256024 402860233 5242 60165414
7059040 8000000 9000000

Section 1: Monthly statistics

59 hours (sunshine duration)

222 07100 10049 20090 30254015 402900225 5241 6016210 7148
8000000 9000000

Section 2: Normal

333 02610 10200 31406 40500 9//0001

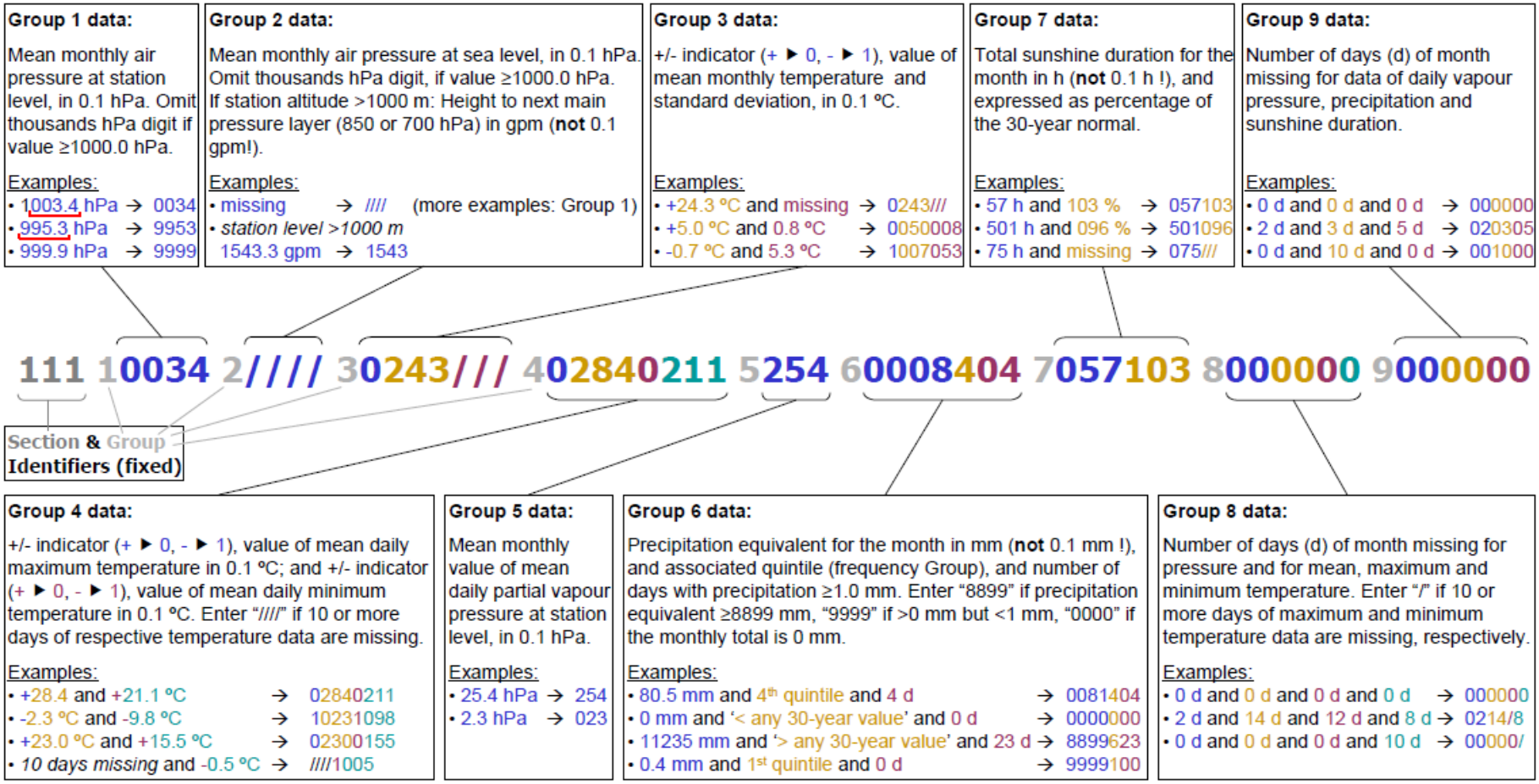
Sections 3: Number of days with parameters beyond certain threshold

444 0030414 1021119 2036115 3020319 4045018 5120502 60200=

Sections 4: extreme values and frequency of thunderstorms and hail

Description of Section 1 contents

Monthly data including number of days with missing values



GCOS–127_CLIMAT_EN.pdf
http://www.wmo.int/pages/prog/gcos/Publications/GCOS-127_EN.pdf (Page 9)

Typical errors in Section 0

Keyword, Month-Year-Identifier, Station Identifier

Code form	CLIMAT MMJJJ IIiii
Possible errors **TO BE AVOIDED !**	**Keyword** • Typing mistakes (e.g. **Climat**, **KLIMAT**, **TEMP**, **AGRO** • missing **Month-Year-Identifier** • 50 added to month (e.g. for May instead of 05 → 55) • too long (e.g. **MMJJJJ**) • month and year exchanged (e.g. **JJJMM**) • previous month • forthcoming month • exchanged with station number • missing • doubly **Station Identifier** • exchanged with Month-Year-Identifier • exchanged with Group 111 of Section 1 • station name added
Examples • incorrect: MESSAGE CLIMAT MOIS :09/2007 • **correct: CLIMAT 04008 10147**	

GCOS–127_CLIMAT_EN.pdf
http://www.wmo.int/pages/prog/gcos/Publications/GCOS-127_EN.pdf (Page 13)

Examples: Erroneous CLIMAT bulletins

Encoded month and year MMJJJ given as 02/2010
MMJJJ should be coded as 02010
Section 222 group 6 should only have 6 code figures
Section 222 group 7 should only have 3 code figures

```
02090
CSLA01 VLIV 040330
CLIMAT 02/2010
48930 111 19769 20118 30246015 403420149 5184
                60000000 7234/// 8000000 9000000
          222 07100 19773 29119 30230013 403090151 5188
                60022303 7203/// 8000000 9000000=
```

02010

6 code figures

3 code figures

Code name CLIMAT and MMJJJ are missing
CSLT10 EYHM is not found in WMO Volume C1

```
02358
CSLT10 EYHM 010600
26730 111 19916 20114 31041038 410211059 5041 60044410 7026037 8000000 9000000=
26524 111 19967 20104 31049035 410211073 5040 60036510 7018028 8000000 9000000=
26629 111 10009 20108 31039050 410171061 5043 60039408
```

ET-OI (CBS Expert Team on GTS-WIS Operations and implementation) report
http://www.wmo.int/pages/prog/www/CBS/Meetings/MG-11/documents/ET_OI_report_on_CLIMAT_201003_v0.3.pdf

There are various kinds of mistakes. Many of them cannot be corrected automatically, and have to be corrected or deleted manually. (It is sometimes difficult to detect the wrong time specification in Section-0.)

Header errors may lead to failure of GTS relay of the bulletin.

We are going to deliver handouts to you in this session.
In each handout , our desire to each of you is written.
I would like to ask you to deliver these handouts to your Focal Point of the RBCN in order to improve the performance of the CLIMAT reports.

- **Please send the CLIMAT reports of stations which are silent now.**
- **Please correct the erroneous CLIMAT bulletins.**

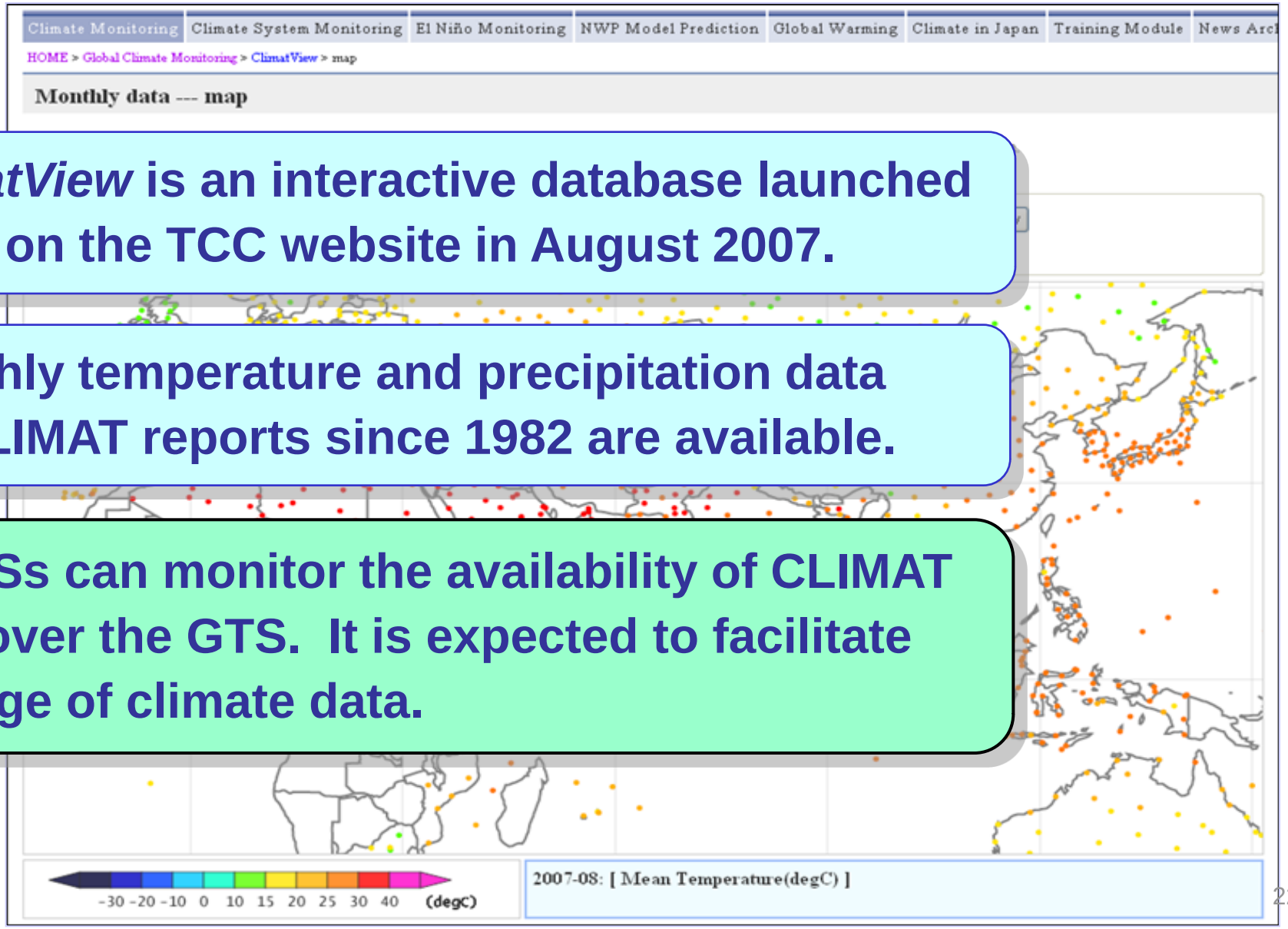
You can send the CLIMAT reports through GTS or by e-mail.

Use of ClimatView and Statistical analysis

2: ClimatView
-JMA's Database of CLIMAT reports-

Climate Database “ClimatView”

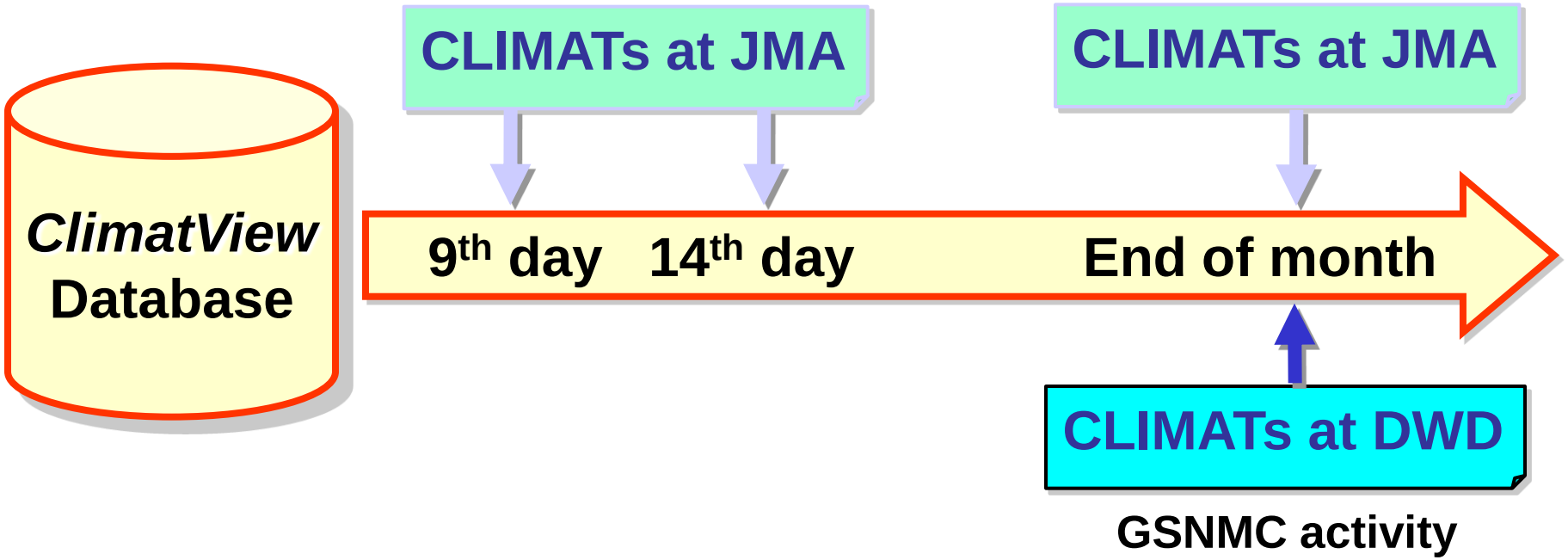
TCC website - http://ds.data.jma.go.jp/gmd/tcc/climatview/



- ***ClimatView*** **is an interactive database launched by JMA on the TCC website in August 2007.**
- **Monthly temperature and precipitation data from CLIMAT reports since 1982 are available.**
- **NMHSs can monitor the availability of CLIMAT report over the GTS. It is expected to facilitate exchange of climate data.**

Data updating on ClimatView

- Data on *ClimatView* are derived from CLIMAT reports received at DWD and JMA.
- Data are updated on around 9th day, 14th day (JMA), and the end of the month (DWD+JMA).



TCC Top Page

http://ds.data.jma.go.jp/tcc/tcc/index.html

ClimatView Top Page

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Tokyo Climate Center
WMO Regional Climate Center in RA II (Asia)

WMO

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HOME > World Climate > ClimatView

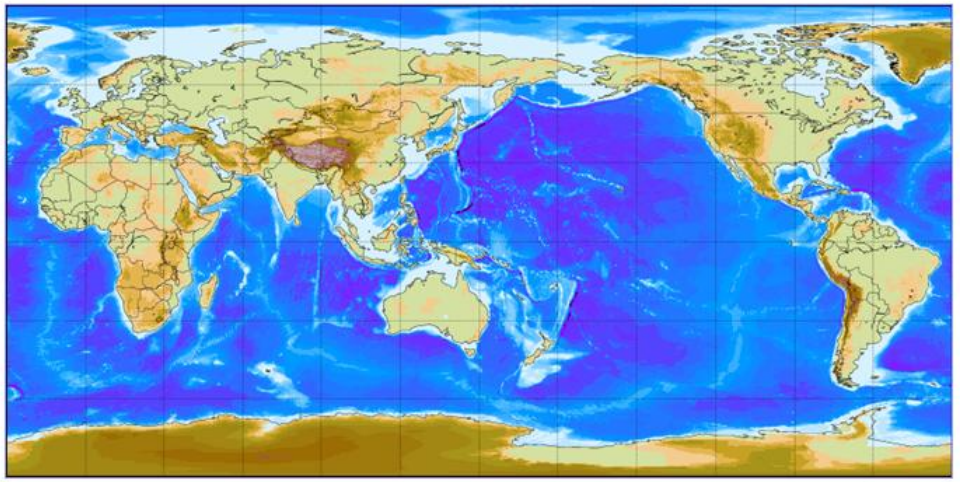
ClimatView --- tool to see monthly climate data

First of all, please read this explanation.

Please click on the area of the following map that you would like to see. Explanation »
Detailed historical monthly data in Japanese stations are available at: http://www.data.jma.go.jp/obd/stats/data/en/smp/index.html

- Notice (18 May 2011)
  JMA has started to use new climatological normals 1981-2010 on 18th May 2011. Please refer to TCC News No. 24 (Page 12).
- Notice (2 April 2012) ⚠
  Some bugs in this tool were fixed. If you have used this tool before, please check the "Notice" page for details.

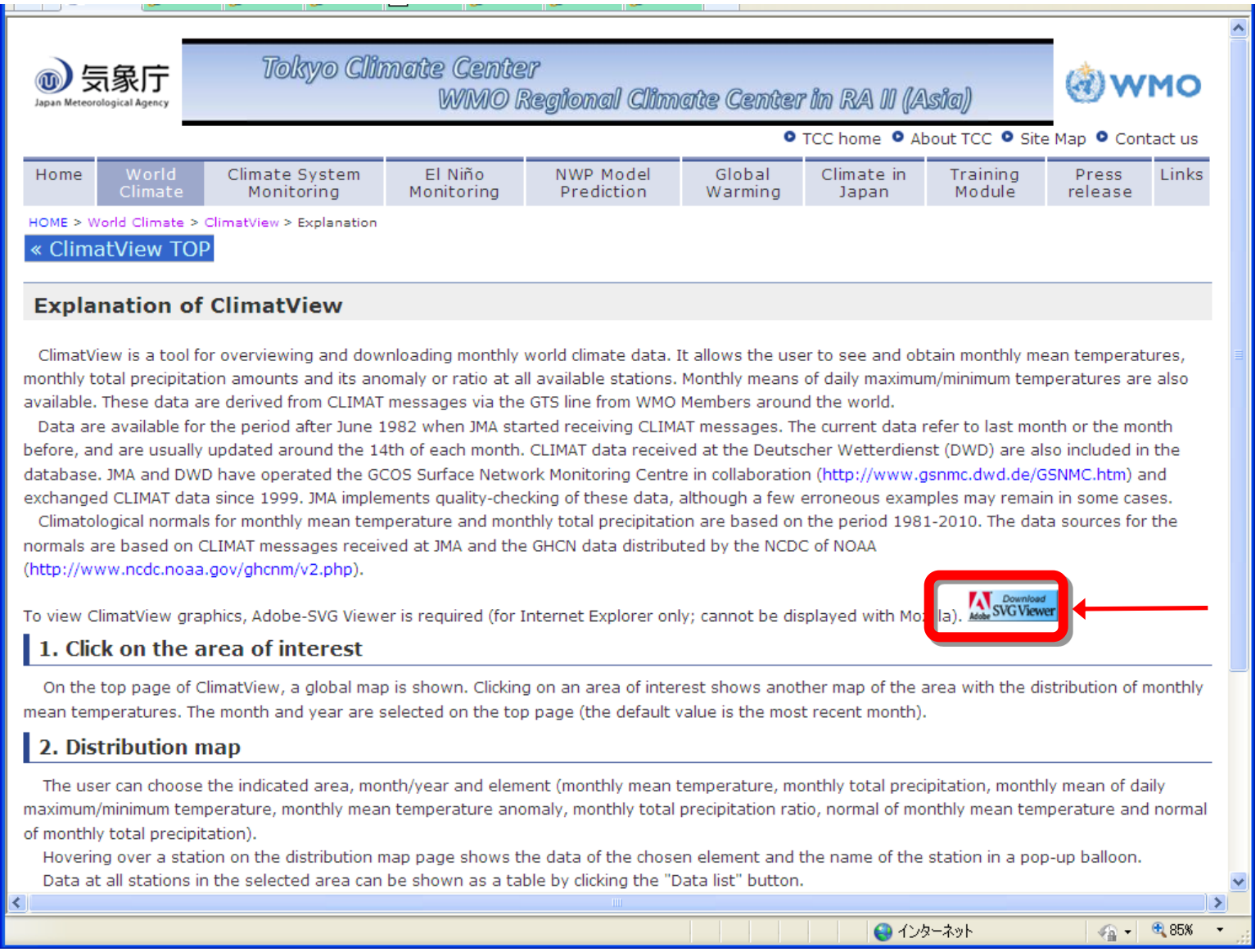
♦Select year/month
year 2012 month 08



Download SVG Viewer
For viewing the graphics you need the SVG Viewer.
(For Internet Explorer only. You cannot display the pictures with Mozilla.)

Explanation Page

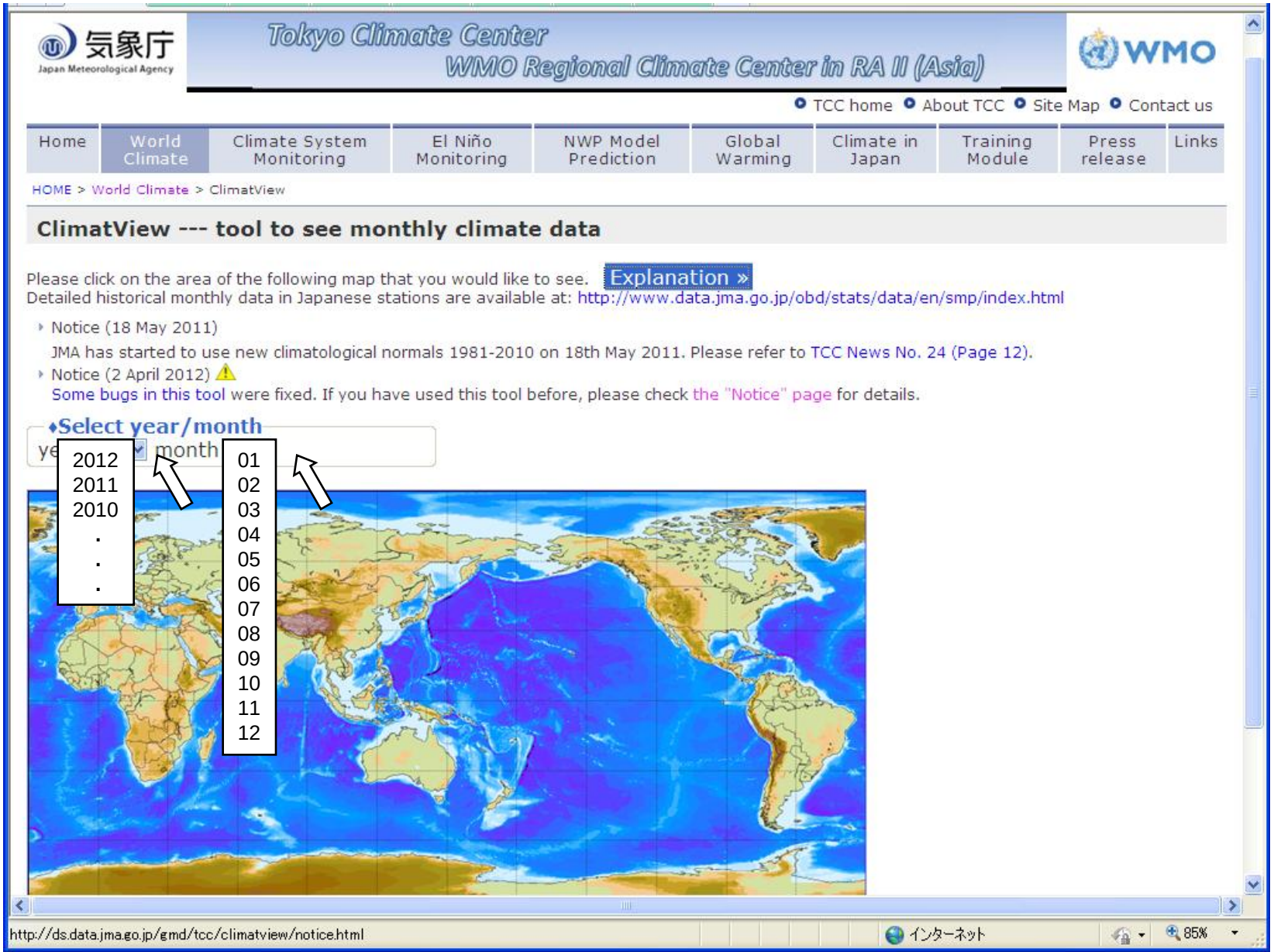
ClimatView needs Internet Explorer for Windows.



Please download the Adobe SVG Viewer, unless you have already installed it on your PC.

Please note that Adobe discontinued support for Adobe SVG Viewer on January 1, 2009. JMA is making the new viewer system not using SVG Viewer.

ClimatView Top Page



ClimatView Top Page

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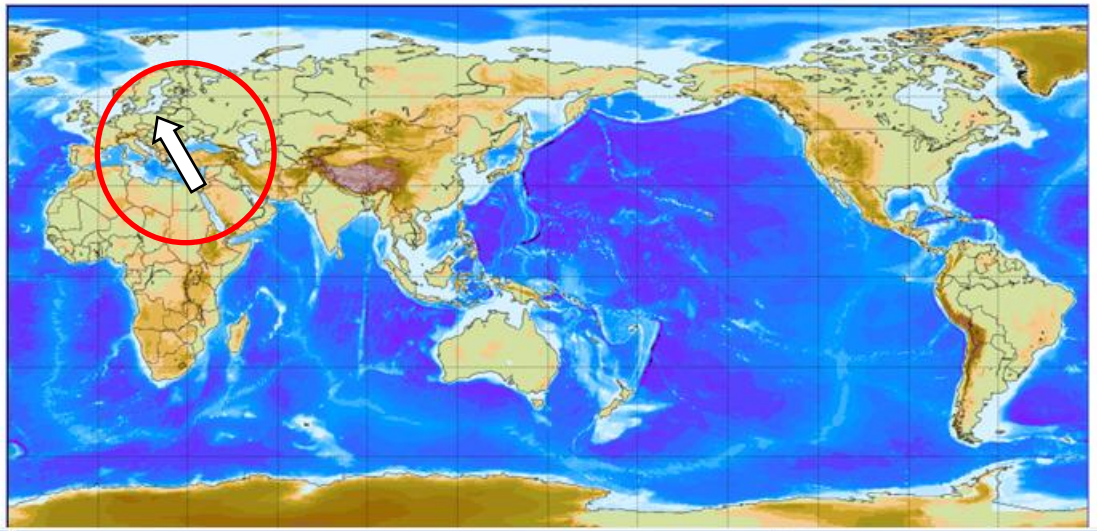
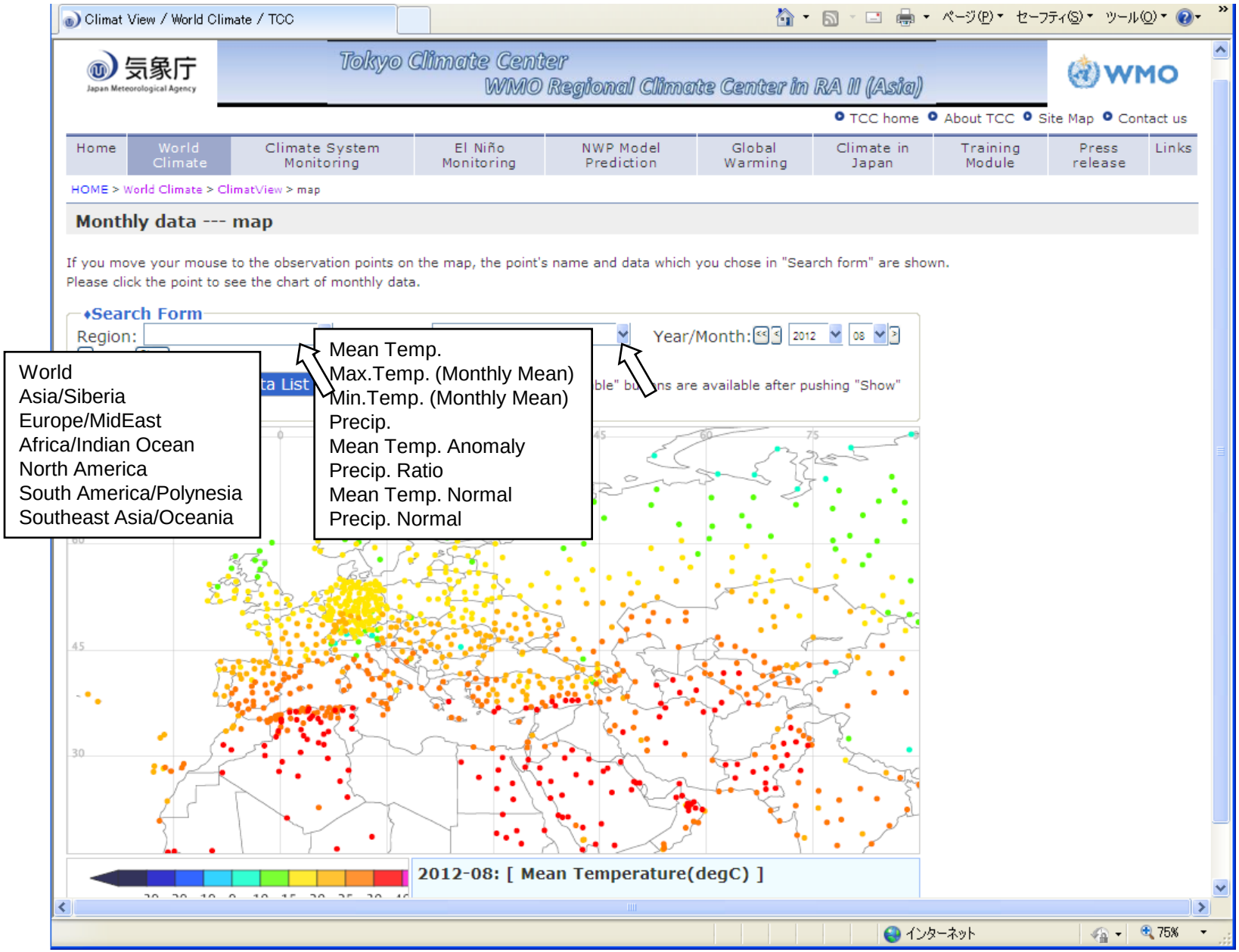
♦Select year/month
year 2012 month 08



Click on the area of interest

http://ds.data.jma.go.jp/gmd/tcc/climatview/notice.html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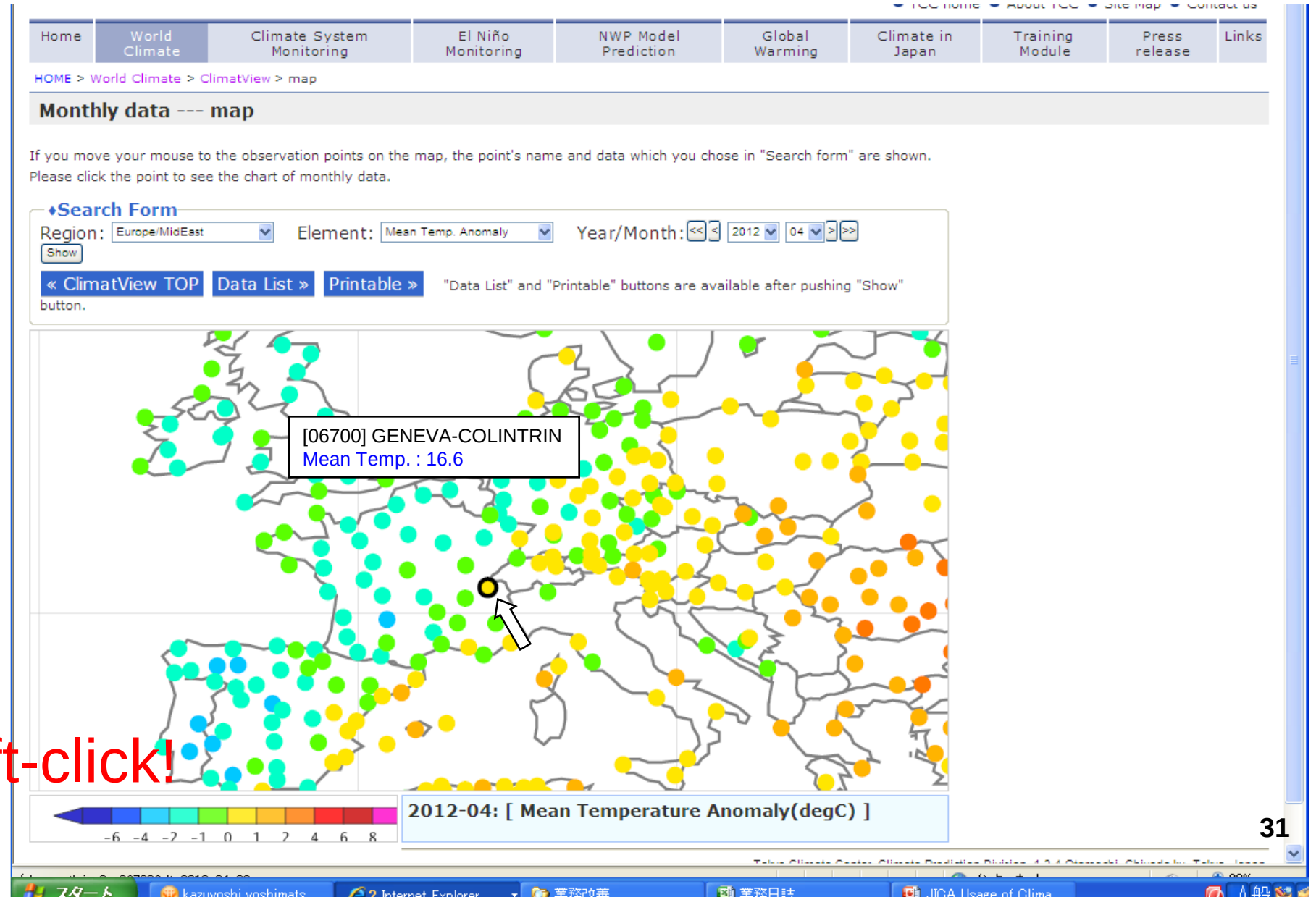
Links
HOME > World Climate > ClimatView > map
Monthly data --- map
If you move your mouse to the observation points on the map, the point's name and data which you chose in "Search form" are shown.
Please click the point to see the chart of monthly data.
♦Search Form
Region:
Year/Month:
2012
08
World
Asia/Siberia
Europe/MidEast
Africa/Indian Ocean
North America
South America/Polynesia
Southeast Asia/Oceania
Mean Temp.
Max.Temp. (Monthly Mean)
Min.Temp. (Monthly Mean)
Precip.
Mean Temp. Anomaly
Precip. Ratio
Mean Temp. Normal
Precip. Normal
2012-08: [Mean Temperature(degC)]
インターネット
75%

Too crowded! Which point is for Geneva?

Surround the area of interest
by drawing the mouse
while left-clicking
and pushing the Ctrl key

I have found the point for Geneva!



Left-click!

Climat View / World Climate / TCC - Windows Internet Explorer

http://ds.data.jma.go.jp/gmd/tcc/climatview/obsmonth.jsp?n=06700&dt=2012-04-30

Climat View / World Climate / TCC

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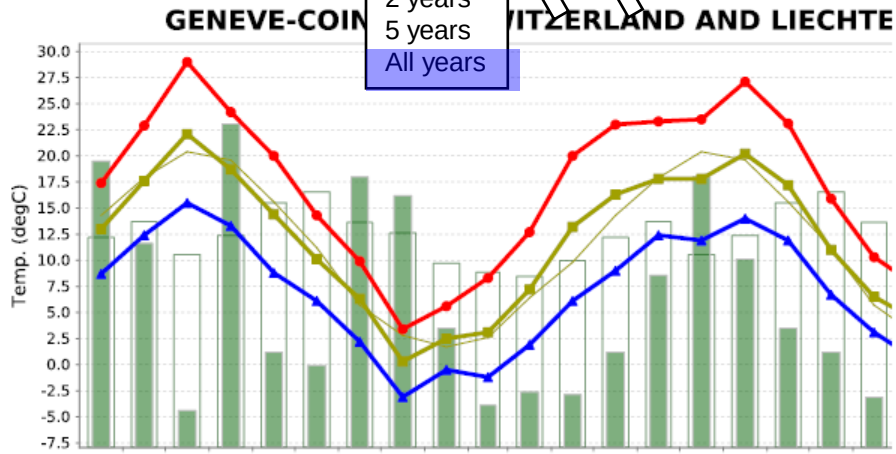
Monthly data --- chart/table

♦Search Form

Year/Month: 2012 04 Term: 2 years Show

« Map Printable »

1 year
2 years
5 years
All years



GENEVE-COINTRIN - SWITZERLAND AND LIECHTENSTEIN
Lon.: 6.12°E / Lat.: 46.23°N Height: 420(m)

Download --- download in text file

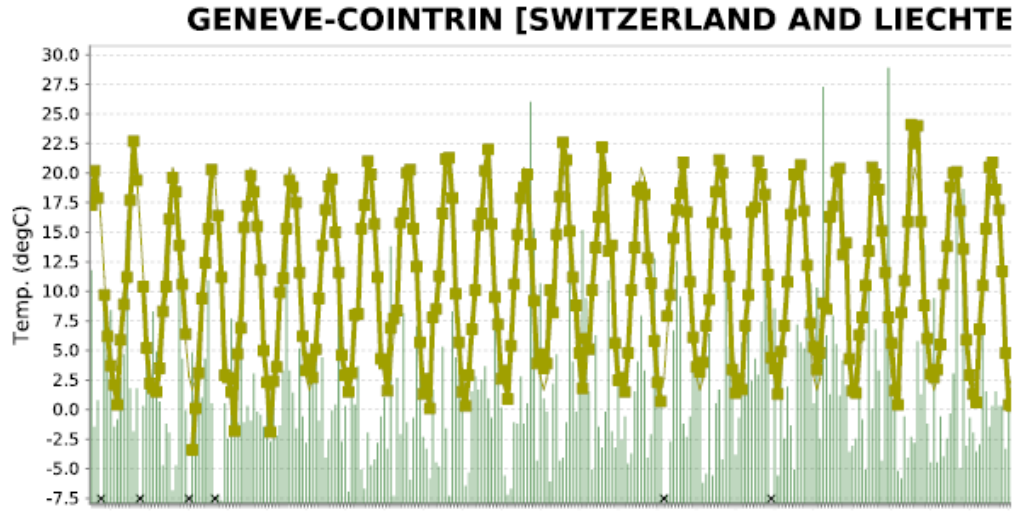
Year/Month	Observation				Normal	
	Mean Temp. [degC]	Max. Temp. (Monthly Mean) [degC]	Min. Temp. (Monthly Mean) [degC]	Precip. [mm]	Mean Temp. [degC]	Precip. [mm]
2010-05	13.0	17.4	8.7	108	14.3	79.2
2010-06	17.6	22.9	12.4	77	17.9	85.2
2010-07	22.1	29.0	15.5	14	20.4	72.8

Monthly data --- chart/table

♦Search Form

Year/Month: 2012 04 Term: all years Show

« Map Printable »

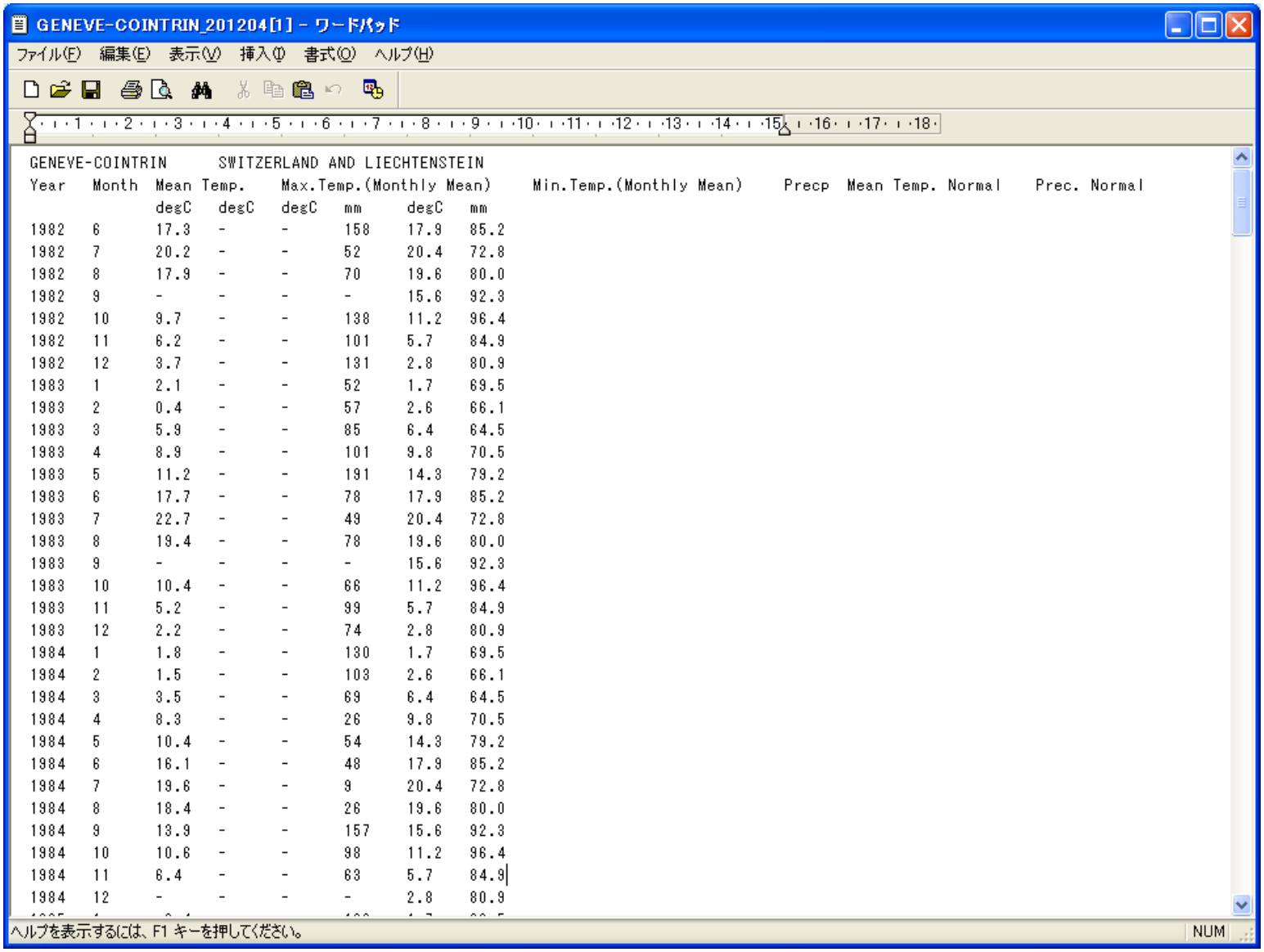


GENEVE-COINTRIN - SWITZERLAND AND LIECHTENSTEIN
Lon.: 6.12°E / Lat.: 46.23°N Height: 420(m)

Download --- download in text file

Year/Month	Observation				Normal	
	Mean Temp. [degC]	Max. Temp. (Monthly Mean) [degC]	Min. Temp. (Monthly Mean) [degC]	Precip. [mm]	Mean Temp. [degC]	Precip. [mm]
1982-06	17.3			158	17.9	85.2
1982-07	20.2			52	20.4	72.8
1982-08	17.9			70	19.6	80.0
1982-09					15.6	92.3

The text file of CLIMAT data for each station can be downloaded to your PC!



GENEVE-COINTRIN_201204[1] - ワードパッド

ファイル(F) 編集(E) 表示(V) 挿入(I) 書式(O) ヘルプ(H)

GENEVE-COINTRIN SWITZERLAND AND LIECHTENSTEIN

Year	Month	Mean Temp.	Max.Temp.(Monthly Mean)		Min.Temp.(Monthly Mean)		Precp	Mean Temp. Normal	Prec. Normal
		degC	degC	degC	mm	degC	mm		
1982	6	17.3	-	-	158	17.9	85.2		
1982	7	20.2	-	-	52	20.4	72.8		
1982	8	17.9	-	-	70	19.6	80.0		
1982	9	-	-	-	-	15.6	92.3		
1982	10	9.7	-	-	138	11.2	96.4		
1982	11	6.2	-	-	101	5.7	84.9		
1982	12	3.7	-	-	131	2.8	80.9		
1983	1	2.1	-	-	52	1.7	69.5		
1983	2	0.4	-	-	57	2.6	66.1		
1983	3	5.9	-	-	85	6.4	64.5		
1983	4	8.9	-	-	101	9.8	70.5		
1983	5	11.2	-	-	191	14.3	79.2		
1983	6	17.7	-	-	78	17.9	85.2		
1983	7	22.7	-	-	49	20.4	72.8		
1983	8	19.4	-	-	78	19.6	80.0		
1983	9	-	-	-	-	15.6	92.3		
1983	10	10.4	-	-	66	11.2	96.4		
1983	11	5.2	-	-	99	5.7	84.9		
1983	12	2.2	-	-	74	2.8	80.9		
1984	1	1.8	-	-	130	1.7	69.5		
1984	2	1.5	-	-	103	2.6	66.1		
1984	3	3.5	-	-	69	6.4	64.5		
1984	4	8.3	-	-	26	9.8	70.5		
1984	5	10.4	-	-	54	14.3	79.2		
1984	6	16.1	-	-	48	17.9	85.2		
1984	7	19.6	-	-	9	20.4	72.8		
1984	8	18.4	-	-	26	19.6	80.0		
1984	9	13.9	-	-	157	15.6	92.3		
1984	10	10.6	-	-	98	11.2	96.4		
1984	11	6.4	-	-	63	5.7	84.9		
1984	12	-	-	-	-	2.8	80.9		

ヘルプを表示するには、F1 キーを押してください。 NUM

Please push “Map” button to return the map page of monthly data.
Then, you can go back to this page.

Home | World Climate | Climate System Monitoring | El Niño Monitoring | NWP Model Prediction | Global Warming | Climate in Japan | Training Module | Press release | Links

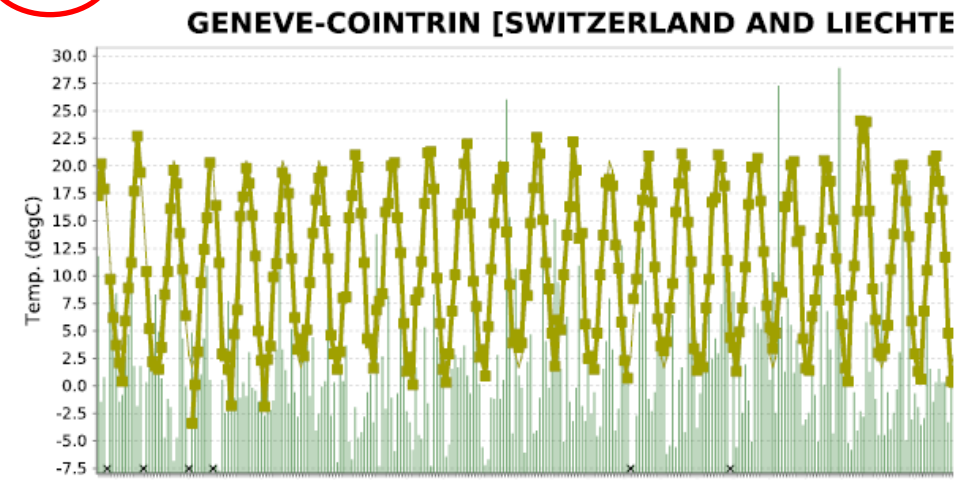
HOME > World Climate > ClimatView > chart/table

Monthly data --- chart/table

♦Search Form

Year/Month: << < 2012 04 > >> Term: all years Show

« Map | Printable »



GENEVE-COINTRIN - SWITZERLAND AND LIECHTENSTEIN
Lon.: 6.12°E / Lat.: 46.23°N Height: 420(m)

Download --- download in text file

Year/Month	Observation				Normal	
	Mean Temp. [degC]	Max. Temp. (Monthly Mean) [degC]	Min. Temp. (Monthly Mean) [degC]	Precip. [mm]	Mean Temp. [degC]	Precip. [mm]
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1982-08	17.9			70	19.6	80.0
1982-09					15.6	92.3

Any data can be found by the station name !
(with using search function of the browser)

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HOME > World Climate > ClimatView > data list

Monthly data list

♦Search Form

Region: Year/Month: 2012 04 Show

world
Asia/Siberia
Europe/MidEast
Africa/Indian Ocean
North America
South America/Polynesia
Southeast Asia/Oceania

	Country	Mean Temp. [degC]	Mean Temp. Anomaly [degC]	Max Temp. (Monthly Mean) [degC]	Min Temp. (Monthly Mean) [degC]	Precip. [mm]	Precip. Ratio [%]
	NORWAY	4.3	-2.0	6.2	2.6	99	
	NORWAY	-0.5		3.2	-3.9	33	
FOKSTUGU	NORWAY	-2.9	-1.8	0.6	-6.3	28	195.8
ORLAND III	NORWAY	3.7	-1.2	6.9	0.6	58	103.4
TRONDHEIM/VERNES	NORWAY	3.2		6.7	0.1	36	
BERGEN/FLORIDA	NORWAY	5.7	-1.1	9.7	2.3	96	70.8
NESBYEN-TODOKK	NORWAY	2.8		8.2	-1.7	54	
OSLO/GARDERMOEN	NORWAY	3.4	-0.6	7.8	-0.4	77	152.5
RENA AP	NORWAY	1.8		7.8	-2.6	68	176.2
UTSIRA LH	NORWAY	5.0	-1.3	7.1	3.2	74	97.6
STAVANGER/SOLA	NORWAY	5.8	-0.5	8.9	2.6	59	98.0
TORUNGEN LH	NORWAY	5.1	-1.0	7.1	3.2	98	262.0
OSLO-BLINDERN	NORWAY	4.9	-0.7	9.0	1.6	73	146.3
HAPARANDA A	SWEDEN	-0.6		3.9	-4.9	64	
HOLMON	SWEDEN	1.0		3.7	-1.3	81	
STOCKHOLM	SWEDEN	4.9	-1.4	9.1	1.5	63	225.8
VISBY	SWEDEN	4.8	-0.1	9.1	1.1	43	159.9
JYVASKYLA	FINLAND	1.3	-0.9	5.6	-3.2	49	142.0
HELSINKI-VANTAA	FINLAND	3.8	-0.3	7.7	0.0	58	184.7
LERWICK	UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND	4.9	-0.9	6.9	2.7	121	166.2
KIRKWALL	UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND	5.8	-1.5	8.5	3.1	82	150.3

Use the ClimatView

- Use the the ClimatView on TCC website.
- Select a station in your home country or other country that you want to see.
- Please see the chart and list at the station.
- Change parameters of the ClimatView.
- Download the data as a text file.

Use of ClimatView and Statistical analysis

3:Statistical research on El Nino impact by using Excel

Exercise

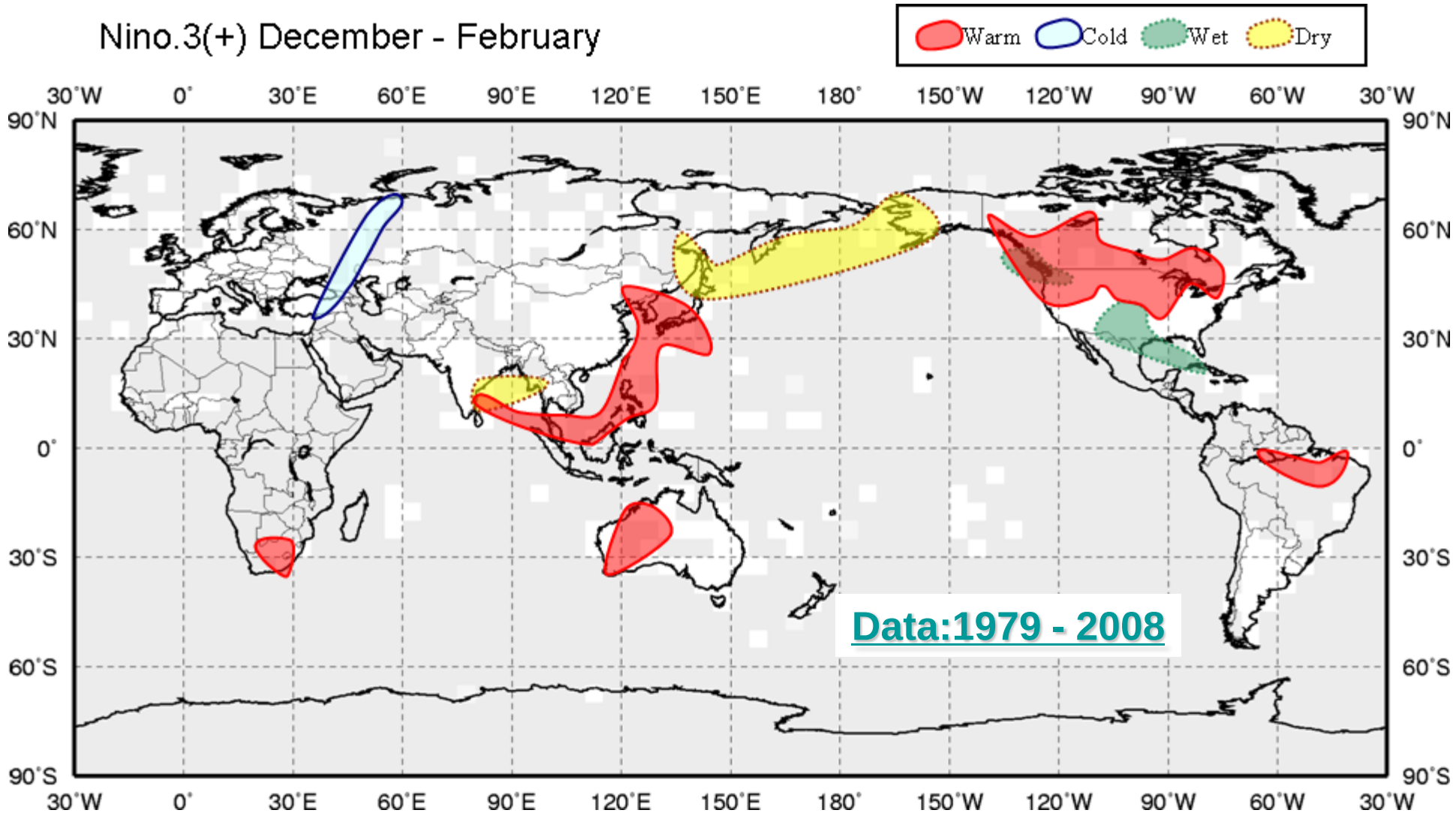
➢**Goal: To understand the basic method for statistical research on the impact of El Nino using Excel.**

Procedure

1. **Select data.**
2. **Confirm the 3-month average temperature and 3-month total precipitation.**
3. **Sort data by the phase of El Nino/La Nina/Neutral**
4. **Use the functions of Excel for making statistical tests.**
5. **Make some graphs.**
6. **Grasp the character of data including statistical tests.**

If we have enough time, please make a presentation about your result.

JMA's statistical research on El Niño impact

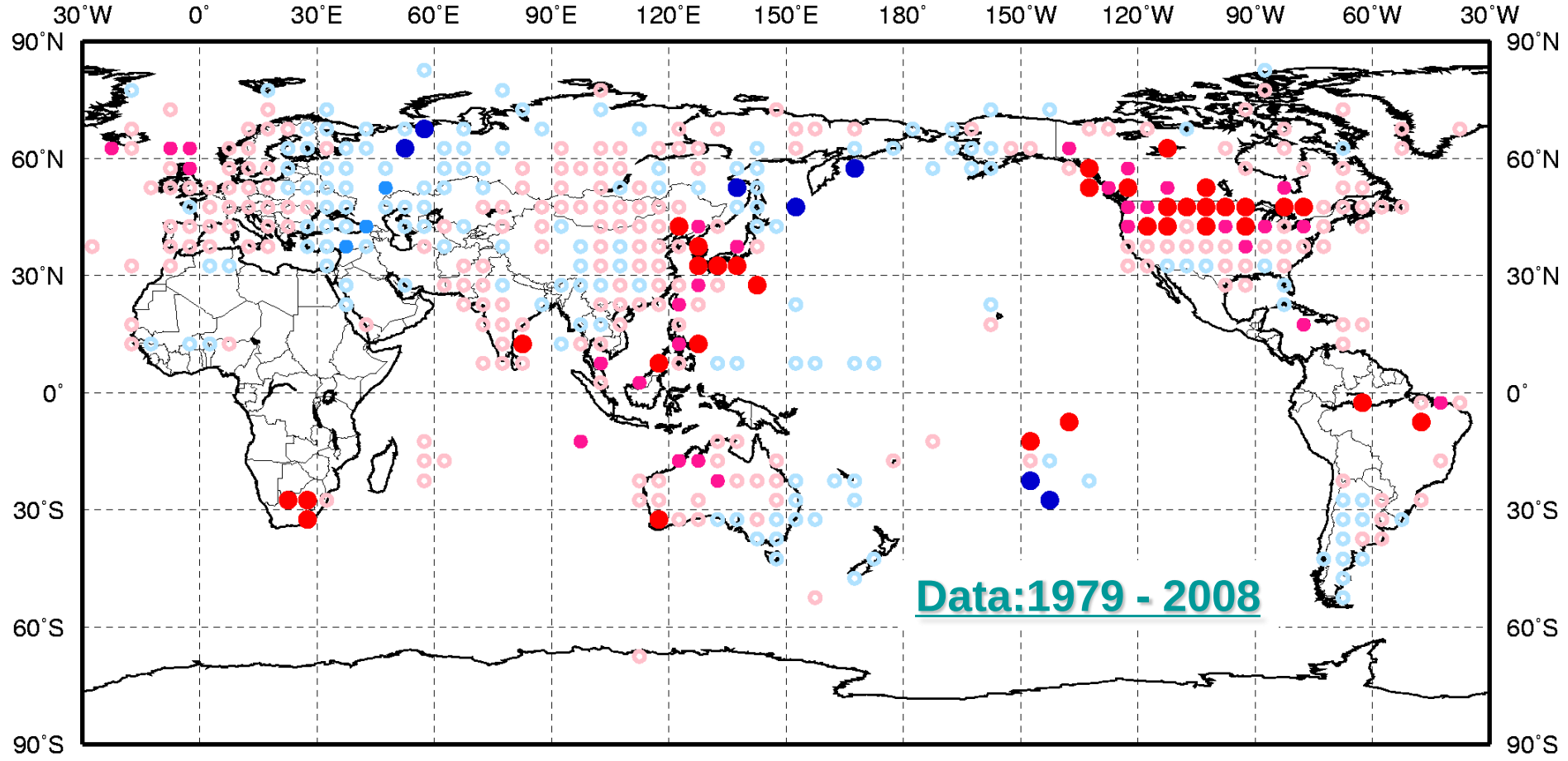


The above map shows the regions where statistically significant climate conditions are observed during El Niño episodes in boreal winter.

JMA's statistical research on El Niño impact

Composite Map on El Niño Phase (Dec-Feb)

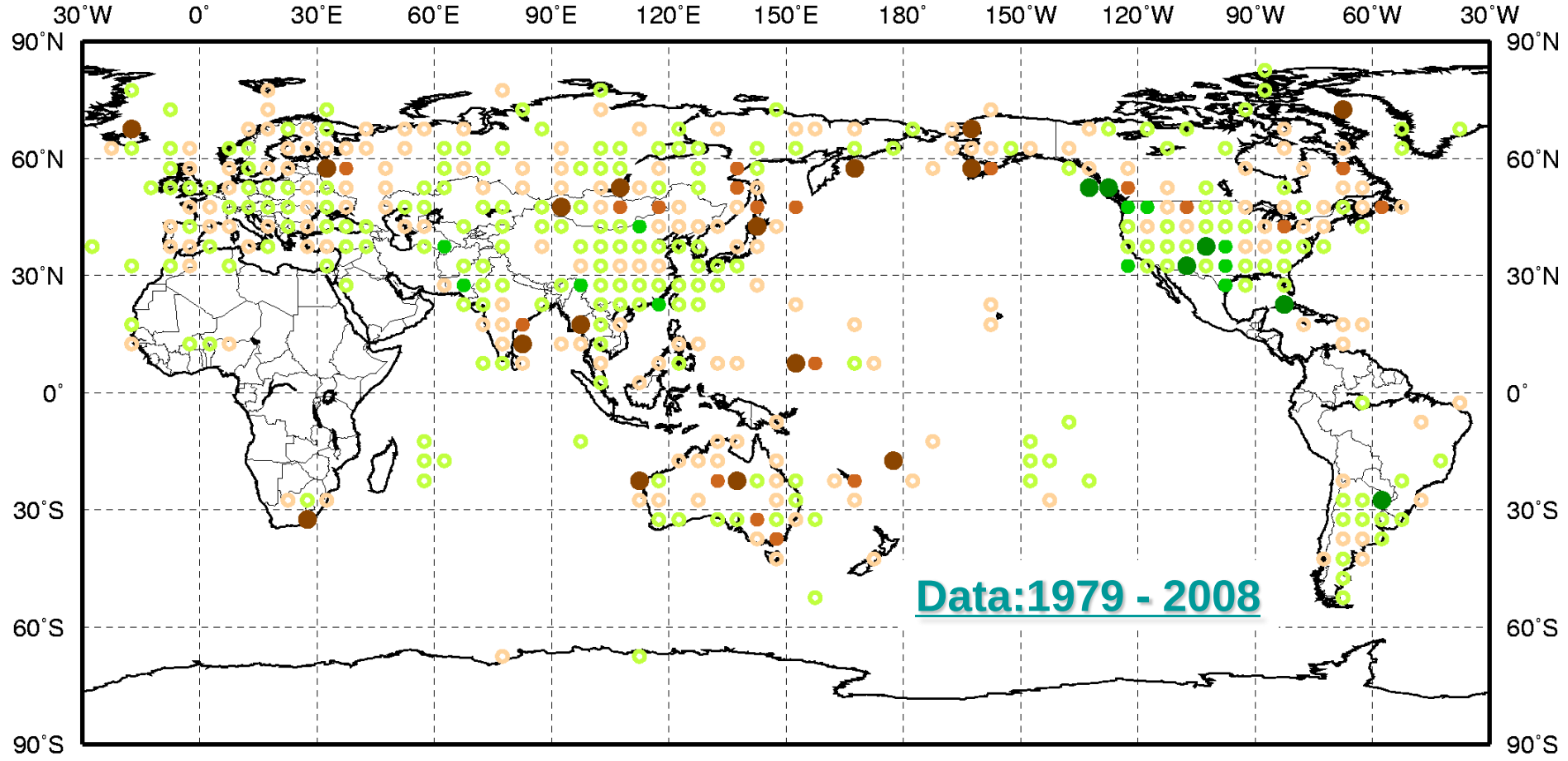
RED (BLUE) : normalized temperature anomaly compared with neutral phase >= 0 (< 0)
Larger filled-marks : significant at 95% or more of confidence level
Smaller filled-marks : significant at 90% or more and less than 95% of confidence level



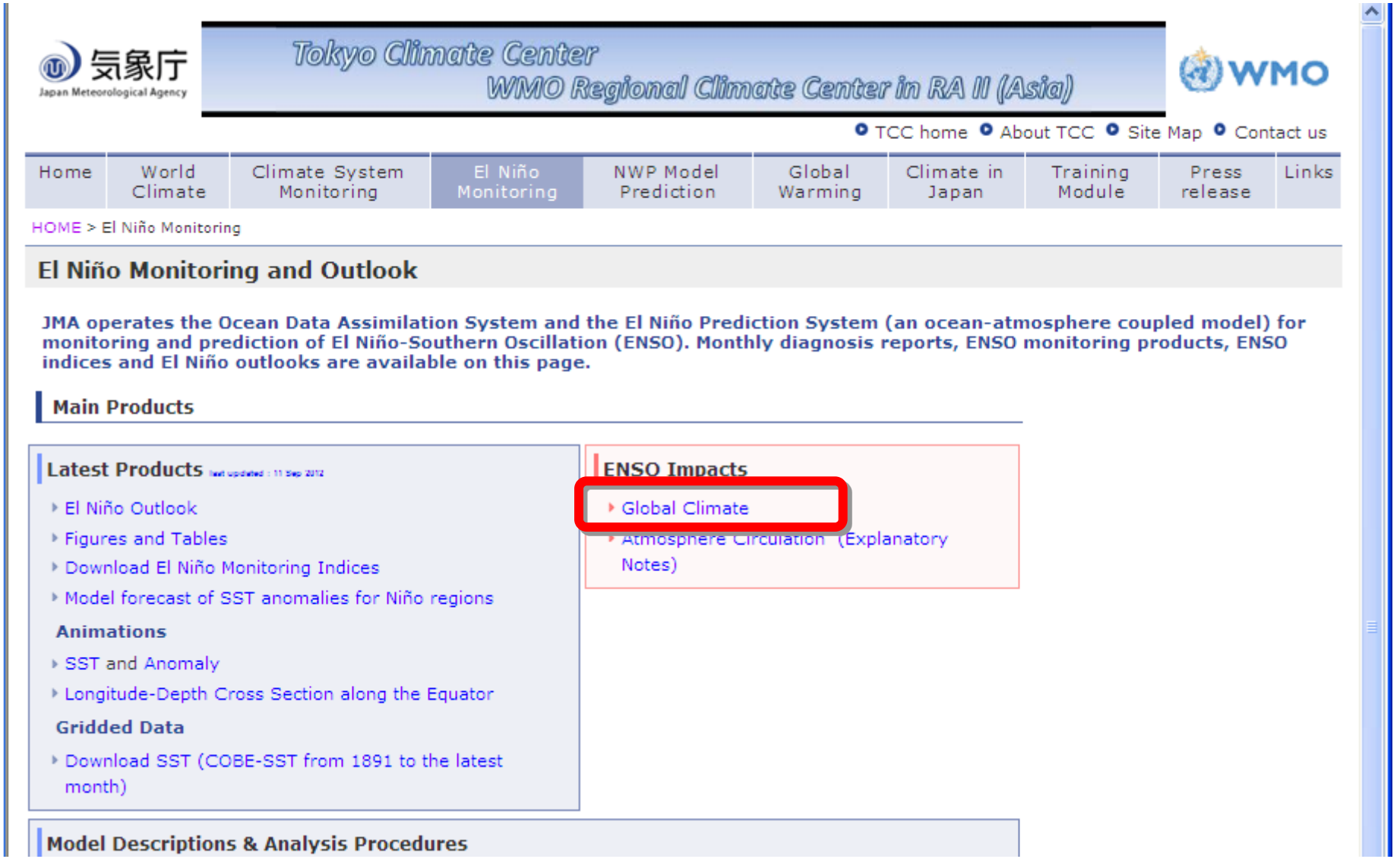
JMA's statistical research on El Niño impact

Composite Map on El Niño Phase (Dec-Feb)

GREEN (Brown) : precipitation ratio compared with neutral phase >= 100% (< 100%)
Larger filled-marks : significant at 95% or more of confidence level
Smaller filled-marks : significant at 90% or more and less than 95% of confidence level



ENSO impact maps on TCC web site



http://ds.data.jma.go.jp/tcc/tcc/products/elnino/index.html

Method of JMA's statistical research

- **5 x 5 degree grid-box data of normalized temperature anomalies and precipitation ratios are produced by averaging all station data in each grid-box.**
- **Each 5 x 5 degree gridded temperature data are detrended by calculating deviations from least square fitted linear trend.**
- **Composite data of temperature anomalies and precipitation ratios in each of El Nino, La Nina and the neutral phases are produced.**
- **The differences between El Nino, La Nina and the neutral phases are with t-test.**

T-test(1)

- T-test of the difference of mean value
  - Sample: X,Y
  - Sample size: m for X, n for Y
  - Mean: <x> for X, <y> for Y
  - Unbiased variance: s^2_x, s^2_y

$$s^2 = \frac{(m-1)s_x^2 + (n-1)s_y^2}{m+n-2}$$

$$T = \frac{< x > - < y >}{s\sqrt{\frac{1}{m} + \frac{1}{n}}} = \sqrt{\frac{mn}{m+n}} \frac{(< x > - < y >)}{s}$$

$$|T| > t_\alpha(m+n-2)$$

$$if \alpha = 5\%, m+n-2 = 18, then \quad t_\alpha(m+n-2) = 2.1$$

T-test(2)

- T-test of the difference of mean value
  - If you use Excel, then
  - Mean: <x>=average(a1:a10), <y>=average(b1:b10)
  - Unbiased variance: s^2_x =var(a1:a10), s^2_y =var(b1:b10)

  But, there is easier function in Excel.

  ↓2=t-test

  =**ttest(a1:a10,b1:b10,2,2)**

  X Y ↑2=two sided test

  If the result is smaller than 5%(significance level), the difference of mean is significant.

Exercise 1

- Open the Excel file “ENSO-Impact.xls” on your desktop.
  - It has “Answer” sheet, “Work” sheet, “Data” sheet, and “Nino3 5-month mean” sheet.
  - “Data” sheet include temperature and precipitation data, which are used in this exercise.
  - “Nino3 5-month mean” sheet has 5-month running mean SST anomaly in Nino.3 region.

Exercise 2

- Make a copy of “Work” sheet as "Work (x)" (X=2, 3 …).
- Copy the data in the “Data” sheet, then paste the data in green cell in the sheet of “Work (X)”.

47807		Fukuoka	
year	month	temperature	precipitation
1979	12	9.3	82
1980	1	6.2	57
1980	2	5.1	32
	….		
2011	10	19.7	127
2011	11	16.3	166.5
2011	12	8.5	38

Copy →

		Fukuoka	
year	month	temperature	precipitation
1979	12	9.3	82
1980	1	6.2	57
1980	2	5.1	32
	….		
2011	10	19.7	127
2011	11	16.3	166.5
2011	12	8.5	38

→ Paste

The “Data” sheet

The sheet of “Work (X)”

Exercise 3

- Confirm three month average temperature and three month total precipitation in the Work(1) sheet.
- Values are automatically calculated in the blue-colored cells, when data exist for consecutive three months.
  - Since we consider the El Nino as seasonal phenomenon, we make these calculations.

			Fukuoka/Japan	
ENSO event	year	mid-month	3 month mean temperature	3 month total precipitation
EL	1979	12		
EL	1980	1	6.9	171
NE	1980	2	7	221
NE	1980	3	9.6	267
NE	1980	4	14.1	468
NE	1980	5	18.6	502
NE	1980	6	22.2	1285
NE	1980	7	24.2	1899
NE	1980	8	23.9	1929
NE	1980	9	21.7	1244
NE	1980	10	18	473
NE	1980	11	12.7	328
NE	1980	12	8	194

Exercise 4

- Column E is the 5-month mean SST deviation for Nino.3 region and column F indicates the El Nino/La Nina/Neutral phase.
  - However this definition is not same as the El Nino/La Nina Event that JMA defined officially.
  - If you want to research the impact of other climatic index, such as the western Pacific SST anomalies, or the Indian Ocean SST anomaly, you just have to change the column E and F.

5 month mean SST deviation (NINO.3)	ENSO event
0.6	EL
0.5	EL
0.4	NE
0.3	NE
0.3	NE
0.3	NE
0.3	NE

Exercise 5

- Copy and paste the calculated data (value) to the next blue cells.
  - Copy the cells from column “ENSO event” to column “3 month total precipitation”. Then select the cell “L3”.
  - On the <Home> tab, click ▼ of <Paste>, and then select <paste value>. If you did not do this work, the 3 month data are unreasonable after next process.

				Fukuoka						Fukuoka	
5 month mean SST deviation (NINO.3)	ENSO event	year	mid-month	3 month mean temperature	3 month total precipitation	ENSO event	year	mid-month	3 month mean temperature	3 month total precipitation
0.6	EL	1979	12							
0.5	EL	1980	1	6.866667	171					
0.4	NE	1980	2	6.966667	221					
0.3	NE	1980	3	9.566667	267					

Copy

Select these columns. Then on the <Edit> menu, click <Paste Special>, and select <value>

The sheet of “Work (X)”

Exercise 6

- Next, sort the data.
  - Click a cell in the pasted column from “ENSO event” to “3 month total precipitation”.
  - On the <Data> menu, click <Sort>.
  - In the <Sort by> box, click the column of “mid-month” with <Ascending> sort option, and <Then by> box, click the column of “ENSO event” with <Ascending> sort option, and then click <OK>.

Exercise 7

- Statistical results are shown from column “R” to column “W” except the result for Dec-Feb (mid-month = 1).

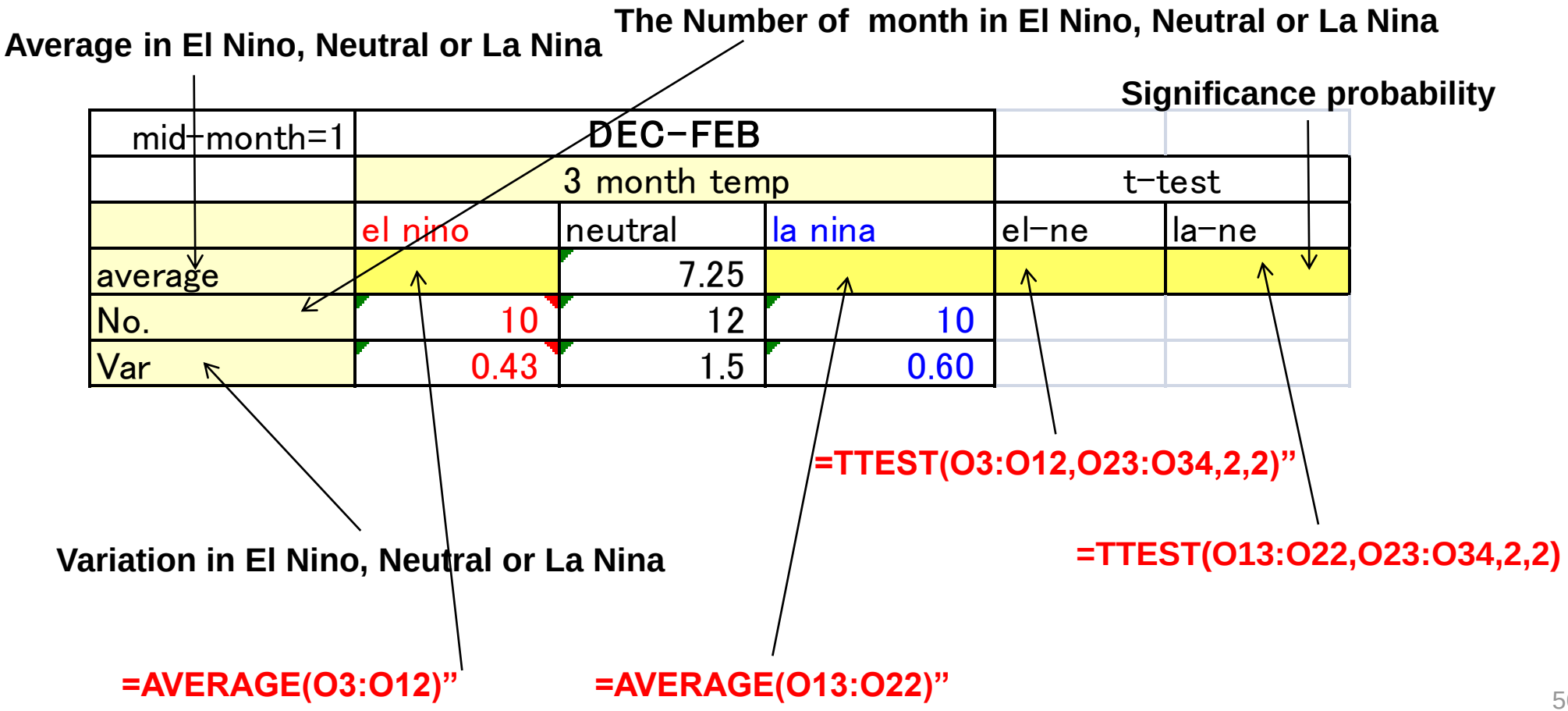
Statistical result (Dec.1978-Dec.2011)

mid-month=1	DEC-FEB				
	3 month temp			t-test	
	el nino	neutral	la nina	el-ne	la-ne
average		7.25			
No.	10	12	10		
Var	0.43	1.5	0.60		
	3month prec			t-test	
	el nino	neutral	la nina	el-ne	la-ne
average	196.40	203.08	197.10	80.3%	82.4%
No.	10	12	10		
Var	5036.88	2809.36	5073.66		

mid-month=2	JAN-MAR				
	3 month temp			t-test	
	el nino	neutral	la nina	el-ne	la-ne
average	8.43	7.88	8.16	27.0%	53.4%
No.	6	17	9		
Var	0.32	1.3	0.75		

Exercise 8

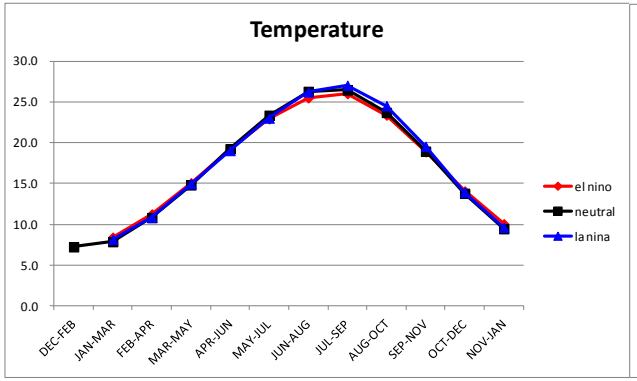
- Please calculate average temperature in each El Nino and La Nina phase using “average” function.
- After that, calculate the statistical significance on the difference of average using “ttest” function.

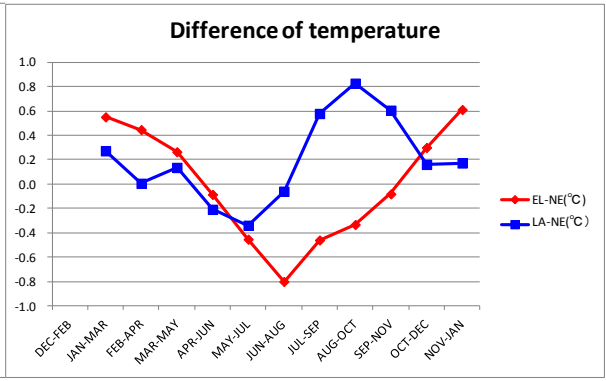


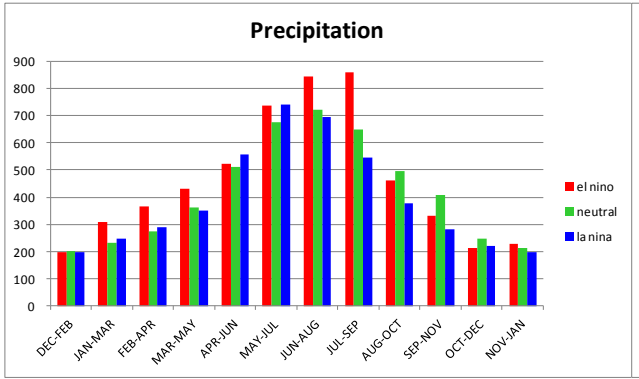
Exercise 9

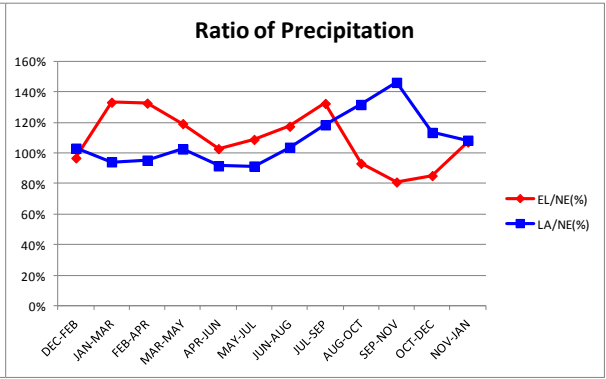
- Confirm a graph of the average of the three month mean temperature for each phase. You may change the graph options.
- Confirm a graph of average of the three month total precipitation

  for each phase.
- Grasp the character of data including statistical tests.

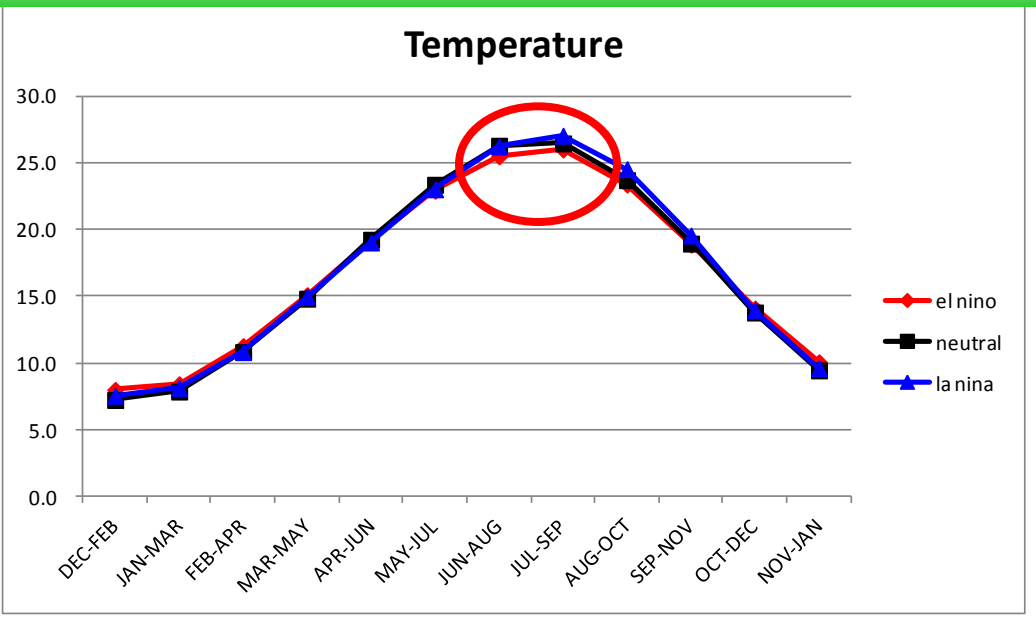






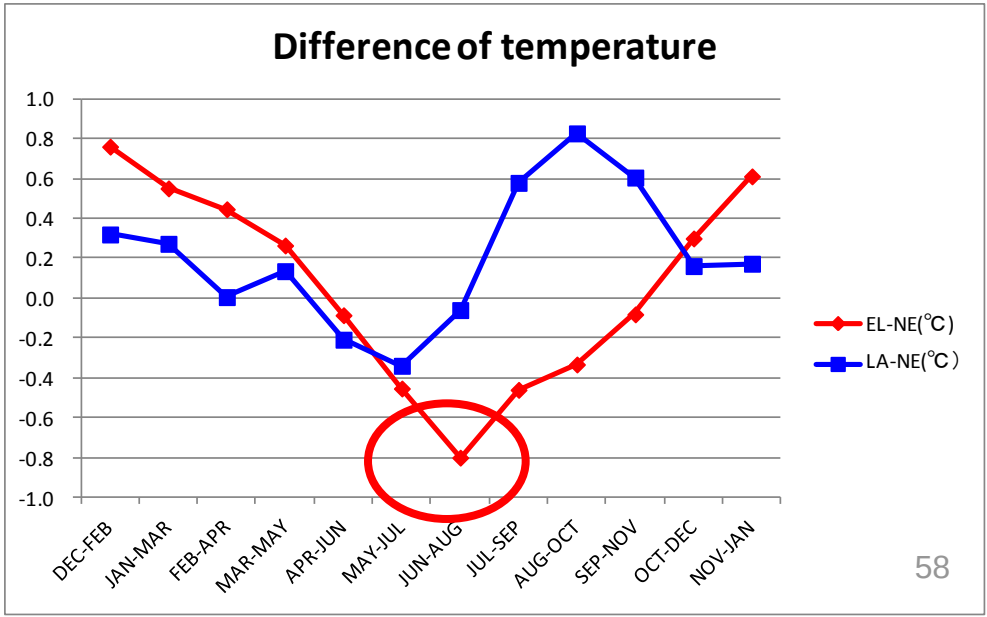


ENSO and Fukuoka (Japan) temperature

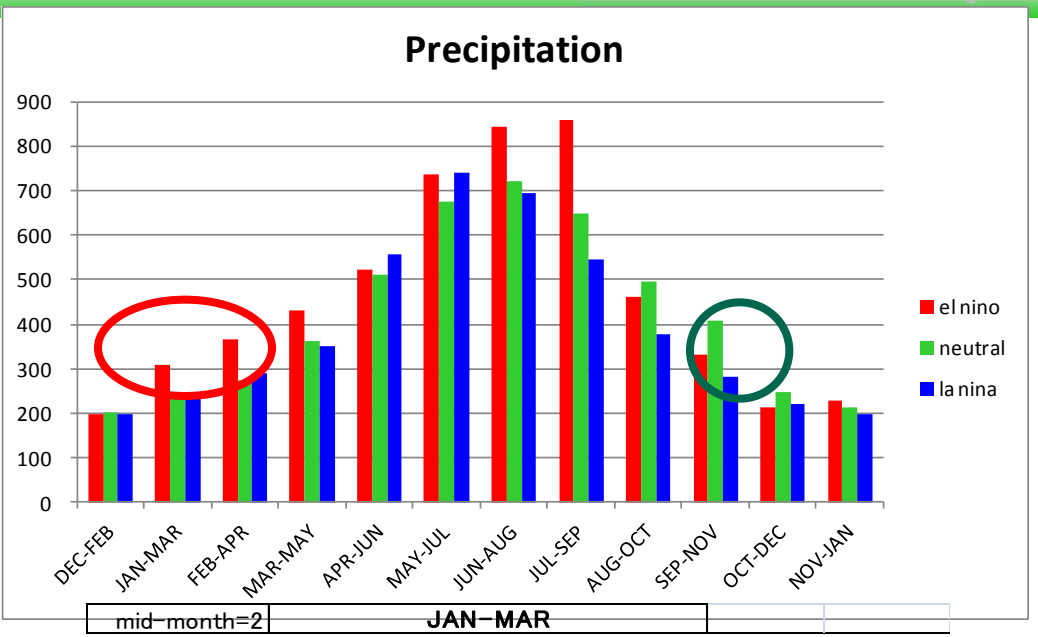


In El Niño phase, there is a tendency of lower than neutral temperature from June to August.

mid-month=7	JUN-AUG				
	3 month temp			t-test	
	el nino	neutral	la nina	el-ne	la-ne
average	25.49	26.29	26.23	2.6%	87.5%
No.	9	16	7		
Var	0.46	0.8	0.47		



ENSO and Fukuoka (Japan) precipitation



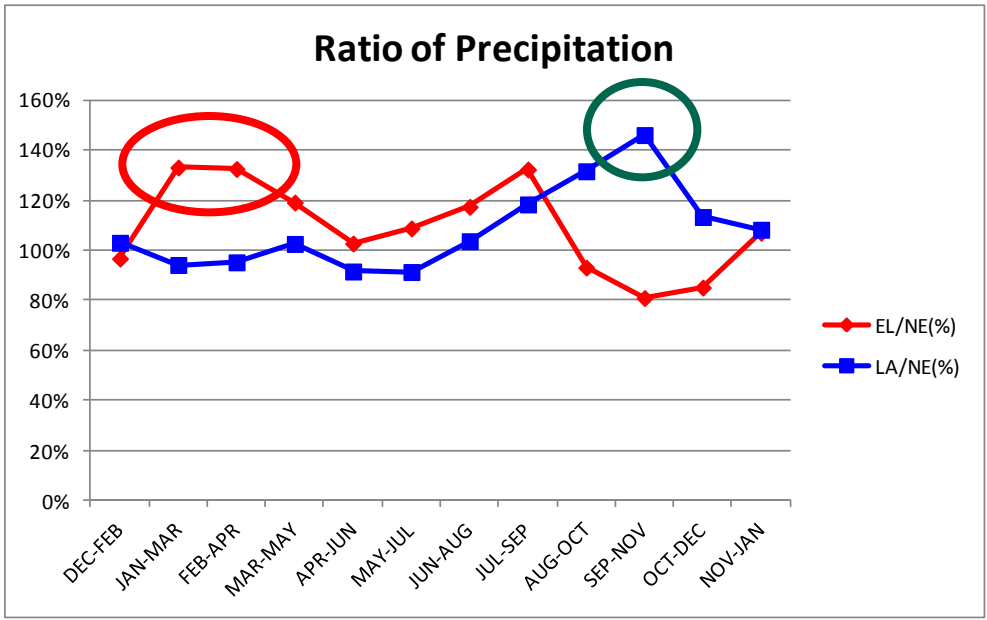
In La Nina phase, there is a tendency of heavier than neutral precipitation from September to November.

mid-month=10	SEP-NOV				
	3month prec			t-test	
	el nino	neutral	la nina	el-ne	la-ne
average	331.44	409.33	280.27	13.3%	1.1%
No.	9	12	11		
Var	5010.53	18218.24	5769.42		

mid-month=2	JAN-MAR				
	3month prec			t-test	
	el nino	neutral	la nina	el-ne	la-ne
average	308.58	231.88	246.22	0.6%	54.5%
No.	6	17	9		
Var	4526.84	2206.86	5203.19		

mid-month=3	FEB-APR				
	3month prec			t-test	
	el nino	neutral	la nina	el-ne	la-ne
average	364.92	275.42	289.21	0.2%	64.3%
No.	6	19	7		
Var	4154.84	2651.59	9758.49		

In El Nino phase, there is a tendency of heavier than neutral precipitation from January to March and from February to April.



Thank you!

JMA Mascot Character 'Hare-run'
'Hare' means sunny weather in Japanese
'Hare-ru' means 'it becomes sunny'.
'Run-run' means happiness feeling.