# A Quick Tutorial for Statistical Analysis by the ITACS

TCC/JMA Training Seminar on 19 January 2011

Climate Prediction Division of Japan Meteorological Agency

# Contents

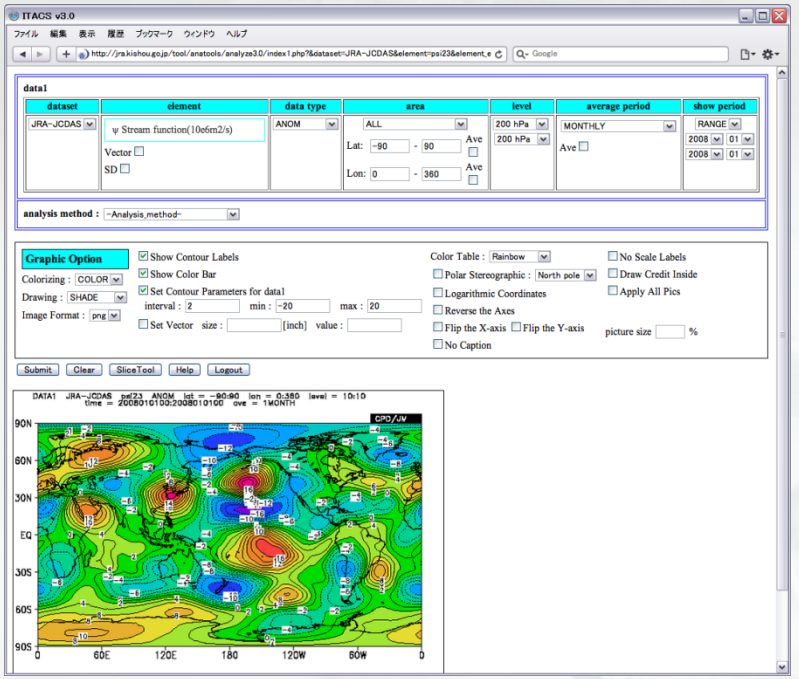
Chapter 1

# Introduction to the ITACS

# ITACS : Interactive Tool for Analysis of the Climate System

## What is the ITACS?

- **A web-based application software for climatological analysis**



# Features of the ITACS

## Various climatological data-sets

- Atmospheric Analysis Data, Outgoing Longwave Radiation (by NOAA), SST, Ocean Analysis Data, etc.

## Various types of charts

- Plain Longitude-Latitude Map, Polar Stereographic Map, Cross Section, Time Series Graph

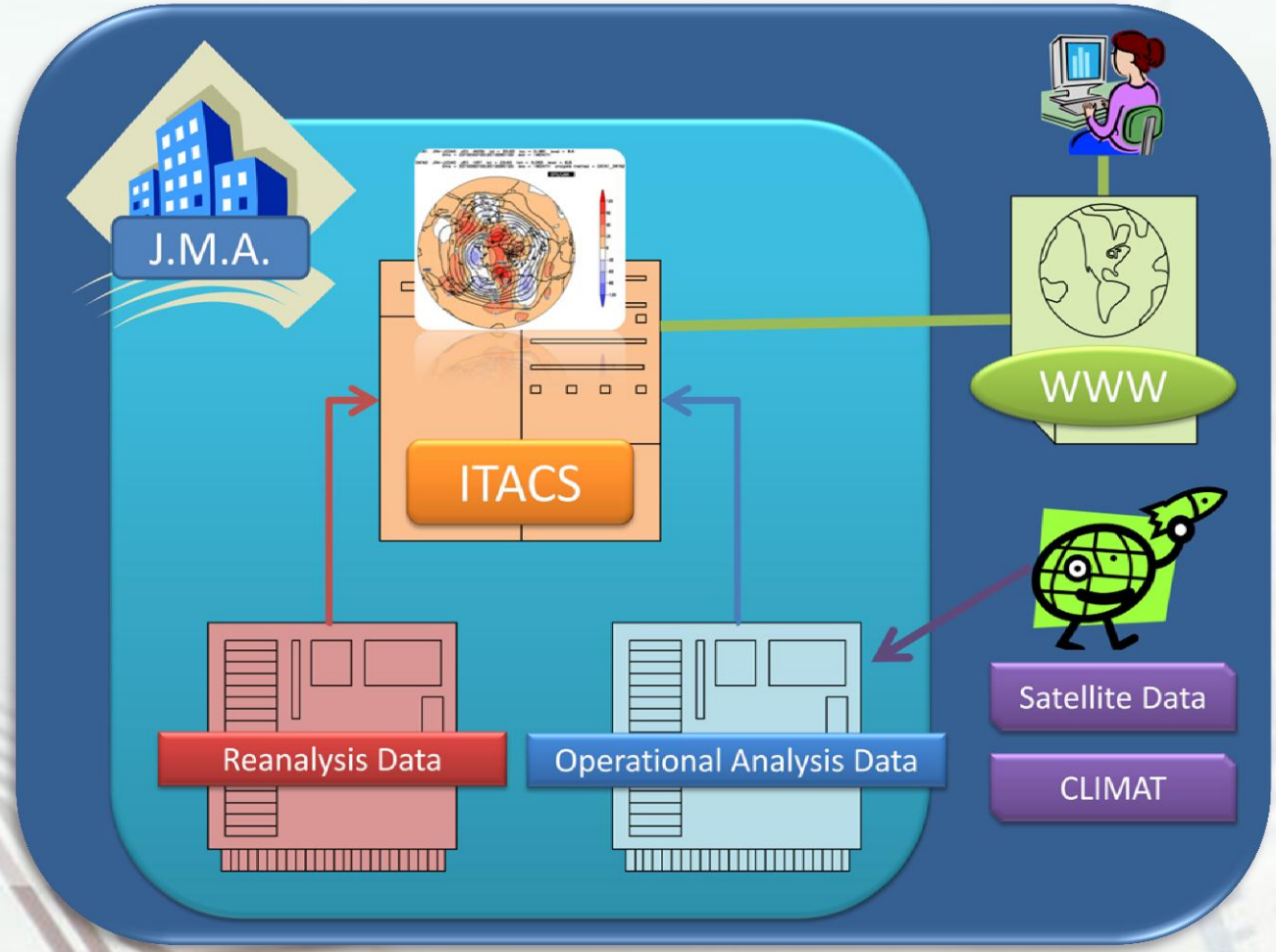
## Various statistical functions

- Linear Regression, Correlation Coefficient, EOF, SVD, FFT, etc.

## Requirement to use the ITACS

- Only A Web-Browser with Accessibility to the World Wide Web.

# Conceptual Outline of the ITACS



Chapter 2

# Basic Operations

# How to access to the ITACS

**Start web browser and access following URL.**

http://jra.kishou.go.jp/itacs/analyze/index.php

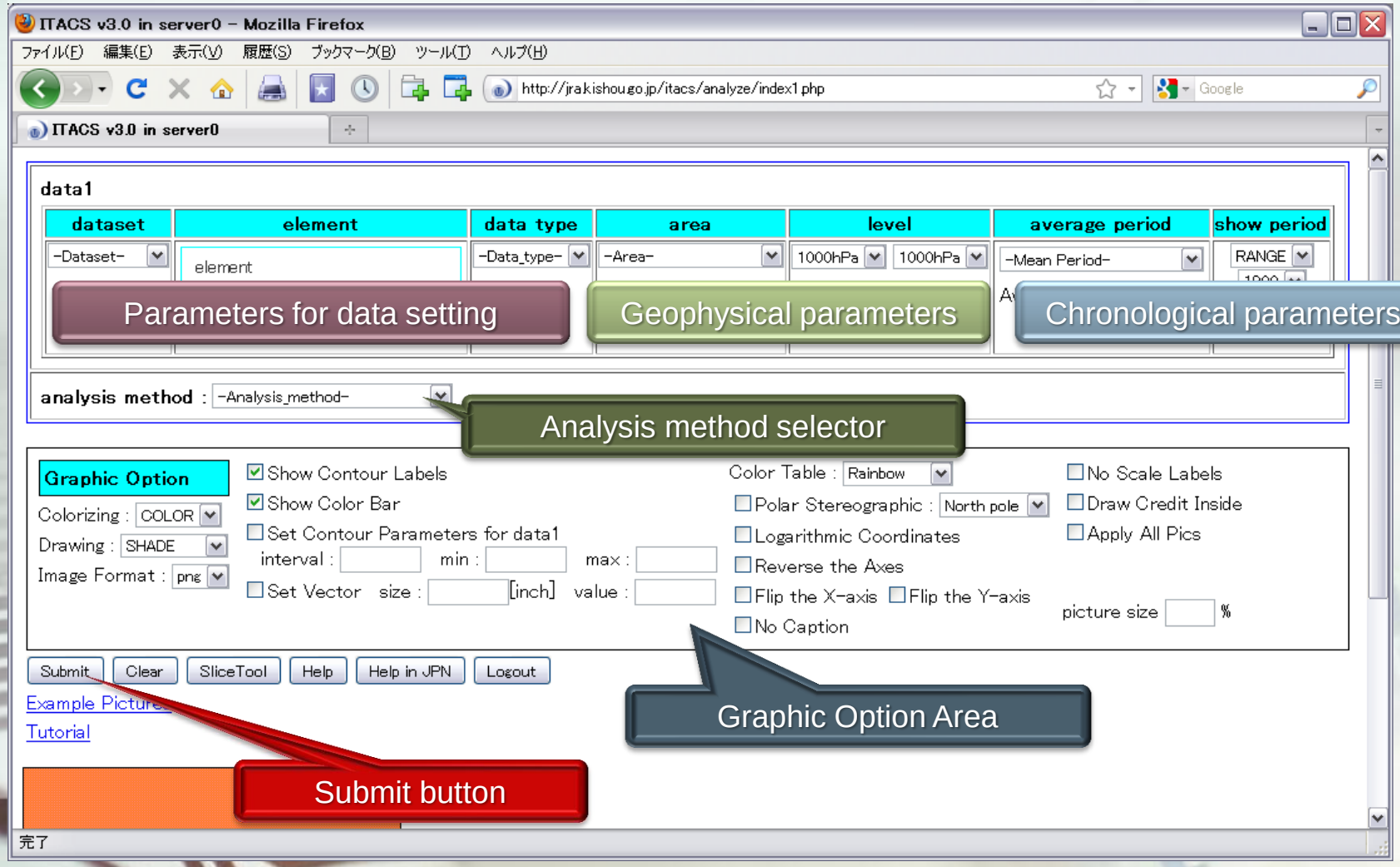
**Input following ID and Password.**

ID: tcc

Password: tcc

**So, you will see main display of the ITACS!**

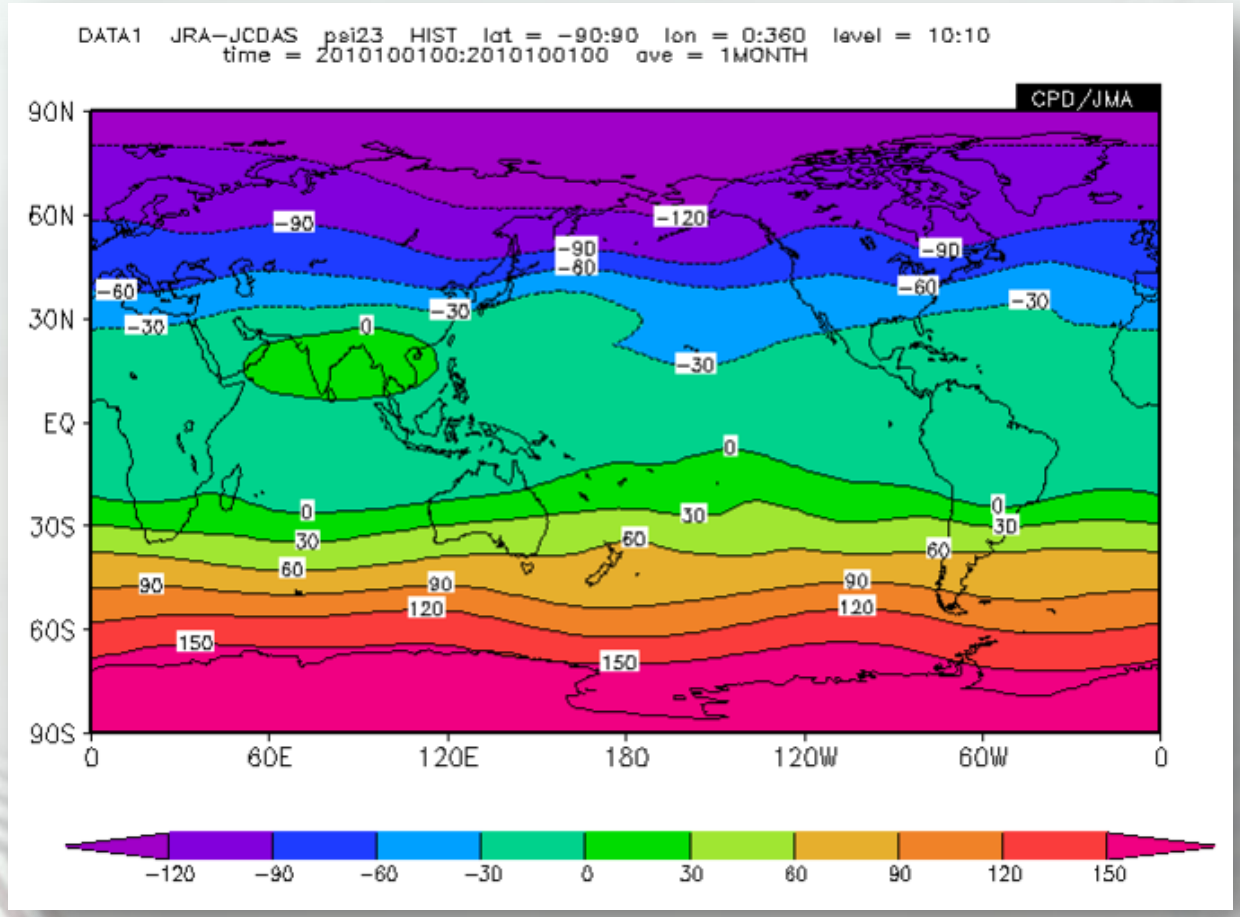
# Main Display of the ITACS



# Procedure for Setting Parameters

1. • Select data-set, element, and data-type.
2. • Set geophysical parameters.
3. • Set chronological parameters.
4. • Select analysis method (in necessity).
5. • Set graphic parameters (in necessity).

# Example1: 1-Element Map

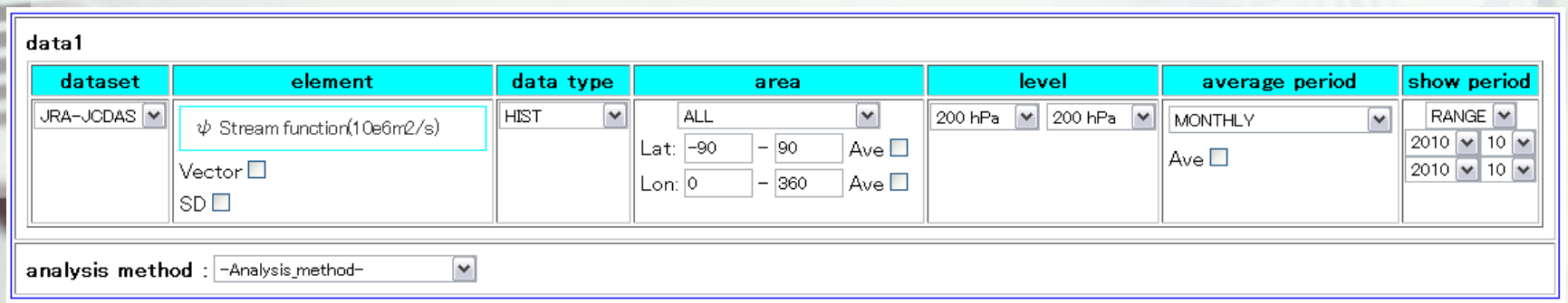



200-hPa Stream Function on October 2010

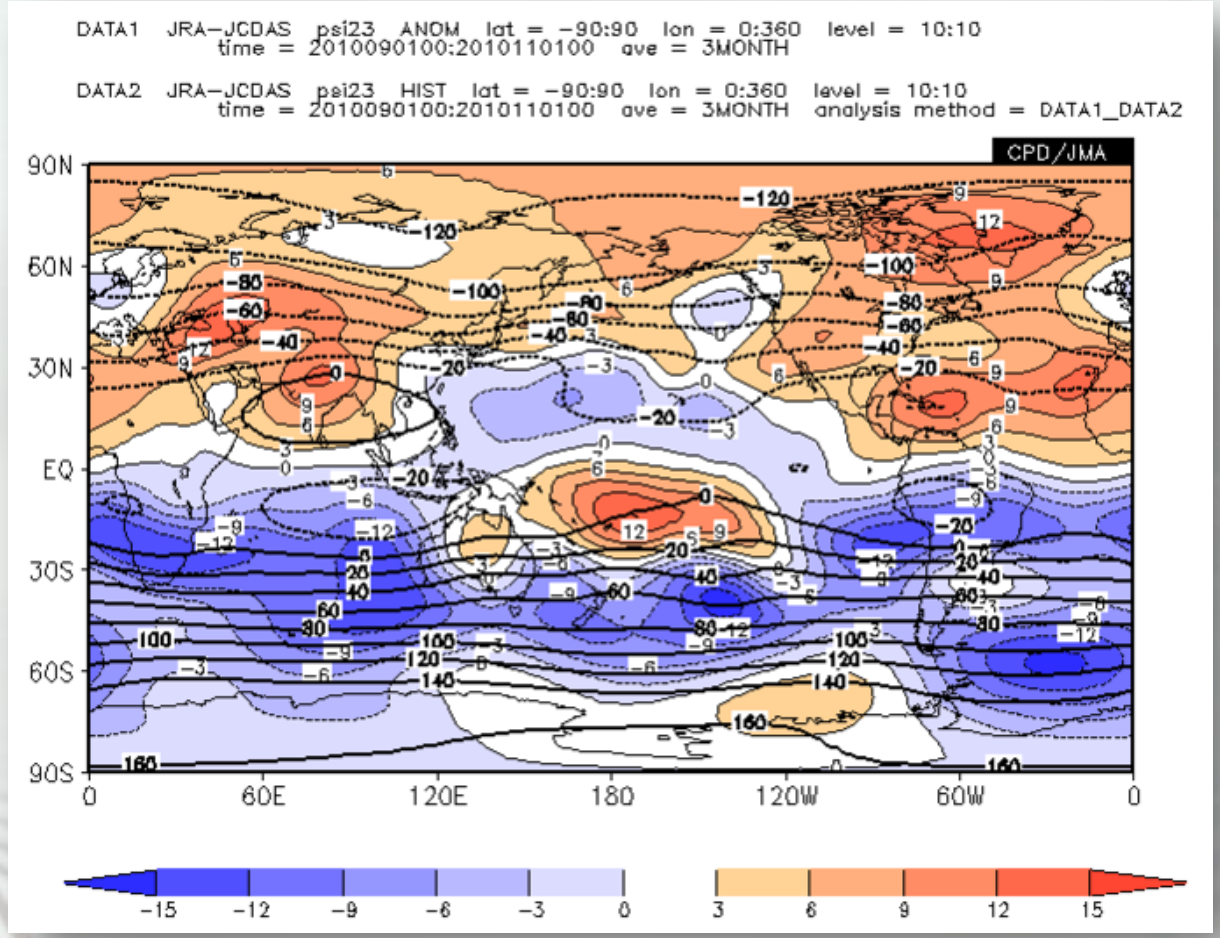
# Parameter Setting

## For data1

- dataset: JRA-JCDAS
- element: Pressure-levels – Stream function
- data type: HIST
  - “Hist” means historical observed or analysis data
  - “Anom” means anomaly
- area: ALL
  - latitude: -90 – 90, longitude: 0 – 360
- level: 200 hPa
- average period: MONTHLY
- show period: RANGE, 2010 10



# Example2: 2-Elements Map




3-month mean 200-hPa Stream Function and Anomaly
September – November 2010

# Parameter Setting

## For data1

- dataset: JRA-JCDAS, element: Pressure-levels – Stream function, data type: ANOM
- area: ALL, level: 200 hPa
- average period: MONTHLY (check “Ave” box)
- show period: RANGE, 2010 09 - 2010 11

## analysis method

- DATA1_DATA2

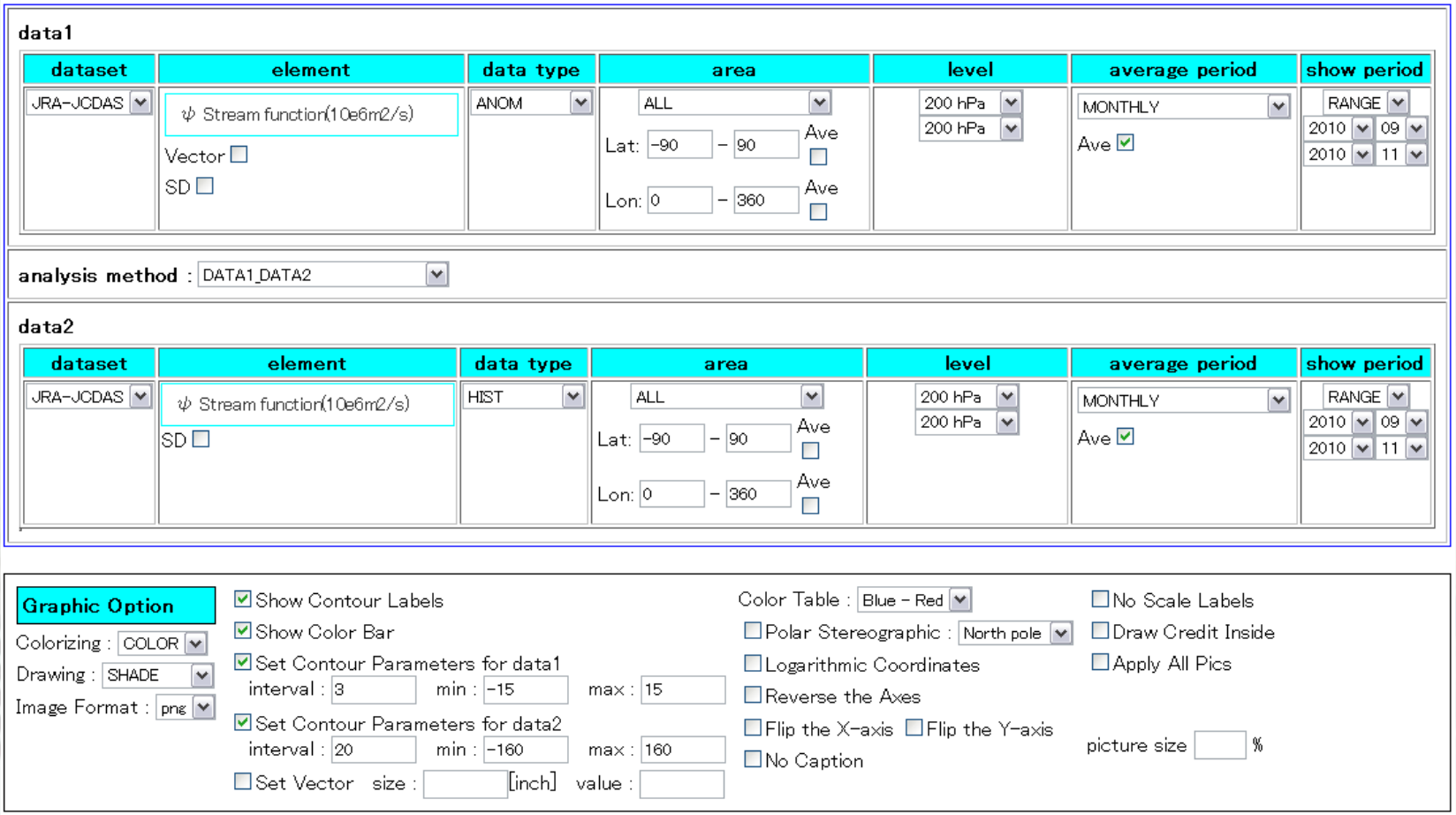
## For data2

- data type: HIST
- Other parameters are the same as for data1.

## Graphic Option

- Set Contour Parameters for data1 – interval: 3 min: -15 max: 15
- Set Contour Parameters for data2 – interval: 20 min: -160 max: 160
- Color Table: Blue-Red

# Parameter Setting (image)

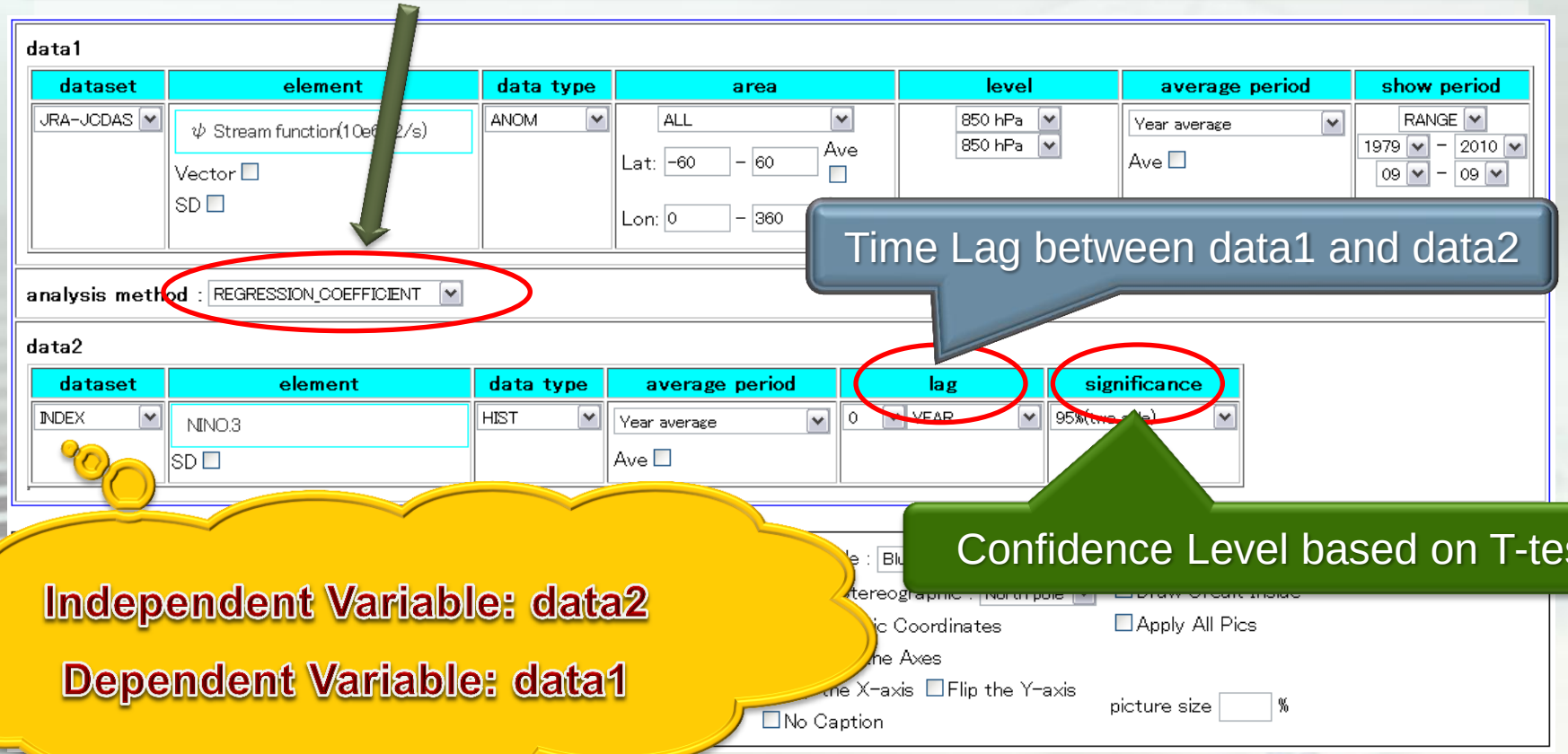


Chapter 3

# Regression Analysis

# How to perform Regression Analysis

**Select "REGRESSION COEFFICIENT" in "analysis method"**



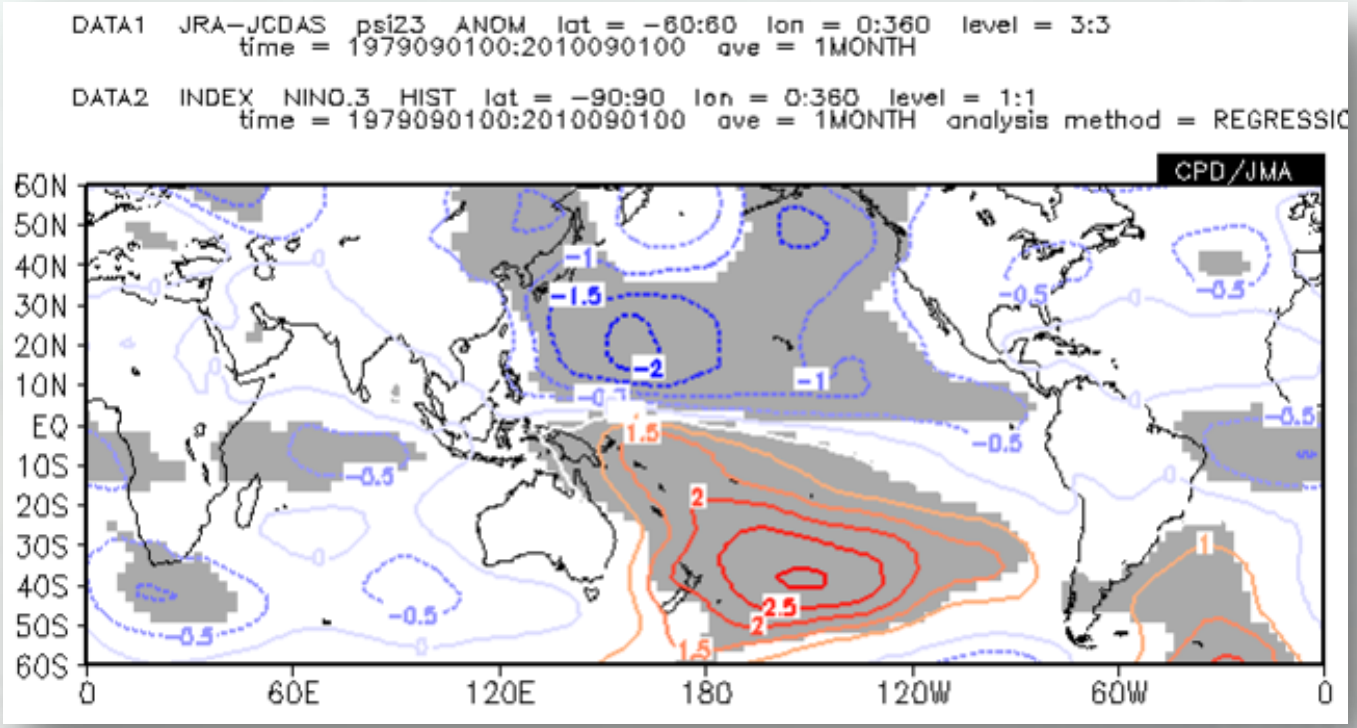

Time Lag between data1 and data2

Confidence Level based on T-test

**Independent Variable: data2**

**Dependent Variable: data1**

# An Example of Regression Analysis




Regression Coefficient between SST for NINO.3 and 850hPa Stream Function

- **Gray shaded areas are statistically significance with 5% significance level**

# Parameter Setting

## For data1 (dependent variable)

- dataset: JRA-JCDAS, element: Stream-function, data type: ANOM
- Lat: -60 – 60, Lon: 0 – 360, level: 850hPa
- average period: Year average, show period: RANGE, 1979/09 – 2010/09

## For analysis method

- REGRESSION COEFFICIENT

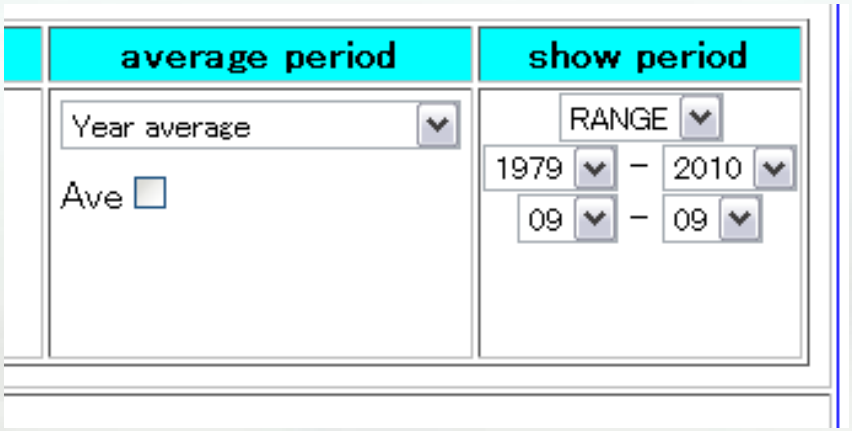
## For data2 (independent variable)

- dataset: INDEX, element: NINO3, data type: HIST
- Significance: 95%(two side)

## For graphic option

- Coloring: COLOR, Drawing: CONTOUR, Color Table: Blue-Red

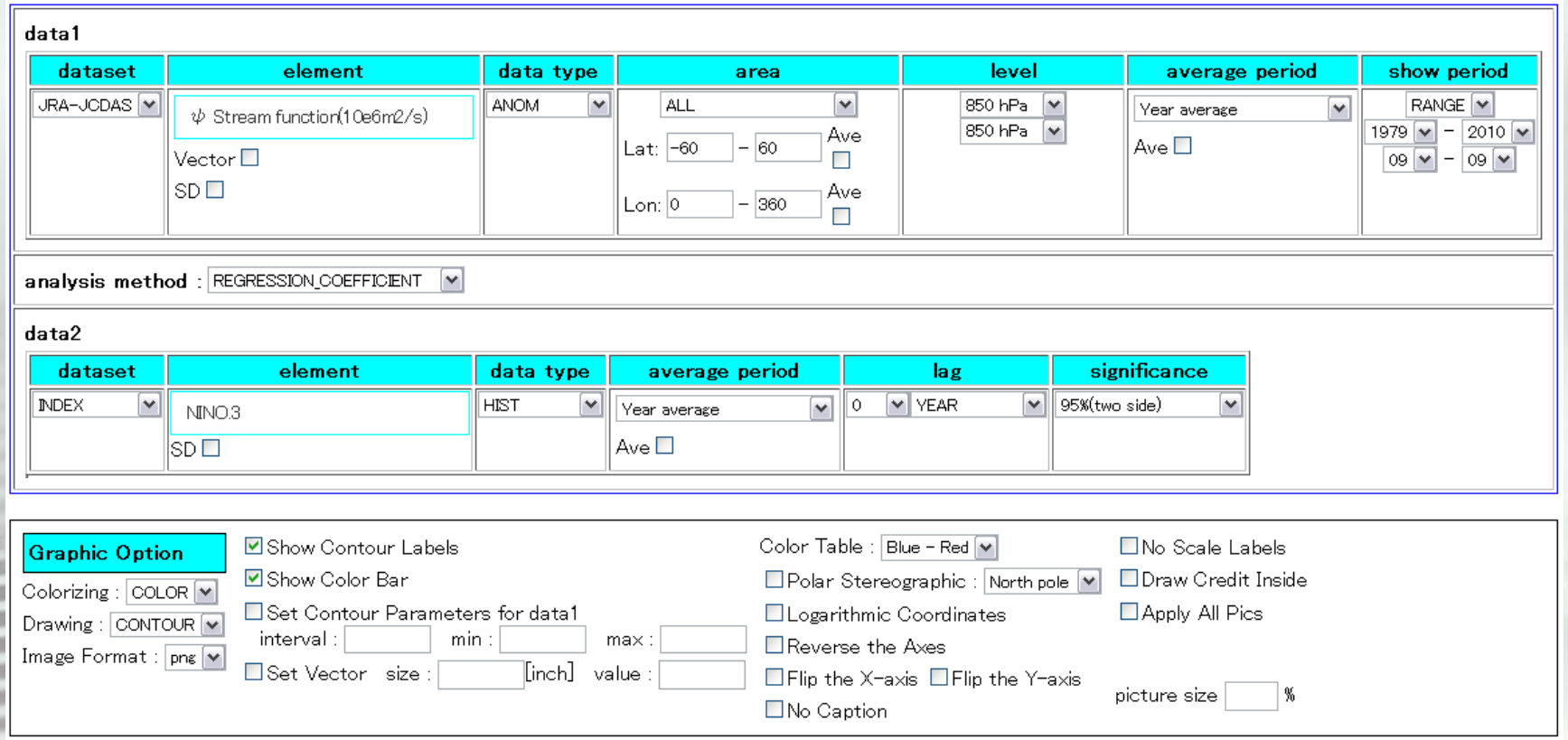
# What means “Year Average”?




| Year | Month |
|---|---|
| 1979 | 01 |
| 1979 | 02 |
| 1979 | 03 |
| 1979 | 04 |
| 1979 | 05 |
| 1979 | 06 |
| 1979 | 07 |
| 1979 | 08 |
| 1979 | 09 |
| 1979 | 10 |
| 1979 | 11 |
| 1979 | 12 |
| 1980 | 01 |
| 1980 | 02 |
| 1980 | 03 |
| 1980 | 04 |
| 1980 | 05 |
| 1980 | 06 |
| 1980 | 07 |
| 1980 | 08 |
| 1980 | 09 |
| 1980 | 10 |
| 1980 | 11 |
| 1980 | 12 |
| ..... | |
| 2010 | 01 |
| 2010 | 02 |
| 2010 | 03 |
| 2010 | 04 |
| 2010 | 05 |
| 2010 | 06 |
| 2010 | 07 |
| 2010 | 08 |
| 2010 | 09 |
| 2010 | 10 |
| 2010 | 11 |
| 2010 | 12 |

Sampling data in the same month from consecutive years

# Parameter Setting (image)



Chapter4

# How to use the data prepared by users on the ITACS

# Requirements on User Input Data

A Text File in CSV format

One Directional Time Series

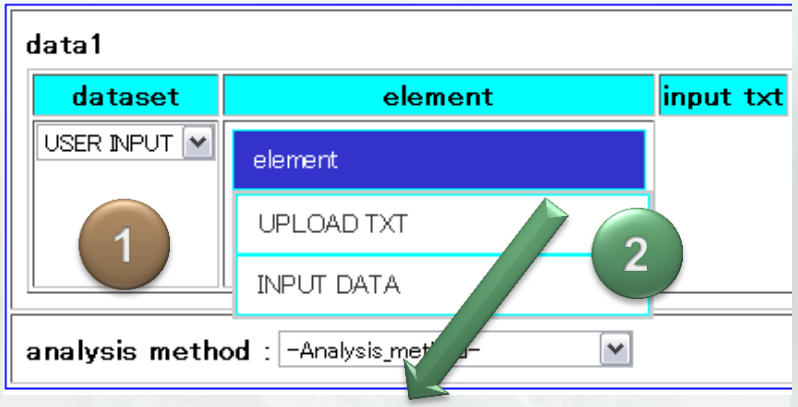
Single Station (Point) Data

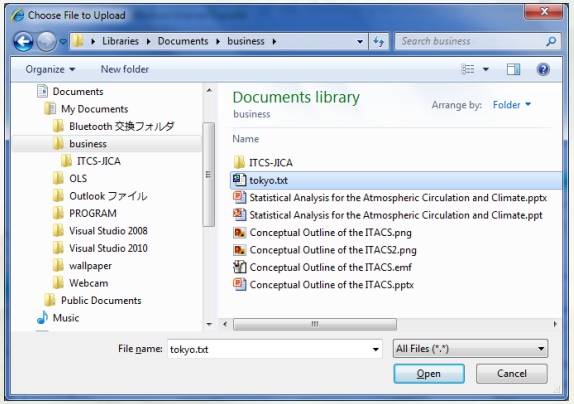
The Order of Fields in a Record ↓

- **<year>,<month>,<day>,<data value>**

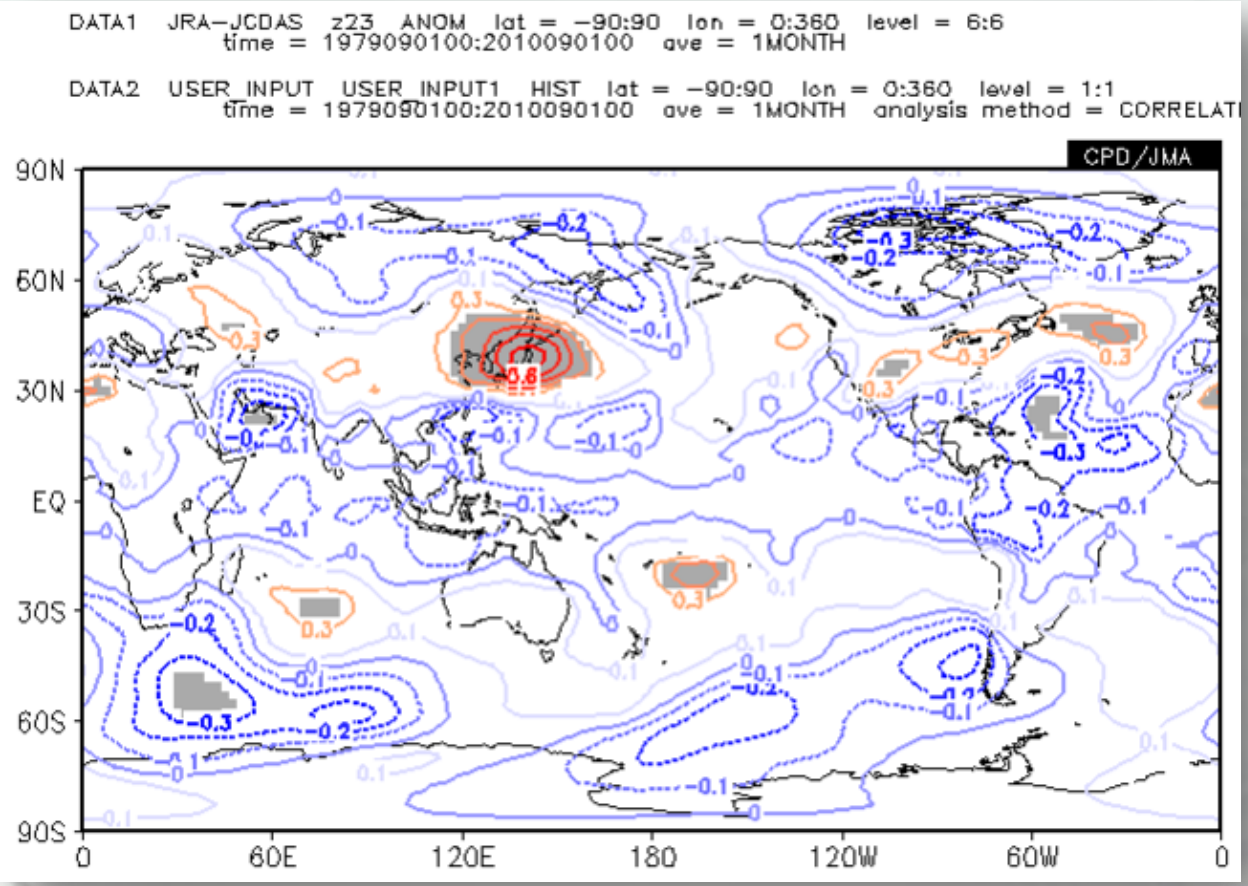
# How to input the User Data

1. Select “USER INPUT” for “dataset”
2. Select “UPLOAD TXT” in “element”.
3. Press “Browse…” button in “input txt”
4. select the data file and press “upload” button.



# An Example for User Input Data




Correlation Coefficient between Temperature of Tokyo and 500-hPa Geopotential Height

# Parameter Setting

## For data1 (dependent variable)

- dataset: JRA-JCDAS, element: Geopotential height, data type: ANOM
- area: ALL, level: 500hPa
- average period: Year average, show period: RANGE, 1979/09 – 2010/09

## For analysis method

- CORRELATION COEFFICIENT

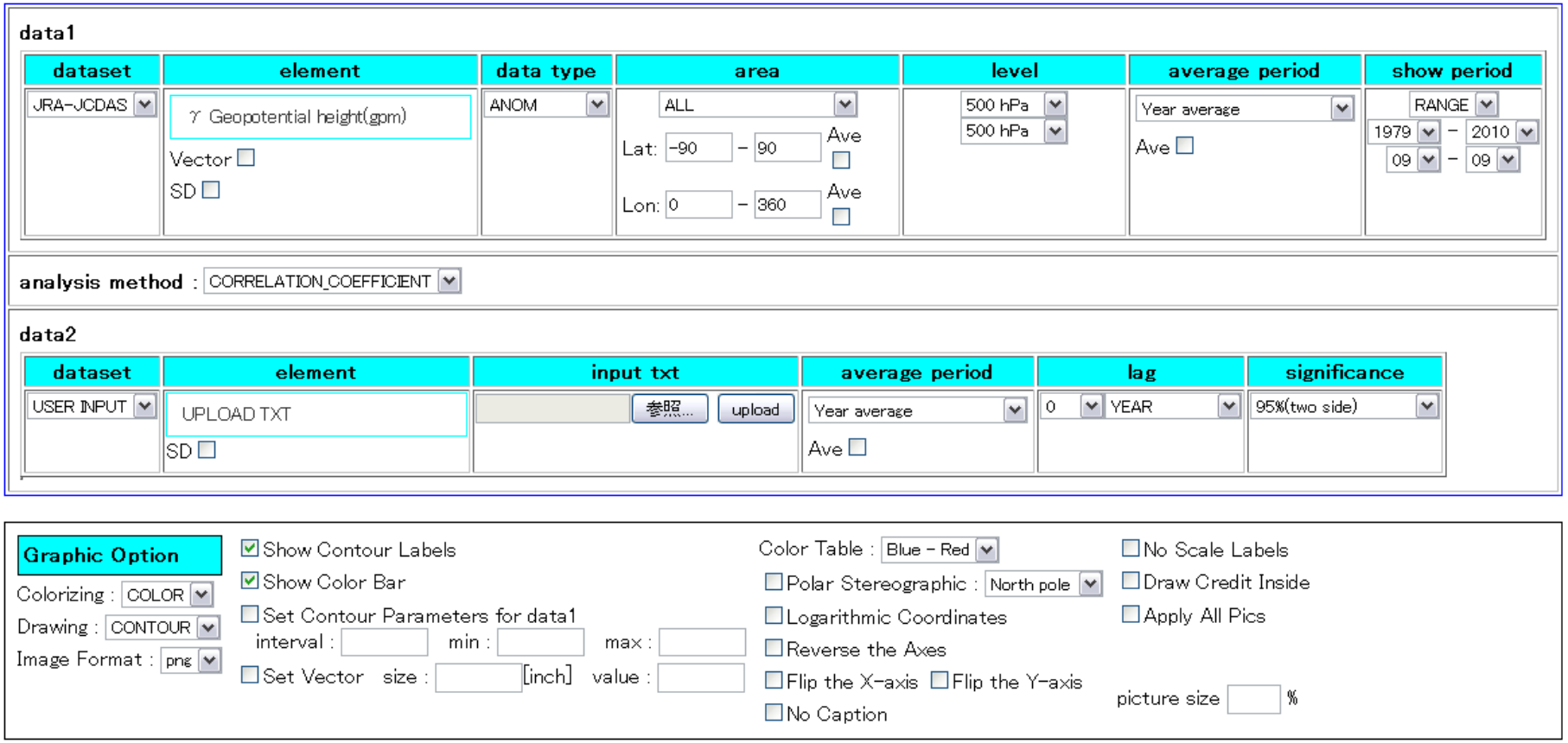
## For data2 (independent variable)

- dataset: USER INPUT
- element: UPLOAD_TEXT (upload tokyo_temp.txt in this exercise)
- Significance: 95%

## For graphic option

- Coloring: COLOR, Drawing: CONTOUR, Color Table: Blue-Red

# Parameter Setting (image)



# Appendix

# I. A Sample for User Input Data

```
#Monthly mean temperature of Tokyo↓
#undef=9999↓
#element=Temperature↓
#year,month,day,temp.↓
1979,1,1,6.6↓
1979,2,1,8.4↓
1979,3,1,9.9↓
1979,4,1,13.9↓
1979,5,1,18.6↓
1979,6,1,24.4↓
1979,7,1,25.2↓
1979,8,1,27.4↓
.............

2010,8,1,29.6↓
2010,9,1,25.1↓
```

A comment line

The Definition of Undefined Value

Denoting Element Name

Every Line must be terminated with a Newline Code

# Typical Examples of Unsuitable Format

Month

Year

```
Year,Jan.,Feb.,Mar.,Apr.,May,Jun.,Jul.,Aug.,Sep.,Oct.,Nov.,Dec.
1979,6.6,8.4,9.9,13.9,18.6,24.4,25.2,27.4,24.1,19.6,14.3,10.1
1980,5.6,5.2,8.2,13.6,19.2,23.6,23.8,23.4,23.0,18.2,13.0,7.7
1981,4.4,5.3,9.0,13.9,17.5,20.2,26.3,26.2,21.8,17.6,10.4,7.6
1982,5.8,5.5,9.9,14.0,20.7,21.4,23.1,27.1,22.3,18.0,14.3,9.5
1983,6.2,6.1,8.6,15.9,19.7,20.5,23.8,27.5,23.1,17.7,12.3,7.1
1984,3.7,3.0,5.9,11.6,17.2,21.8,26.2,28.6,23.5,17.7,12.2,7.7
1985,4.1,6.5,7.8,14.2,19.1,20.2,26.3,27.9,23.1,17.9,13.3,7.4
1986,4.5,4.3,7.8,13.9,17.9,21.1,23.9,26.8,23.7,17.1,12.3,8.5
1987,5.8,6.8,9.3,14.4,19.3,22.1,27.0,27.3,23.3,18.9,12.8,8.1
1988,7.7,4.9,8.4,14.3,18.2,22.3,22.4,27.0,22.8,17.5,11.4,8.4
1989,8.1,7.5,9.6,15.6,17.7,20.7,24.1,27.1,25.2,17.5,14.2,9.2
1990,5.0,7.8,10.6,14.7,19.2,23.5,25.7,28.6,24.8,19.2,15.1,10.0
1991,6.3,6.5,9.5,15.4,18.8,23.6,26.7,25.5,23.9,18.1,13.0,9.2
1992,6.8,6.9,9.7,15.1,17.3,20.6,25.5,27.0,23.3,17.3,13.0,9.4
1993,6.2,7.7,8.7,13.4,18.1,21.7,22.5,24.8,22.9,17.5,14.1,8.5
1994,5.5,6.6,8.1,15.8,19.5,22.4,28.3,28.9,24.8,20.2,13.4,9.0
1995,6.3,6.5,8.9,15.0,19.1,20.4,26.4,29.4,23.7,19.5,12.7,7.7
1996,6.6,5.4,9.2,12.7,18.1,22.6,26.2,26.0,22.4,18.0,13.2,9.3
1997,6.8,7.0,10.5,15.2,19.2,22.7,26.6,27.0,22.9,18.7,14.3,9.2
1998,5.3,7.0,10.1,16.3,20.5,21.5,25.3,27.2,24.4,20.1,13.9,9.0
1999,6.6,6.7,10.1,15.0,19.9,22.8,25.9,28.5,26.2,19.5,14.2,9.0
2000,7.6,6.0,9.4,14.5,19.8,22.5,27.7,28.3,25.6,18.8,13.3,8.8
2001,4.9,6.6,9.8,15.7,19.5,23.1,28.5,26.4,23.2,18.7,13.1,8.4
2002,7.4,7.9,12.2,16.1,18.4,21.6,28.0,28.0,23.1,19.0,11.6,7.2
2003,5.5,6.4,8.7,15.1,18.8,23.2,22.8,26.0,24.2,17.8,14.4,9.2
2004,6.3,8.5,9.8,16.4,19.6,23.7,28.5,27.2,25.1,17.5,15.6,9.9
2005,6.1,6.2,9.0,15.1,17.7,23.2,25.6,28.1,24.7,19.2,13.3,6.4
2006,5.1,6.7,9.8,13.6,19.0,22.5,25.6,27.5,23.5,19.5,14.4,9.5
2007,7.6,8.6,10.8,13.7,19.8,23.2,24.4,29.0,25.2,19.0,13.3,9.0
2008,5.9,5.5,10.7,14.7,18.5,21.3,27.0,26.8,24.4,19.4,13.1,9.8
2009,6.8,7.8,10.0,15.7,20.1,22.5,26.3,26.6,23.0,19.0,13.5,9.0
2010,7.0,6.5,9.1,12.4,19.0,23.6,28.0,29.6,25.1,18.9,13.5,9.9
```

2-Directional Time Series

```
#year,month,day,Gifu,Nagoya,Tsu,Shizuoka
1979,1,1,5.7,5.6,5.7,7.3
1979,2,1,7.4,7.2,7.2,9.4
1979,3,1,8.5,8.2,7.6,10.2
1979,4,1,13.2,13,12.5,14.5
1979,5,1,18.4,18.1,17.7,17.9
1979,6,1,24.1,23.6,22.9,23.7
1979,7,1,25.8,25.2,24.9,24.8
1979,8,1,27.9,27.4,27,27
1979,9,1,23.9,23.8,23.2,24.3
1979,10,1,18.8,18.5,18.2,19.6
1979,11,1,12.7,12.6,12.6,14.9
1979,12,1,8.2,7.9,8,10.1
1980,1,1,4.2,4.1,4.4,6.5
1980,2,1,3.5,3.4,3.9,5.7
1980,3,1,8.1,7.9,7.4,9.7
1980,4,1,13.2,12.9,12.4,14.3
1980,5,1,18.6,18.4,17.7,18.7
1980,6,1,23.4,23.1,22.8,22.9
1980,7,1,25,24.8,24.3,24.8
1980,8,1,25.3,25.1,24.7,24.9
1980,9,1,22.8,22.5,21.9,23
1980,10,1,17.5,17.2,17.2,18.6
1980,11,1,12.5,12.1,12,14.2
1980,12,1,5.1,5.1,5.7,7.3
```

Multiple Station Data

# II: A Passage to ITACS

## Application to the ITACS

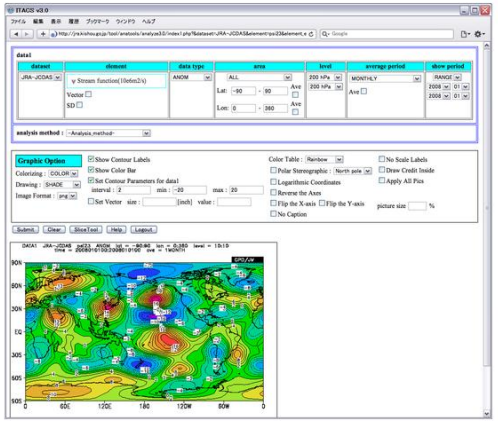
- http://jra.kishou.go.jp/itacs-info/tcc/itacsinfo.html

### ITACS : Interactive Tool for Analysis of the Climate System

The ITACS is a web-based application for climatological analysis.

The Japan Meteorological Agency (JMA) has developed the ITACS to assist National Meteorological and Hydrological Services (NMHSs) in analyzing the causes of extreme climate events. The ITACS will enable users not only to monitor current climate conditions but also to analyze the characteristics and factors that lie behind such conditions and extreme climatic events. Those who are, basically at NMHSs, interested in using the ITACS are required to submit application to JMA in order to receive permission for the use (*Application for using the ITACS page*).

For using the ITACS, users are required only to access the Internet through major web browsers, but not necessary to set up any programs and download any data sets.



The Display of the ITACS

### Application for using the ITACS

Please read the ***Conditions of Use*** outlined below before applying to JMA to use the ***Interactive Tool for Analysis of the Climate System*** (ITACS). The Japan Meteorological Agency (JMA) will examine applications and, if the application is accepted, issue ID and password.

**JMA permits persons at National Meteorological and Hydrological Services to use the ITACS.**

#### Conditions of Use

1. Users should provide user information including name, affiliation, e-mail address and purpose of data use.
2. The use of figures and/or data produced by ITACS for commercial purposes is prohibited.
3. Users should not let any third party use the ID/password information issued, and should keep this information private at all times.
4. The use of ITACS should be duly acknowledged in scientific or technical papers, publications, press releases or other communications.

   **Sample of citation:**

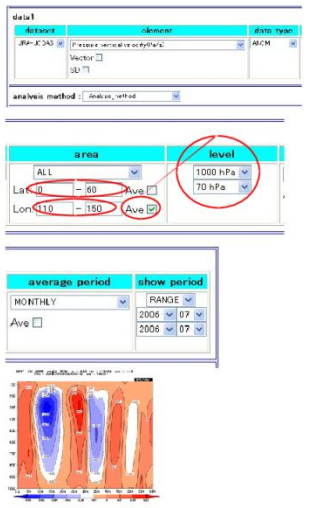
   - The figures and statistical analysis in this study were made using ITACS data provided by the Japan Meteorological Agency.
5. The data source used in ITACS should be checked, and acknowledged if necessary, in scientific or technical papers, publications, press releases or other communications.
6. Users should provide JMA with a copy of their scientific or technical papers, publications, press releases or other communications involving ITACS.

# III: More Intimate Tutorial for the ITACS

## Please access following URL.

- **http://jra.kishou.go.jp/itacs/ana3.0/Tutorical.pdf**
  - **Notice: Required A Formal ITACS Account**

ITACS ver.3.0 Tutorial




**5. Proper way to fix dimensions**

In ITACS we treat four-dimensional data but we can draw one or two-dimensional data in ITACS. In other words, we must fix the other dimensions. Now we try to draw latitude-height cross section chart to understand the proper way to fix dimensions. Please select as below.

Analysis Method / -Analysis method-
Dataset / JRA-JCDAS
Element / Pressure levels Pressure vertical velocity
Data Type / ANOM

Here, we will average pressure vertical velocity from 110−150° E and show them on latitude-height cross section (0-60° N, 1000-70hPa). So please select and customize as below.

Area / all Lat 0-60 "Ave" unchecked
Lon 110-150 "Ave" checked
Level / upper: 1000hPa lower: 70hPa

When "Ave" for "Lon" checked, data are averaged from specified longitude range so longitude dimension is fixed. And when different levels are chosen from each menu in "Level", vertical dimension are set to vary.
In this case, among three spatial dimensions, two dimensions (latitude dimension and vertical dimension) are set to vary (longitude dimension is fixed.). So if we set time dimension we can show latitude-height cross section. Please select as below and click "Submit".
average period / MOMTHLY
show period / upper: RANGE middle and lower: 2006 07