2nd International Interdisciplinary Conference on Predictions for Hydrology, Ecology, and Water Resources Management:
Changes and Hazards caused by Human Interventions and Climate Change, Prague, Czech Republic, 22-23 September 2010

Water security of Sameura dam project under the influence of global climate changes in the western part of Japan

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22 September 2010

This study examine the vulnerability of water resources under the influence global climate changes in the western part of Japan since 1970s when the sea surface water temperature along the pacific coast of Kochi prefecture has started to increase by steps.

The sea surface water temperature along the coast of Kochi prefecture rose more than 2 ℃ in the past 25 years from 1975 to 2000, of which the increasing rate is alarming and among the highest in Japan island, owing to the direct effect of warm Kuroshio (Black) current.

Frequent change of sea surface water temperature along the off-shore of Koch has a relation with effect of global scale climatic changes such as La-Nina and El-Nino

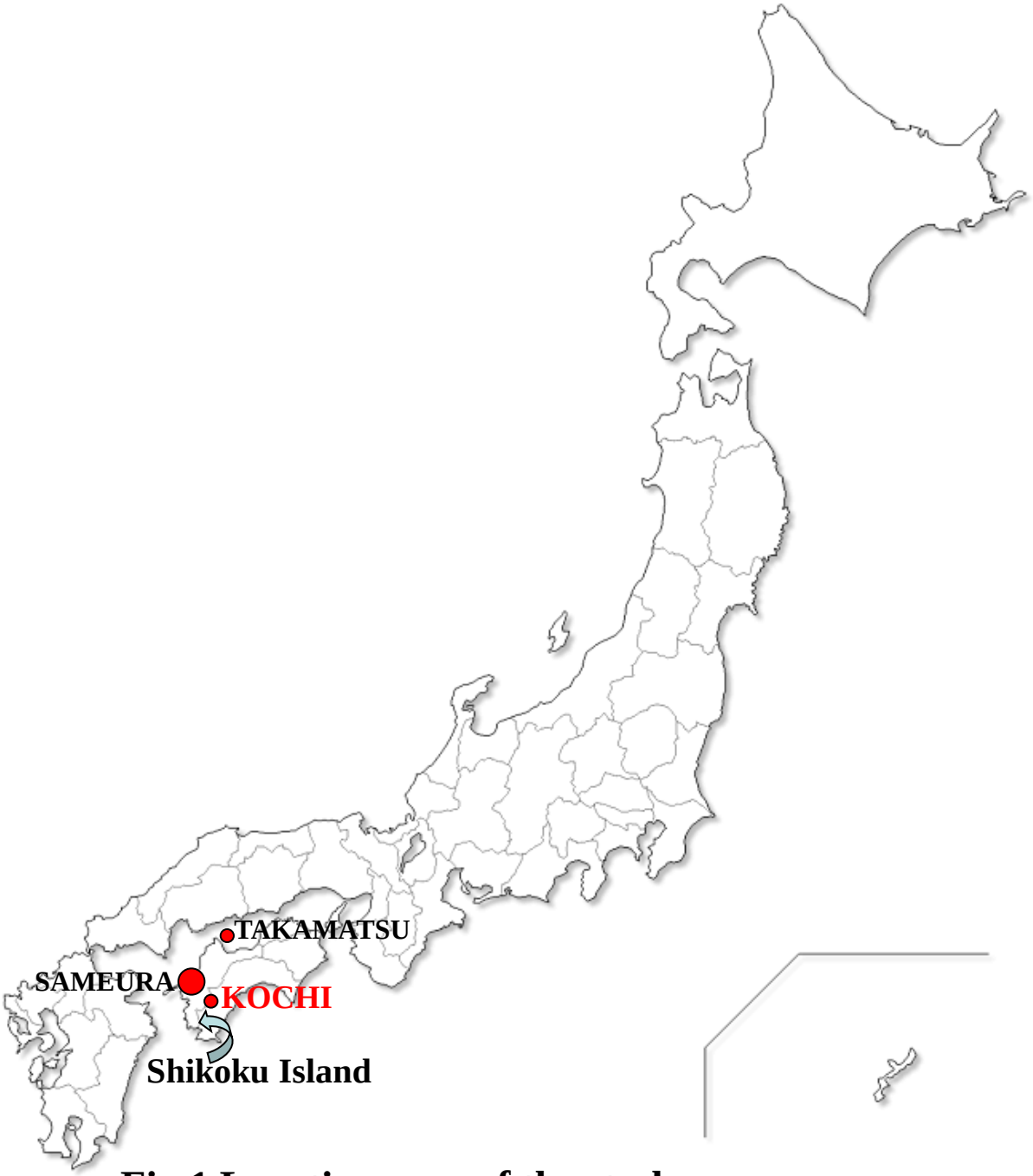


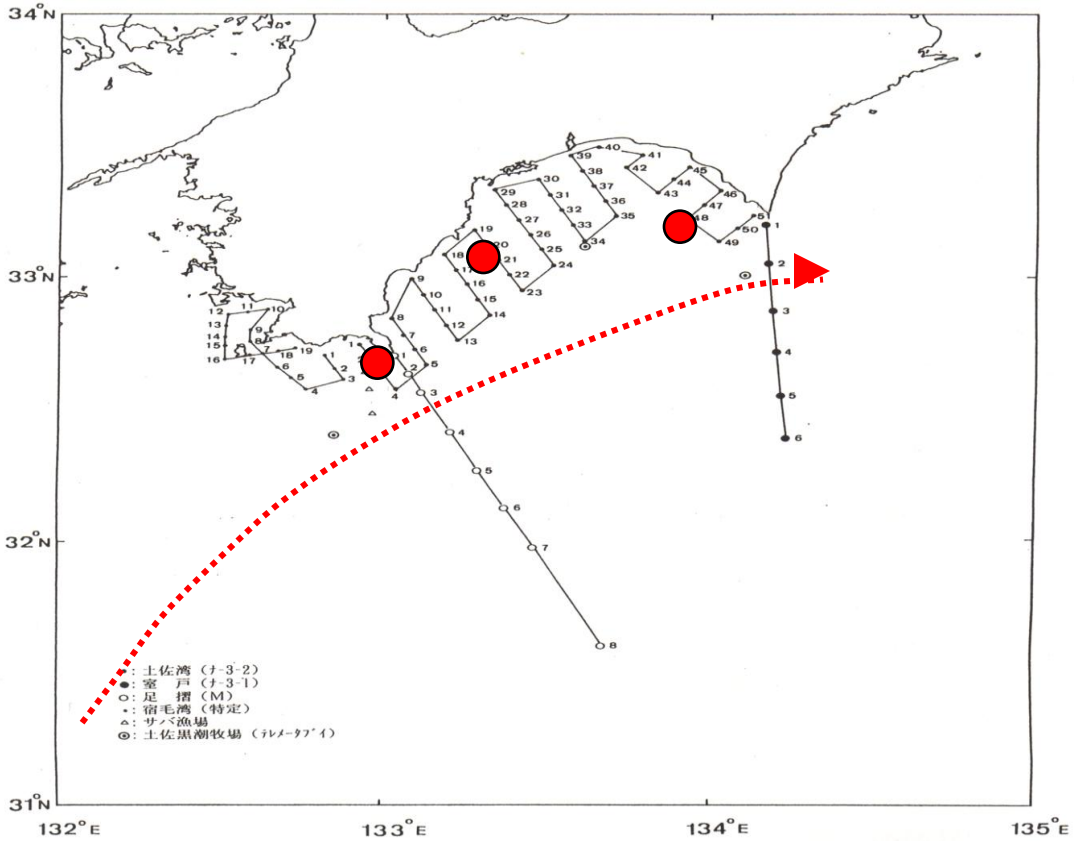
Fig.1 Location map of the study area

Bonito ride the warm Kuroshio or Black Current north to Sanriku from spring to summer.

Fishing season may often be delayed in the future if global warming continues

SASHIMI, Raw Fish of Bonito

Sea Surface Water Temperature Monitoring



Legend：●(Ashizuri・Tosa Bay・Muroto)

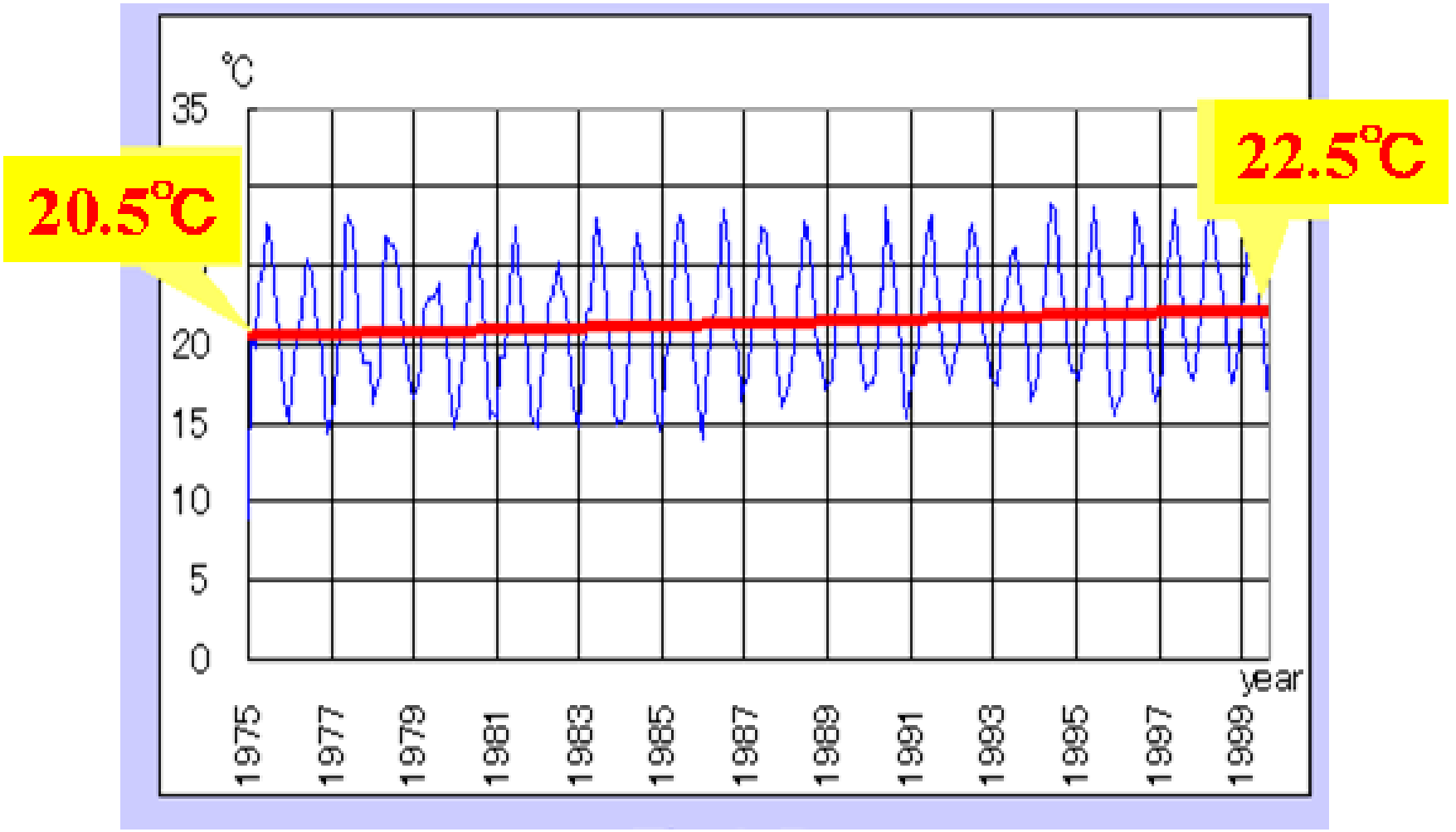
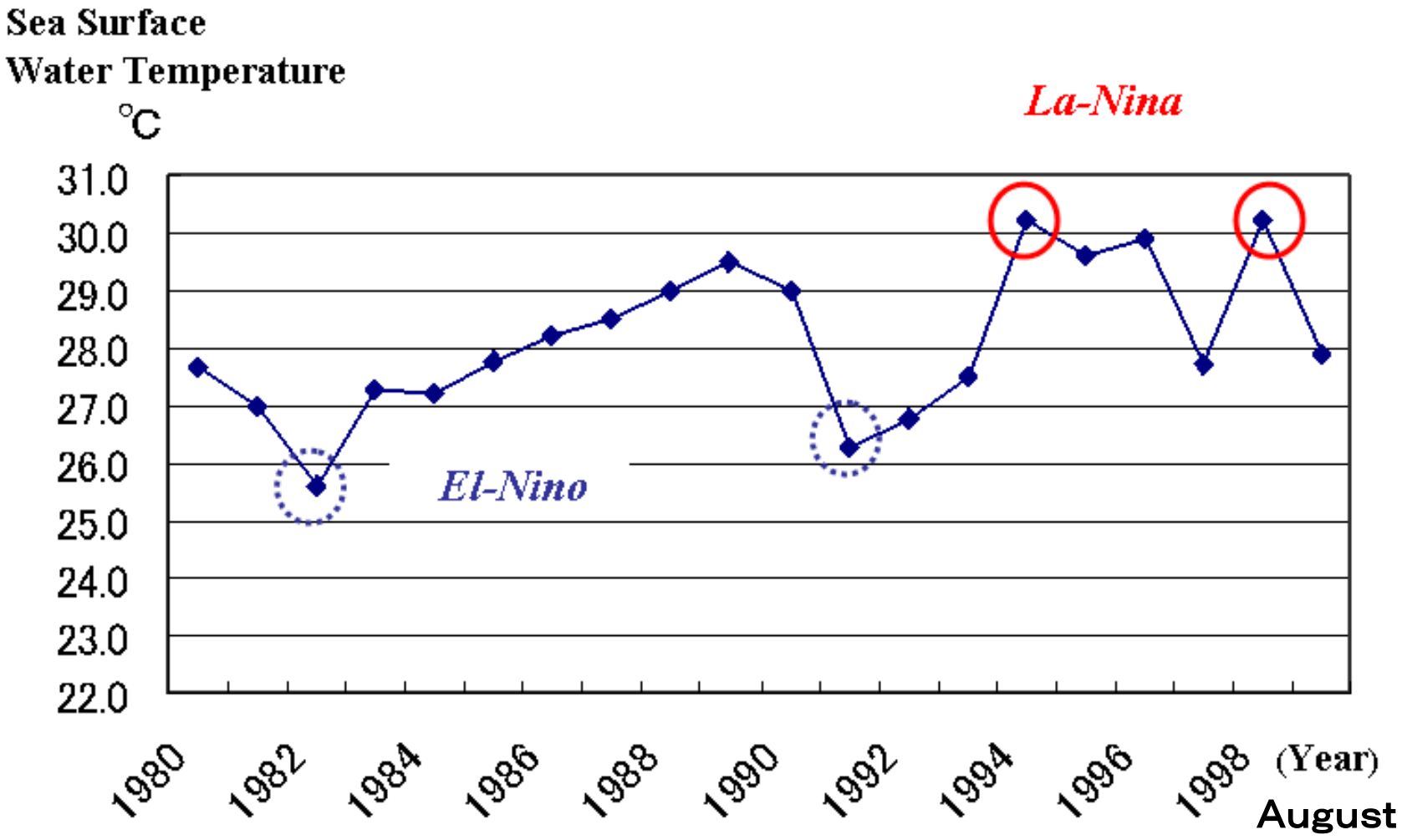
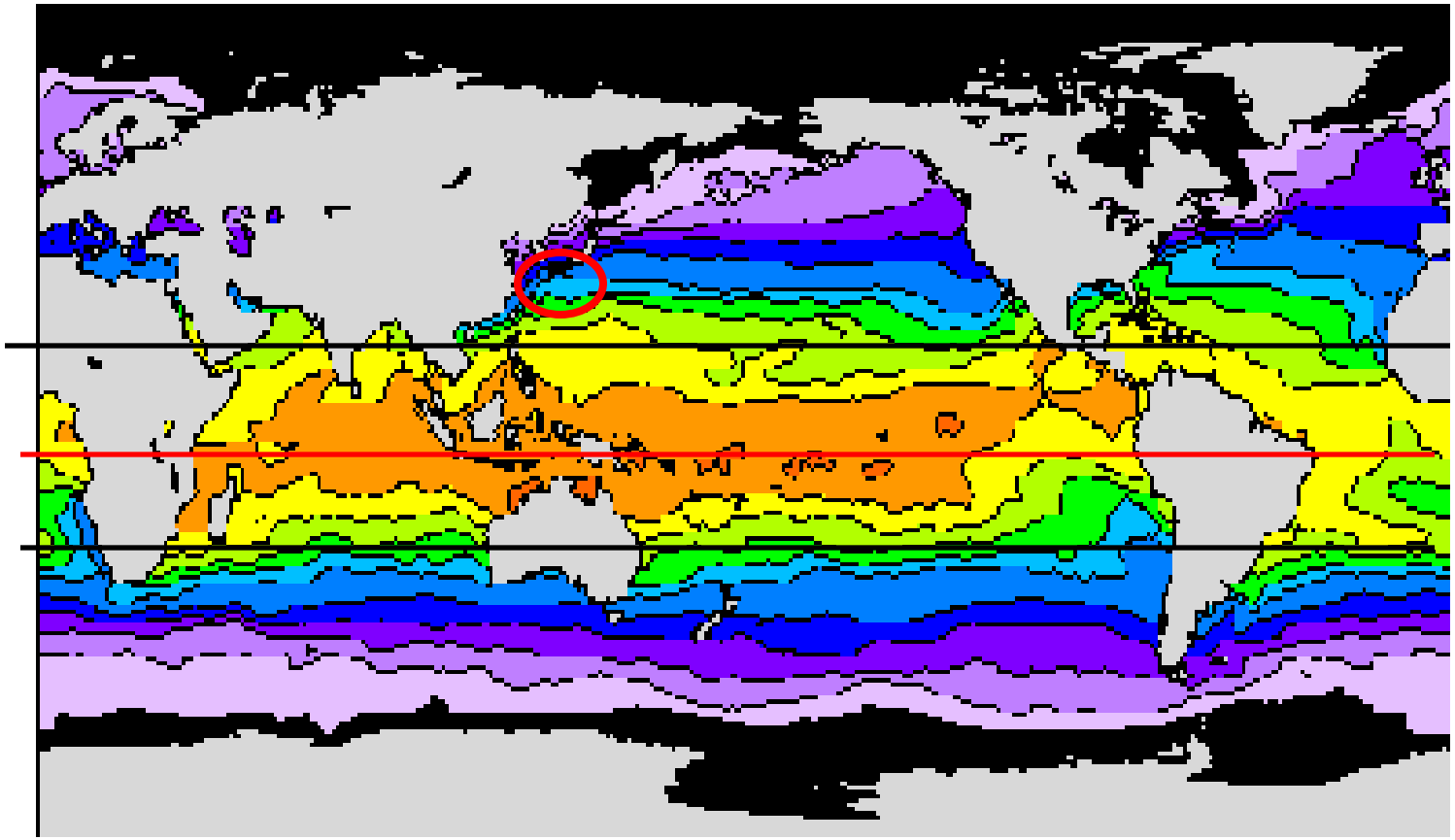


Fig.6 Annual change of sea surfaced water temperature from 1975 to 2000

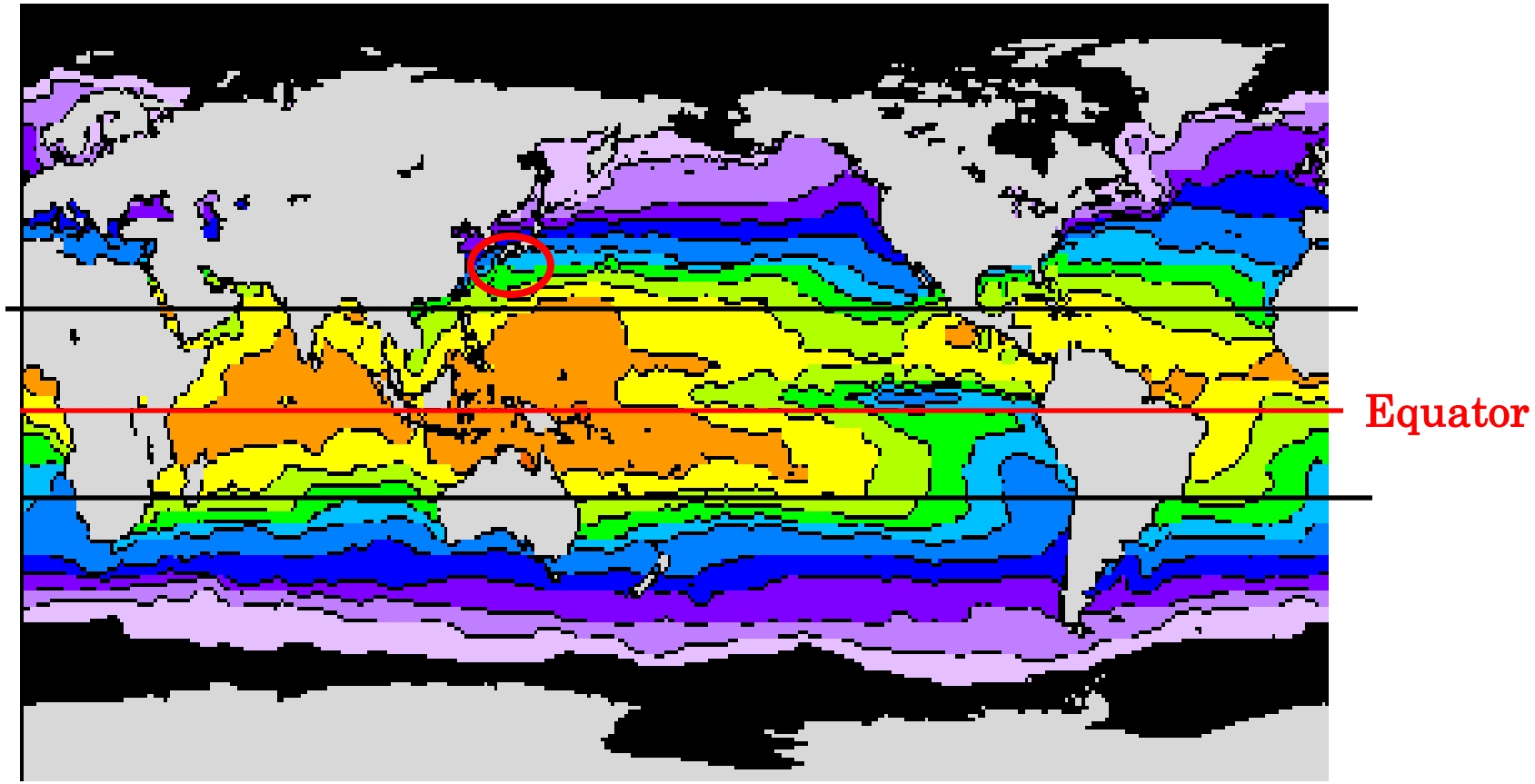


E-Nino - La Nina and Annual Sea Surface Water Temperature Change in August at Tosa Bay in Kochi, Japan

Global Sea Surface Water Temperature (El-Nino)



Global Sea Surface Water Temperature (La-Nina)



Atmospheric general circulation model (MRI-AGCM

⇔

Down Scale Modeling

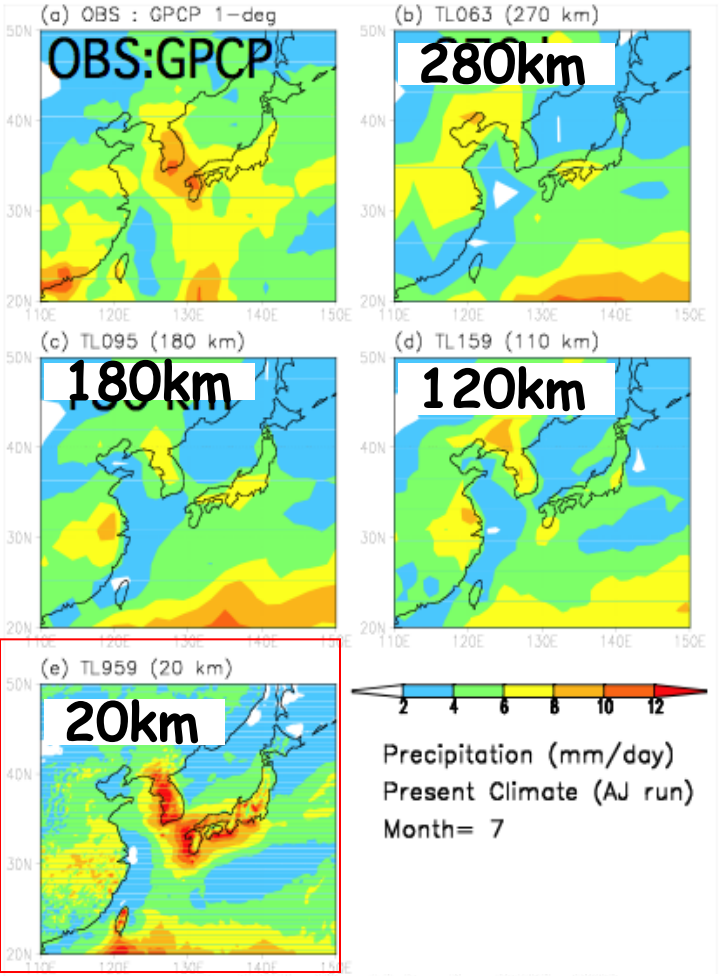
GCM ⇔ Down Scale Modeling

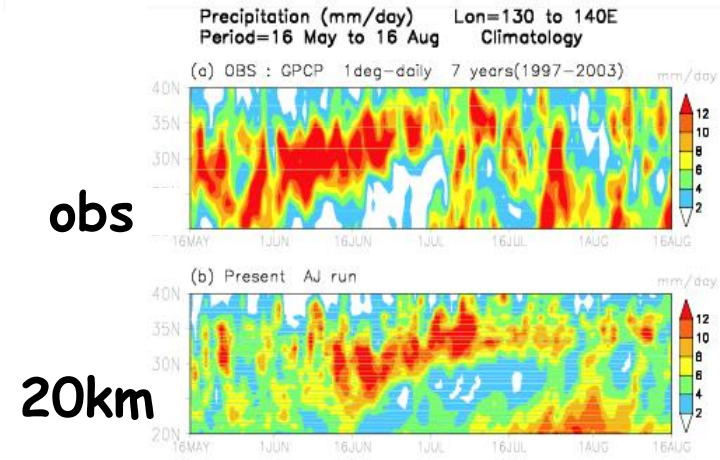
Atmospheric general circulation model (MRI-AGCM), which has just been developed by Japan meteorological agency in 1997, suggests the significant influence of global warming on the long-term changes in rainfall patterns and intensity up to the middle of 21st century (2050).

The temporal result of long-term forecasting is alarming with irregular extreme events of droughts and floods to fear the sustainable water use in the western part of Japan.

It is, however, the grid size of GCM with 20kmx20m is not favor to simulate the local scale climatic changes including the river basins in Japan.

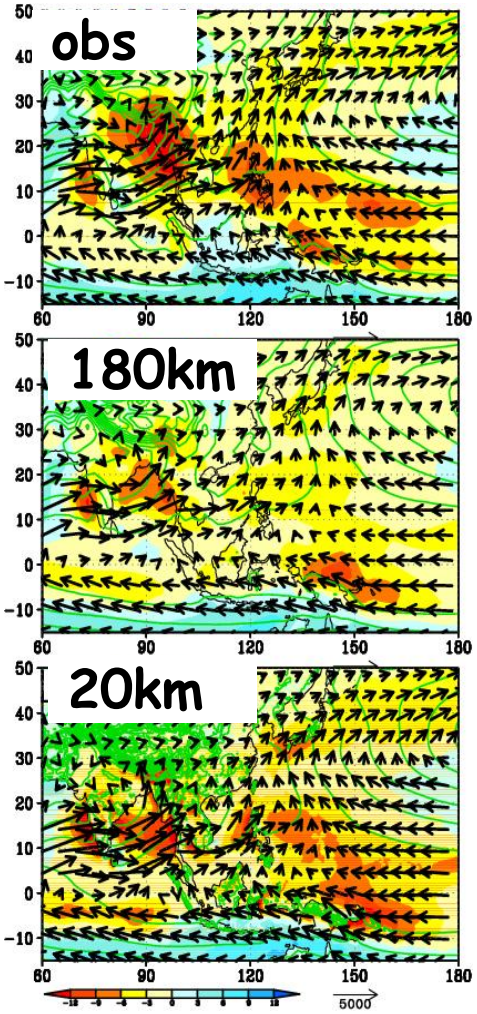
East Asian monsoon

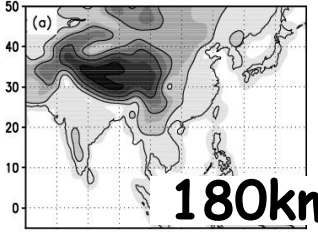


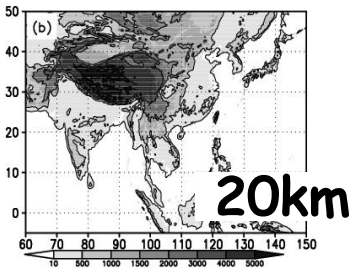


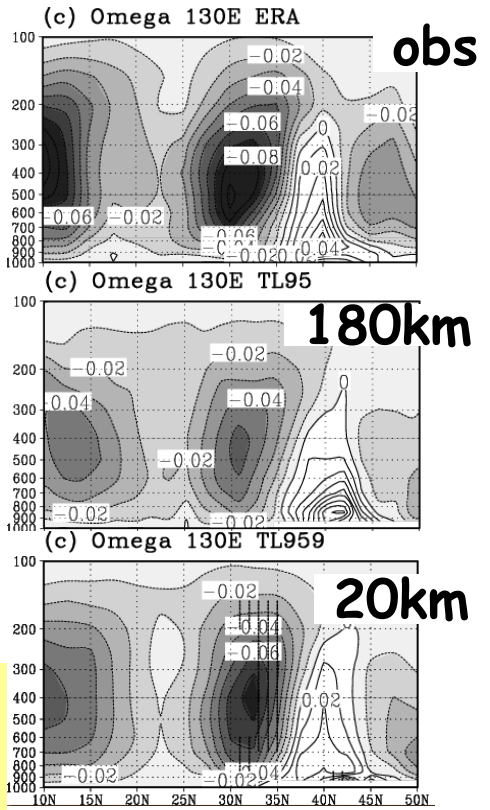
obs

20km







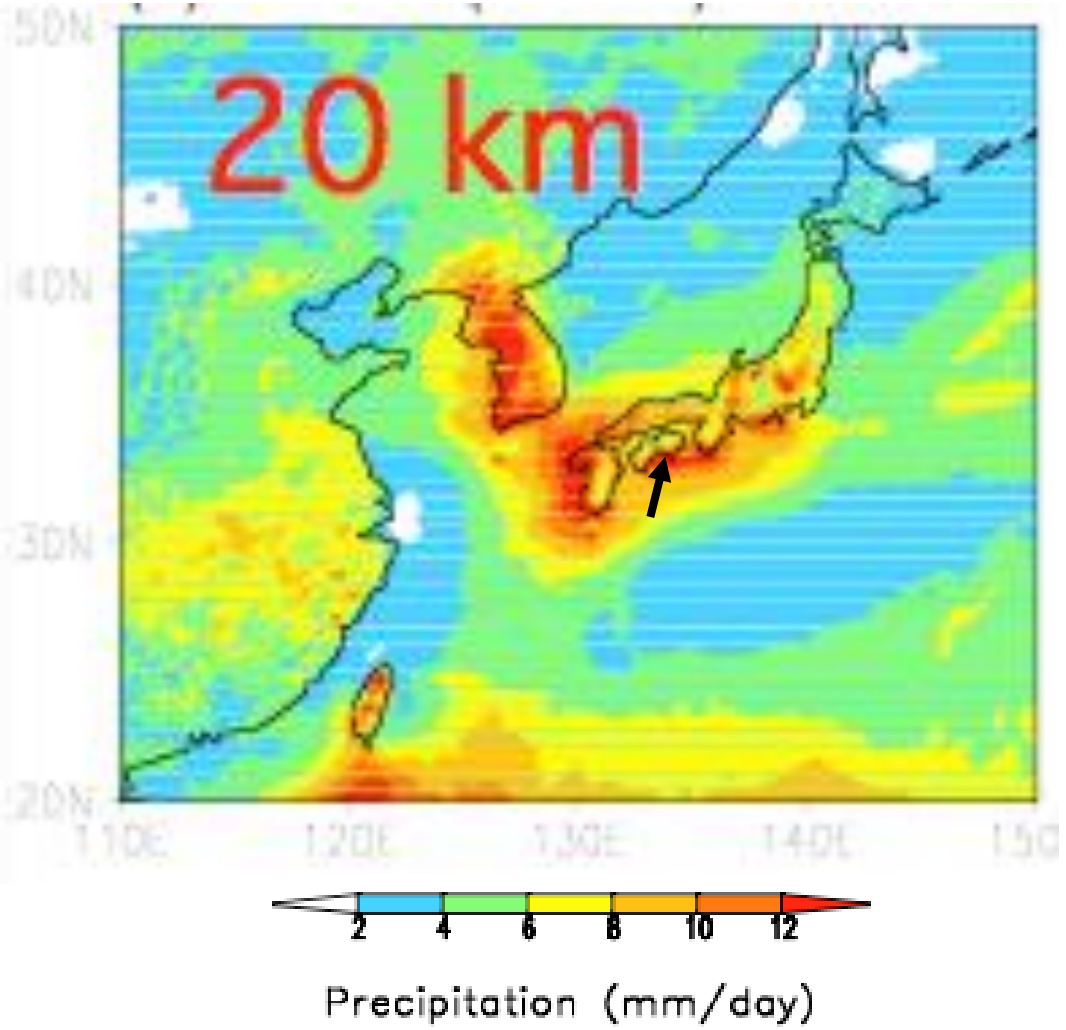


Asian monsoon is evaluated well, but not yet for other parts of the world

Mizuta et al. (2006) JMSJ
Kitoh and Kusunoki (2007) ClimDyn

Future change in annual mean temperature and precipitation in and around Japan island, projected by 20-km-grid MRI-AGCM

(Meteorological Research Institute, Atmospheric General Circulation Model)



Vulnerability of Water Resources

Under the influence of global climatic changes

A Case of SAMEURA Dam in Kochi, Japan

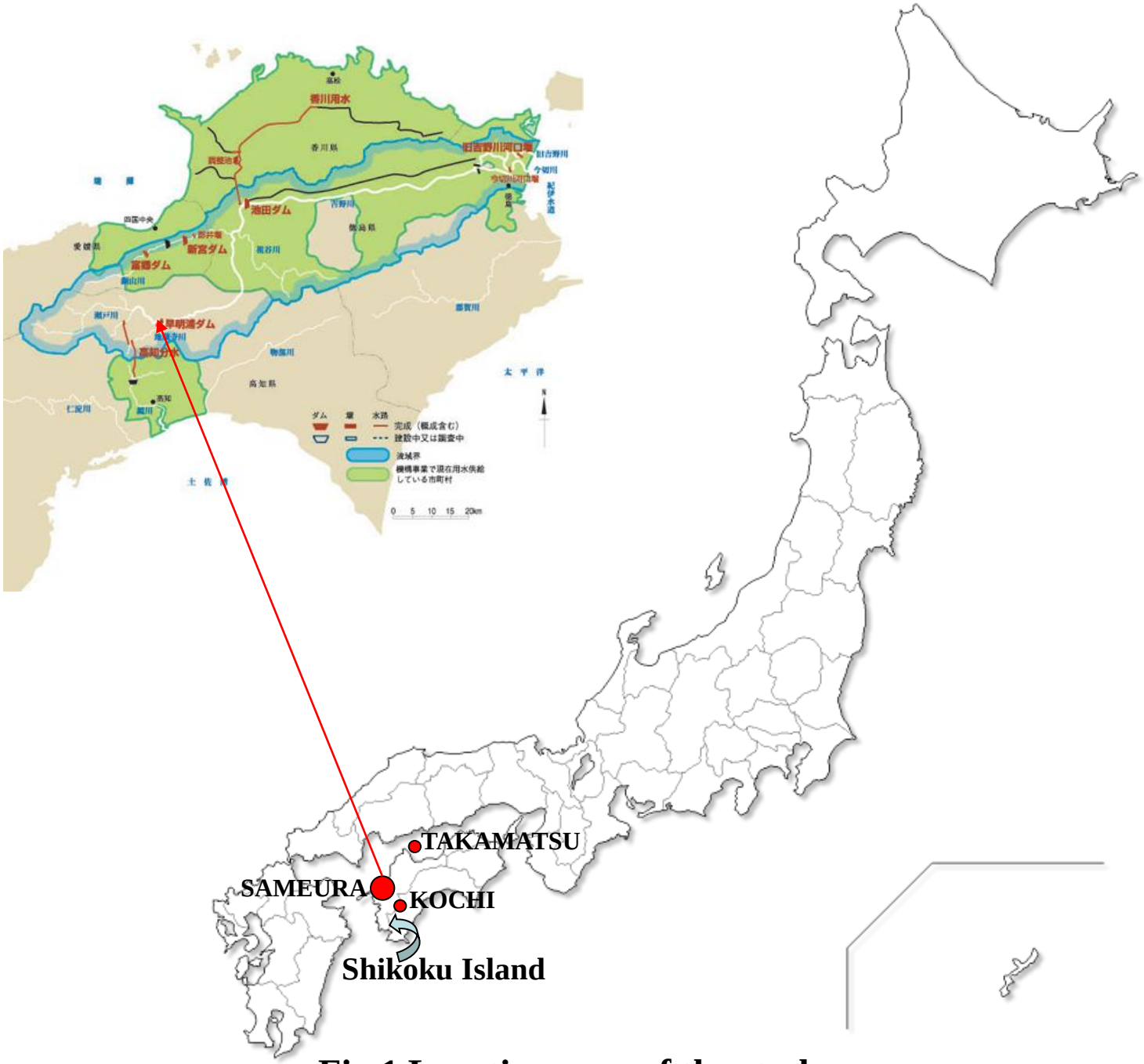
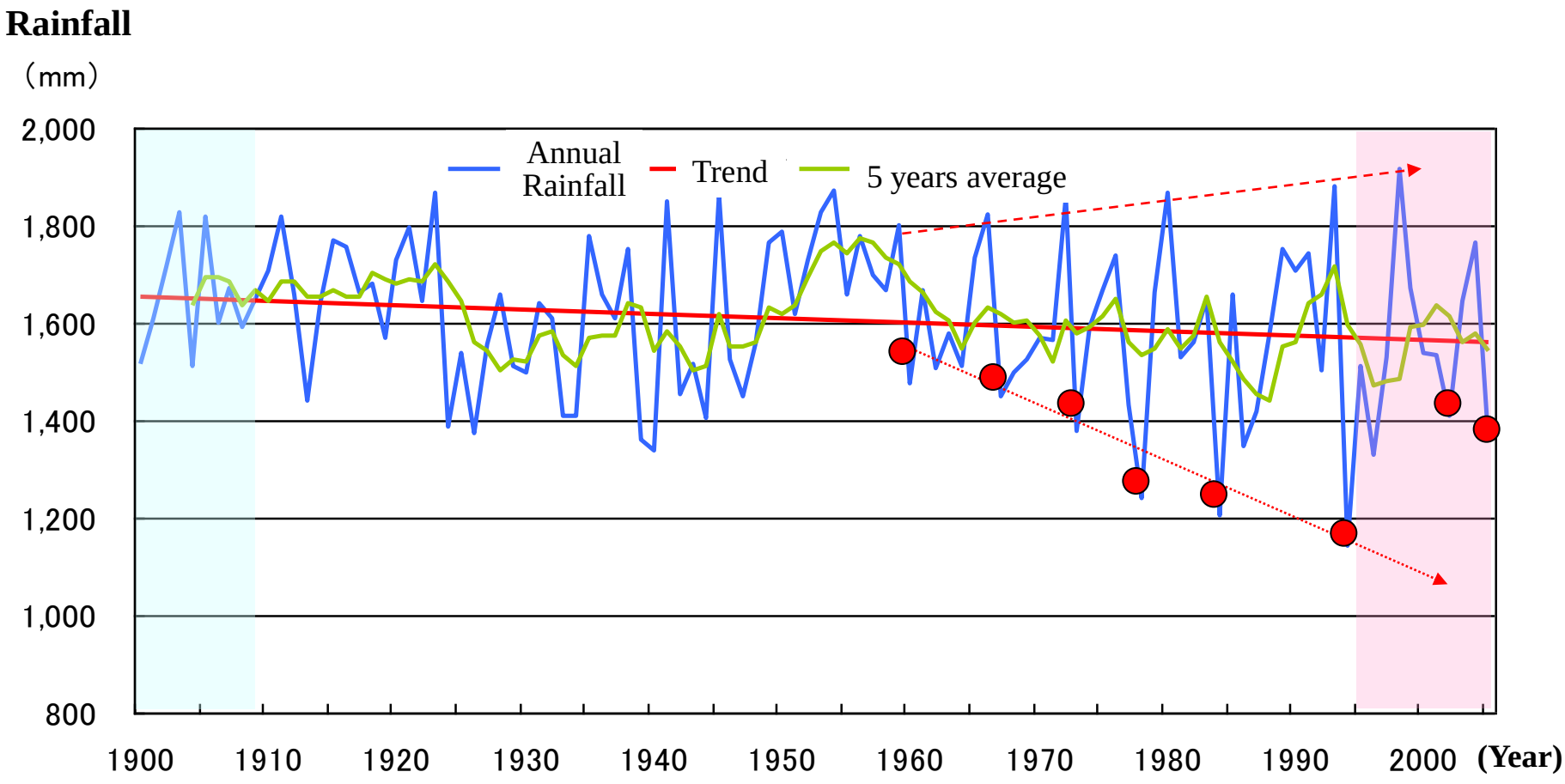


Fig.1 Location map of the study area



Long-term trend of annual rainfall changes in Japan (1900–2000)

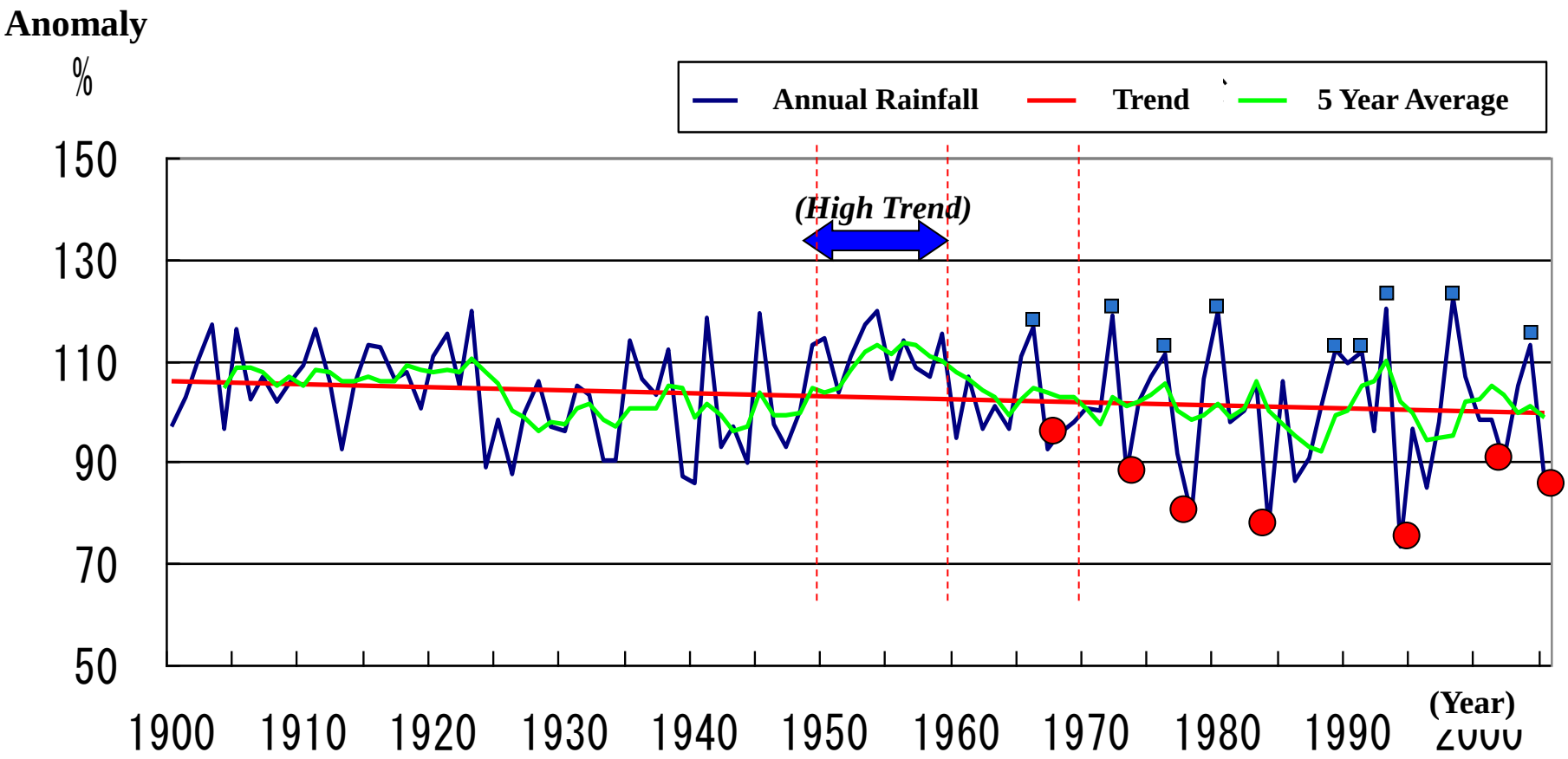


Fig.2 Anomaly of annual rainfall in Japan (1900–2000)

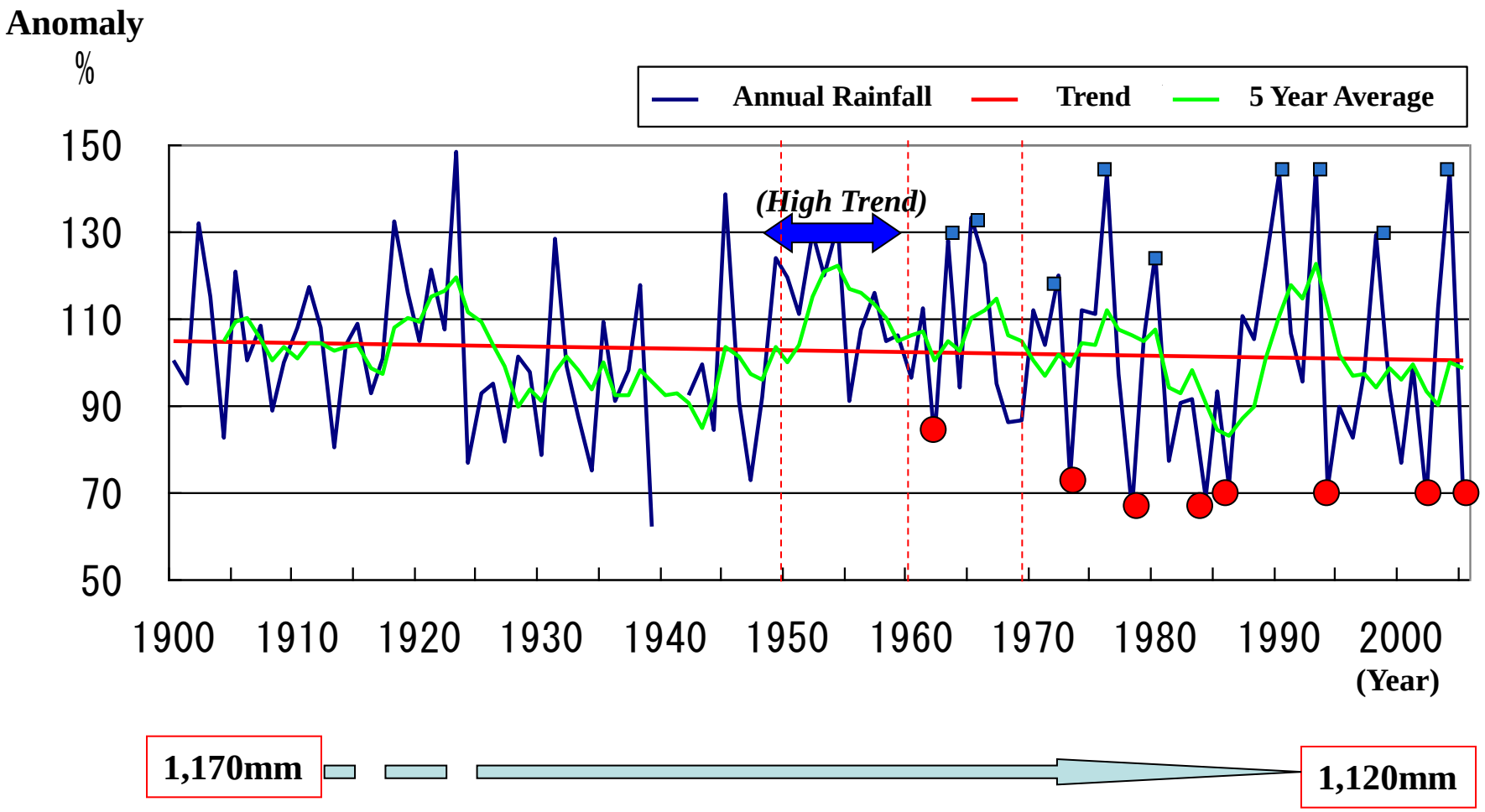


Fig.3 Anomaly of annual rainfall in Takamatsu (1900–2000)

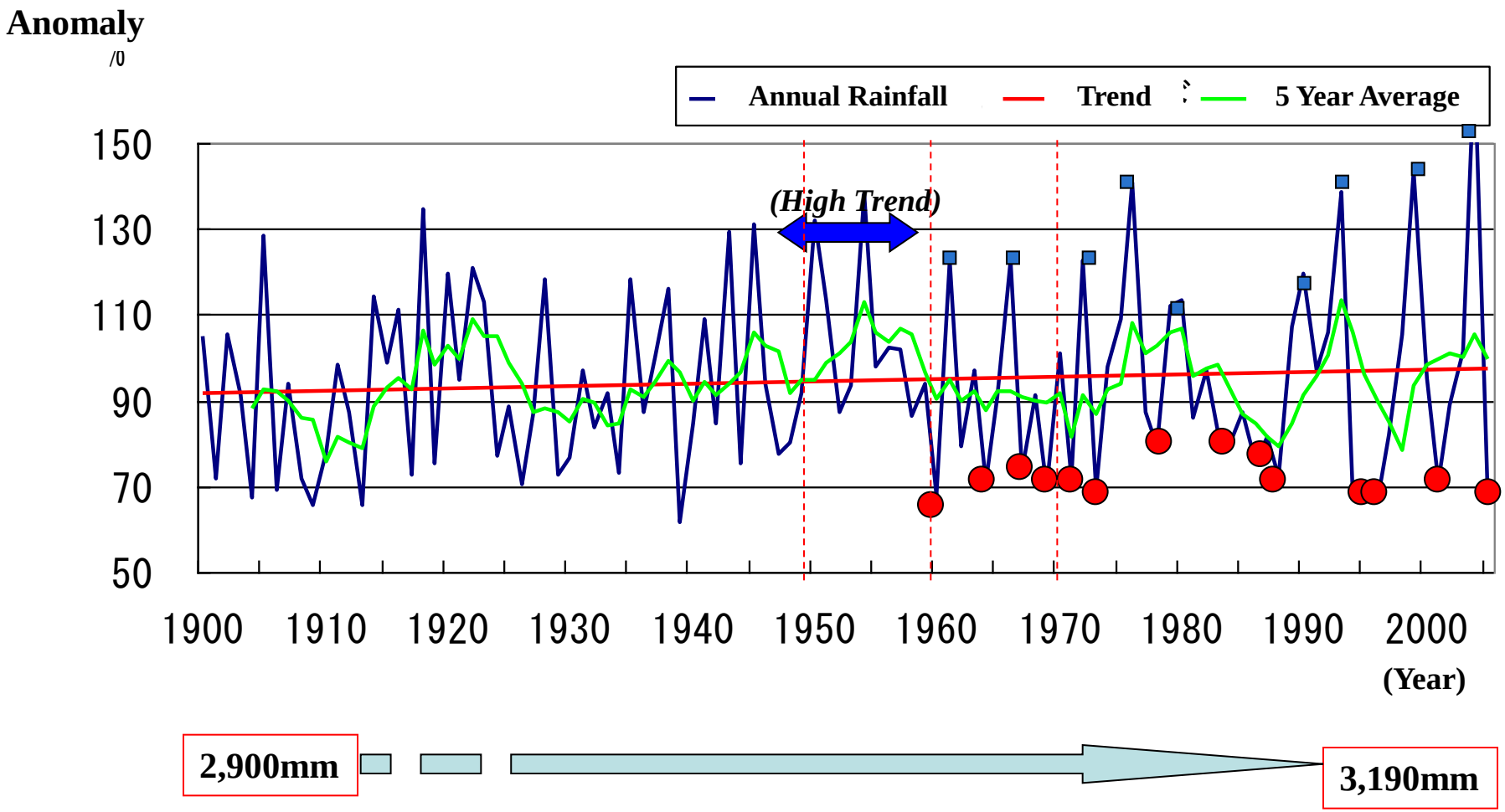
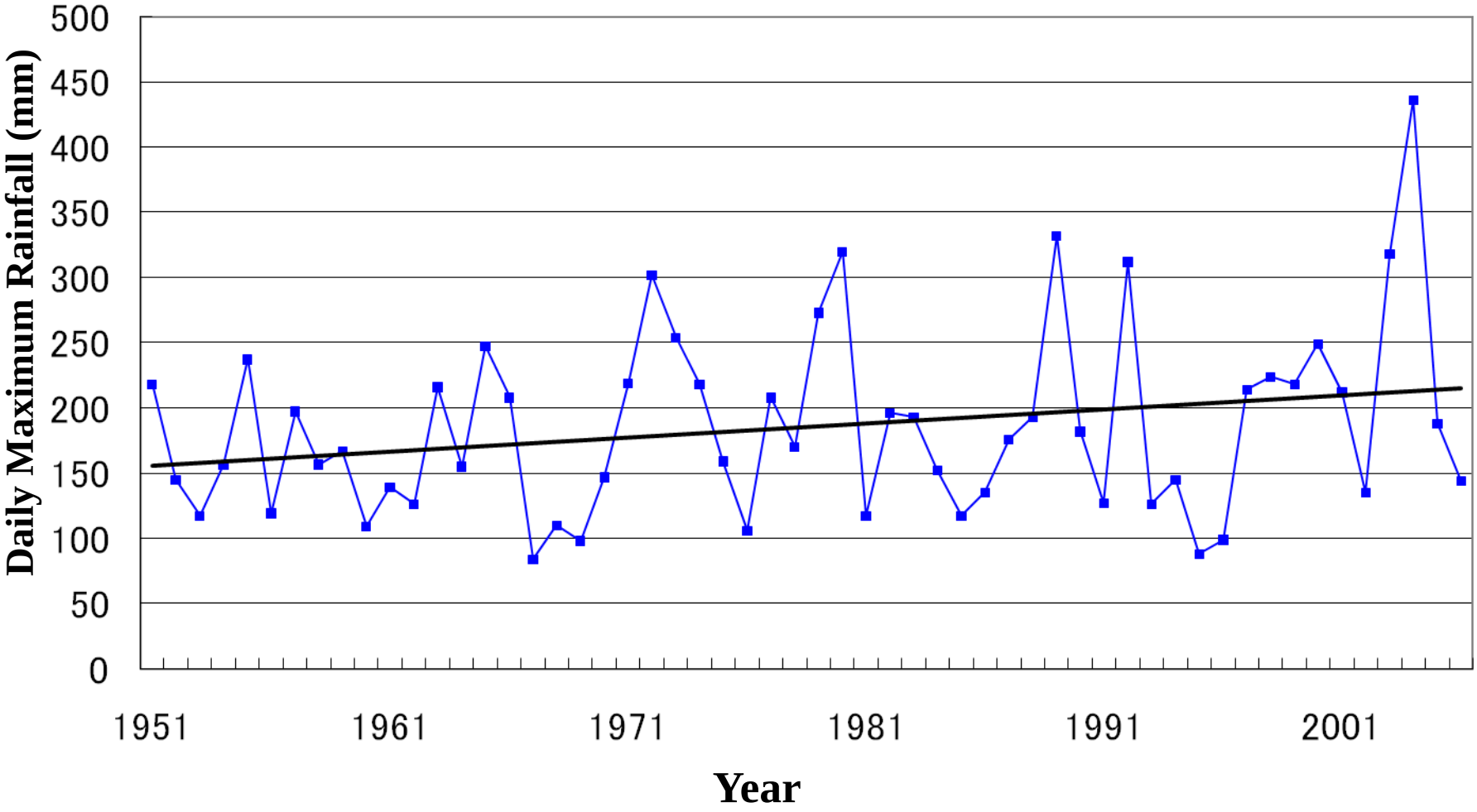


Fig.4 Anomaly of annual rainfall in Sameura (1900–2000)

Drying up SAMEURA Dam in Kochi, Japan (31 July 1994)

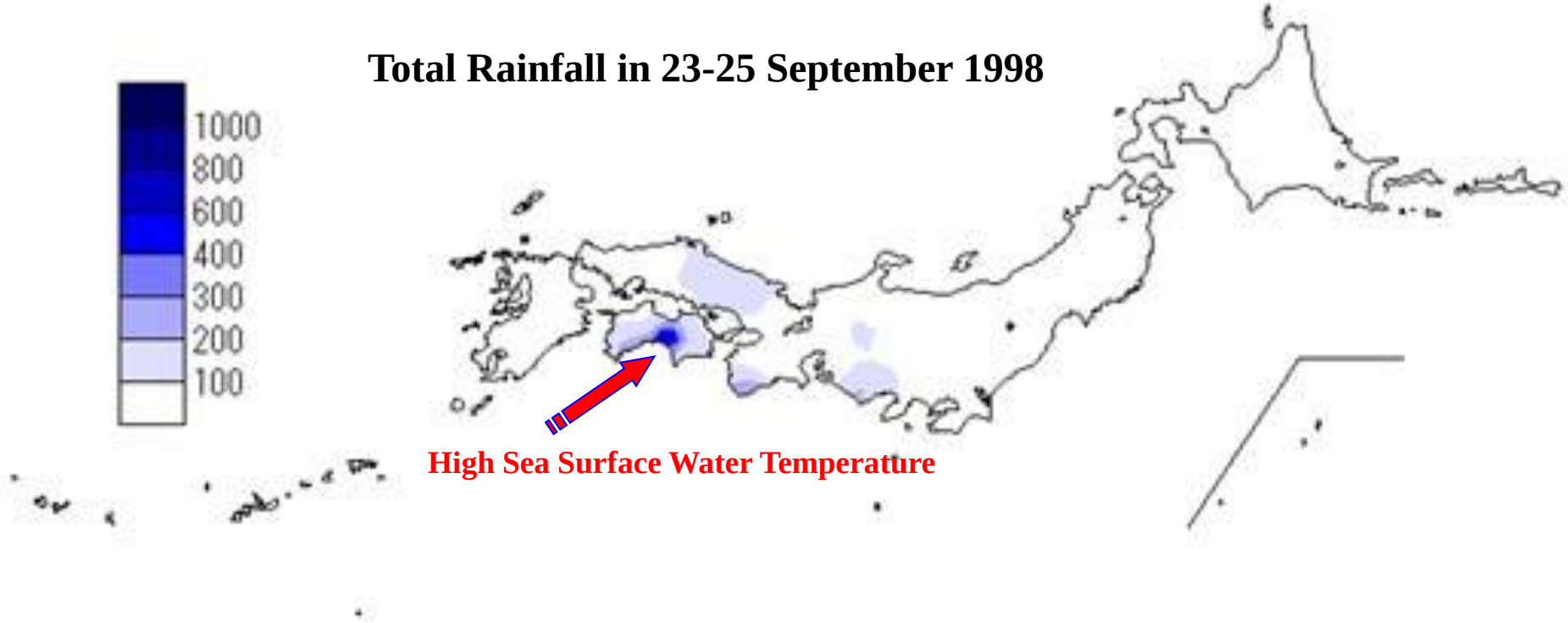
Daily Maximum Rainfall at Nakamura, Kochi

（1951～2006）



Extreme Event

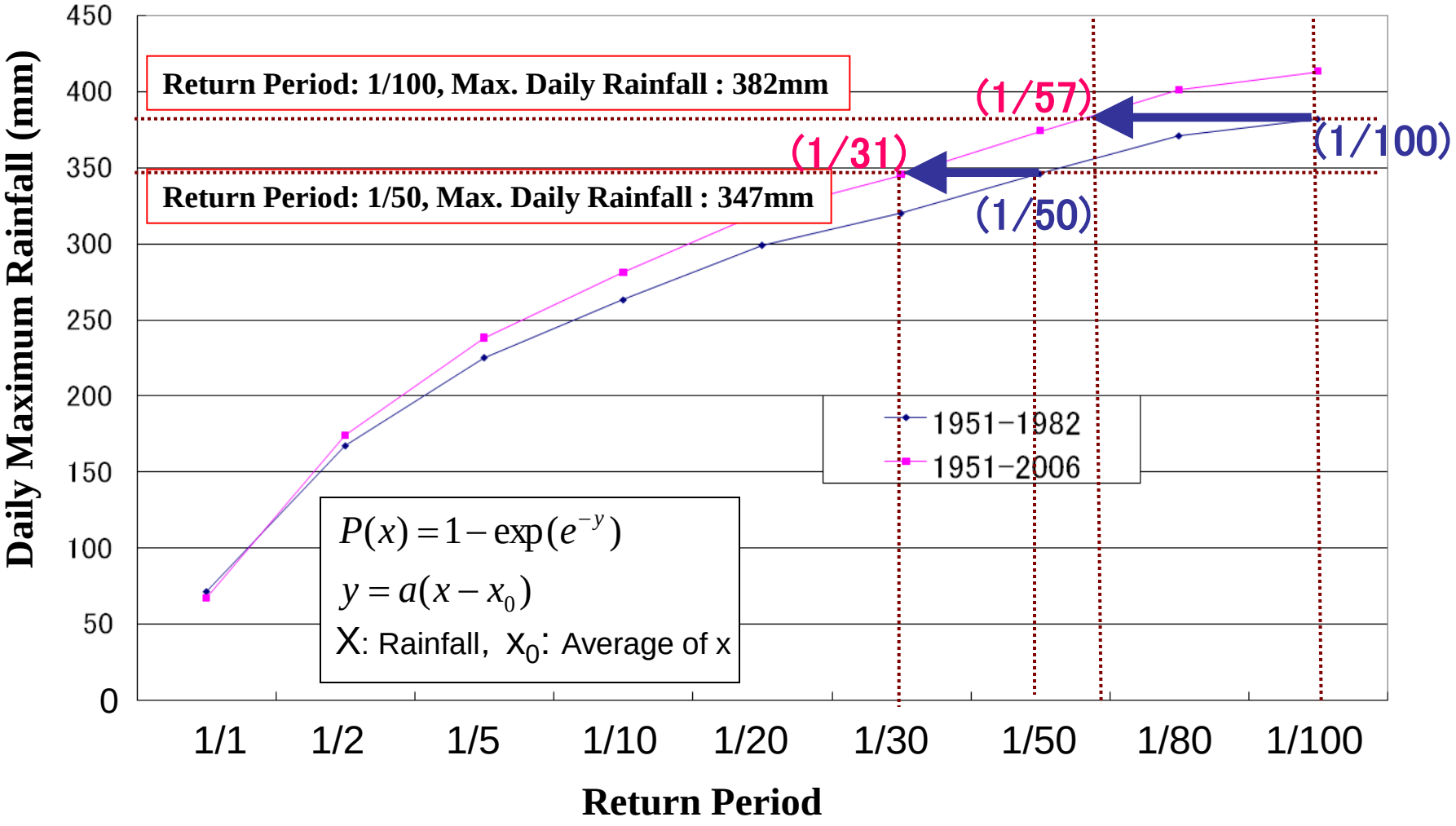
Total Rainfall in 23-25 September 1998



High Sea Surface Water Temperature

Creeping Return Period of Daily Maximum Rainfall at Nakamura, Kochi

（Comparison between [1951-1982] and [1951-2006] by Gumbel Method）



Influence of Global –Regional Climatic Changes

On

Eco-Security
(Fish Ecology)

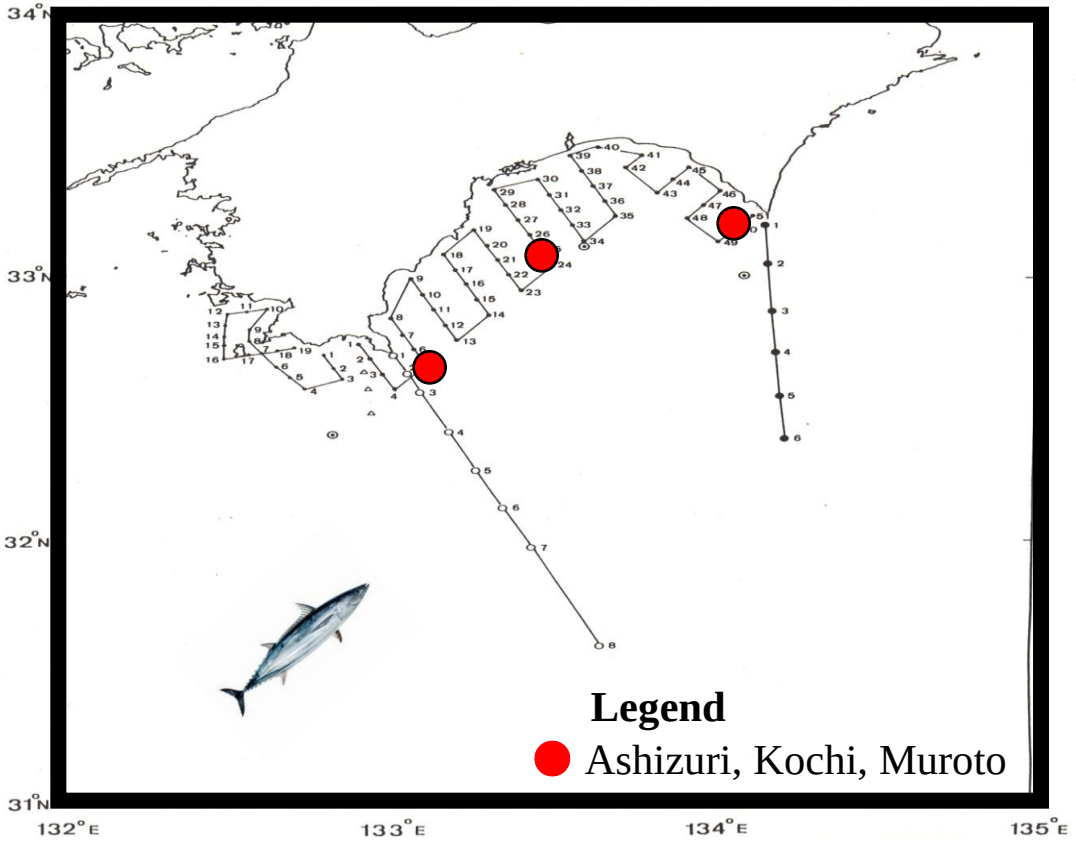


Fig. 5 Monitoring points of sea surface water temperature

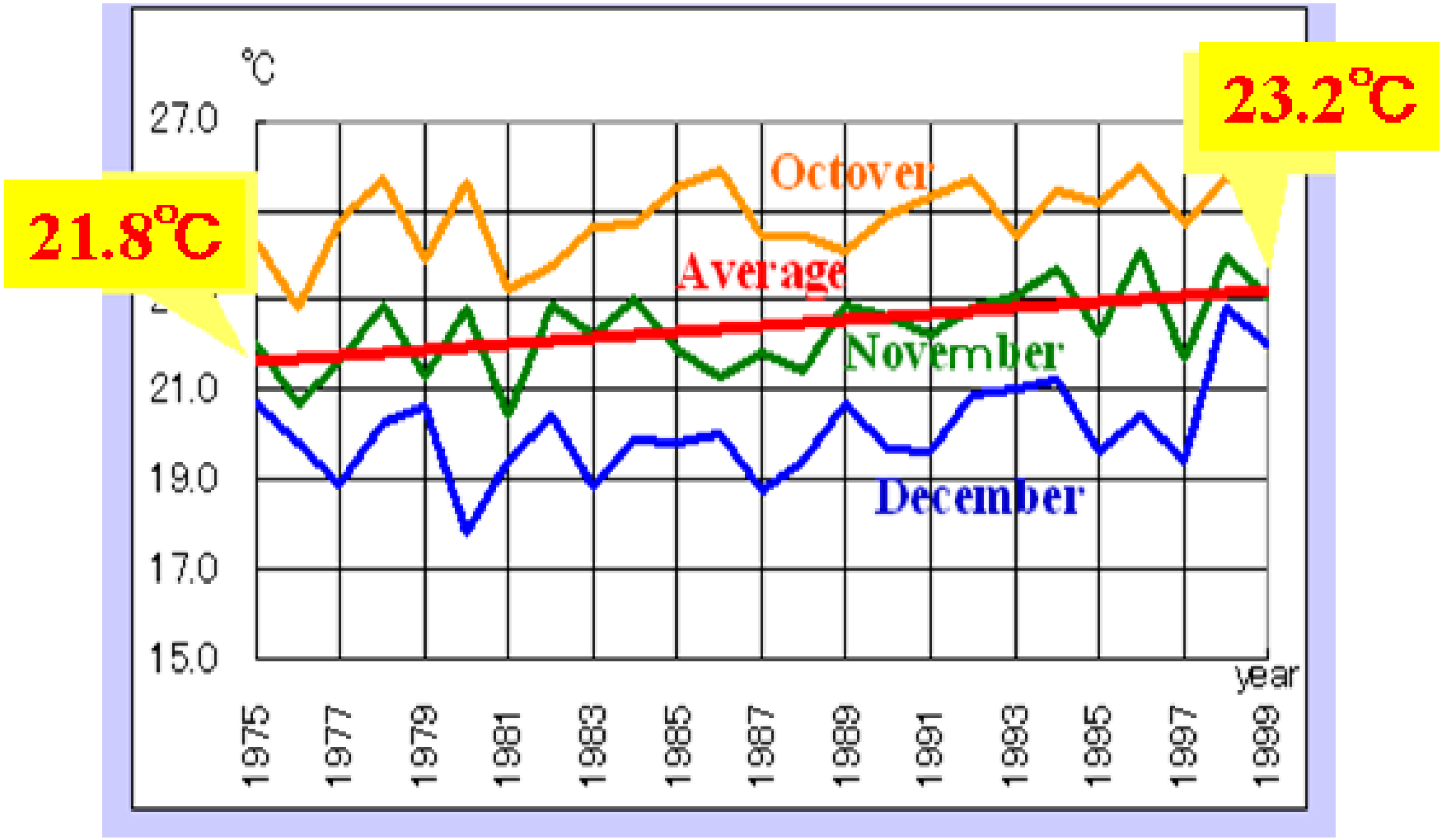


Fig.7 Monthly change of sea surfaced water temperature from 1975 to 2000

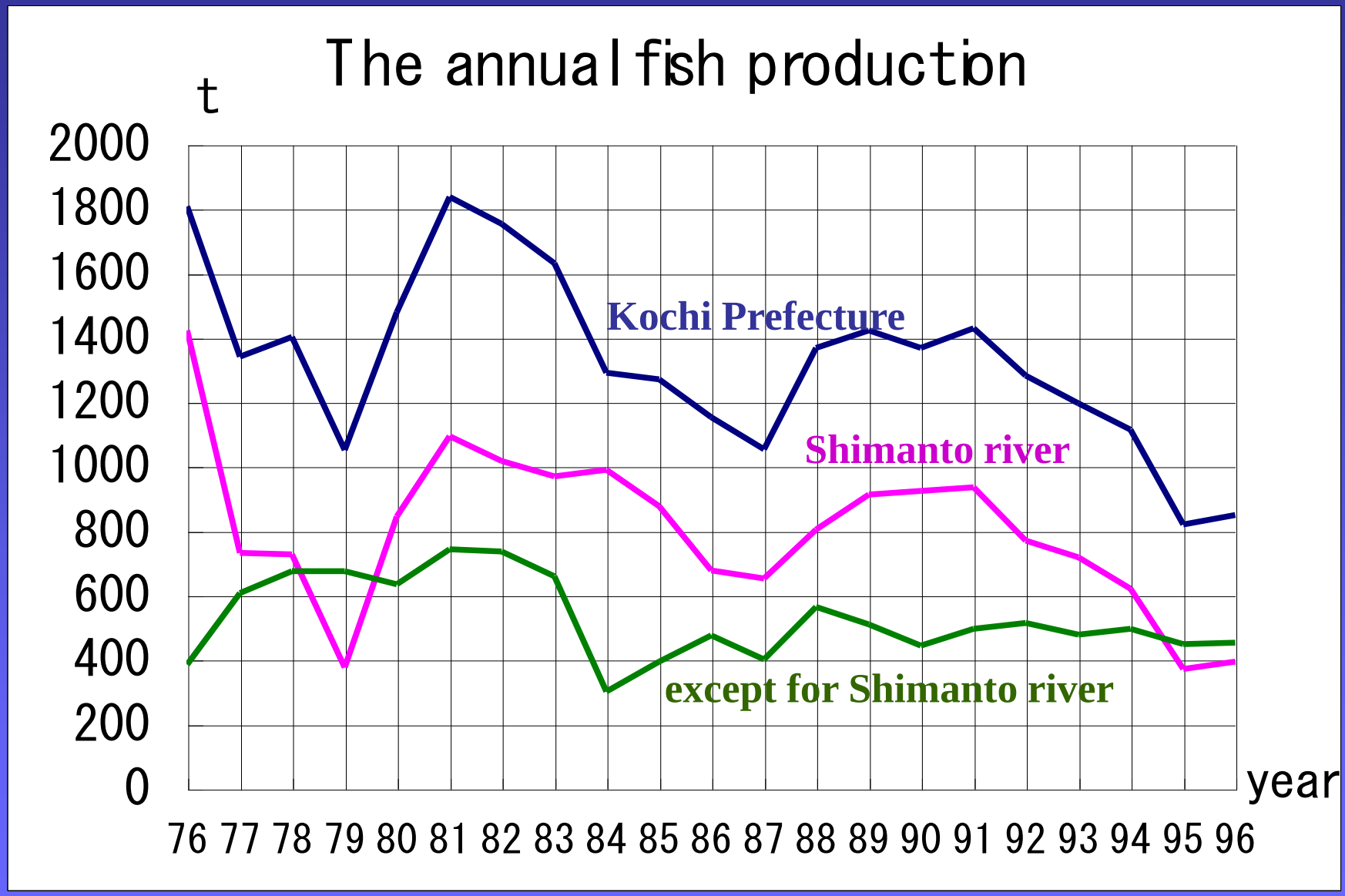


Fig.2 The annual fish production

AYU (*Plecoglossus altivelis*) Life Cycle

Upper Reaches

Summer Season

Middle Reaches

Lower Reaches

Autumn Season

Winter Season

Sea

Spring Season

http://www.agri.pref.kanagawa.jp/suisoken/naisui/fishfile/syumei.htm

Ayu（Plecoglossus altivelis）stays at off shore of Pacific ocean during winter season

The Change of seawater surface temperature and annual fish production of the Shimanto river

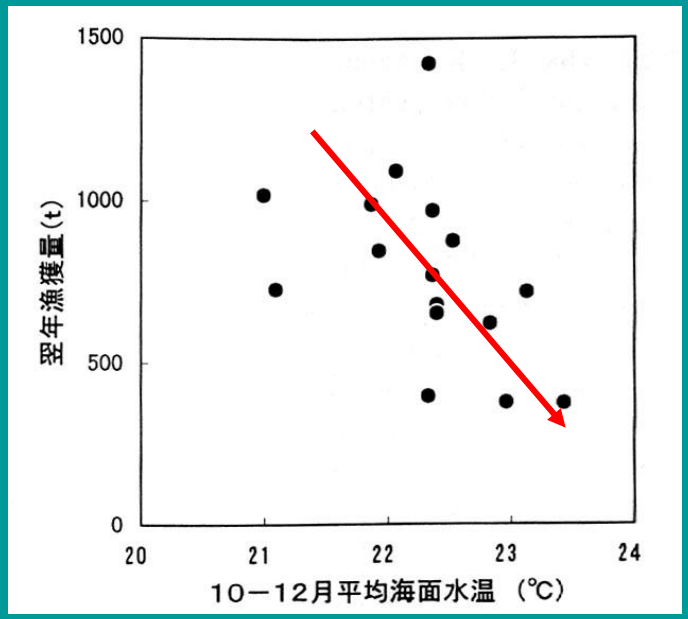


Fig.3-A

The relation between annual fish production and sea surface water temperature (in October to December)

<Takahashi;Nishinihon Institute of Technology >

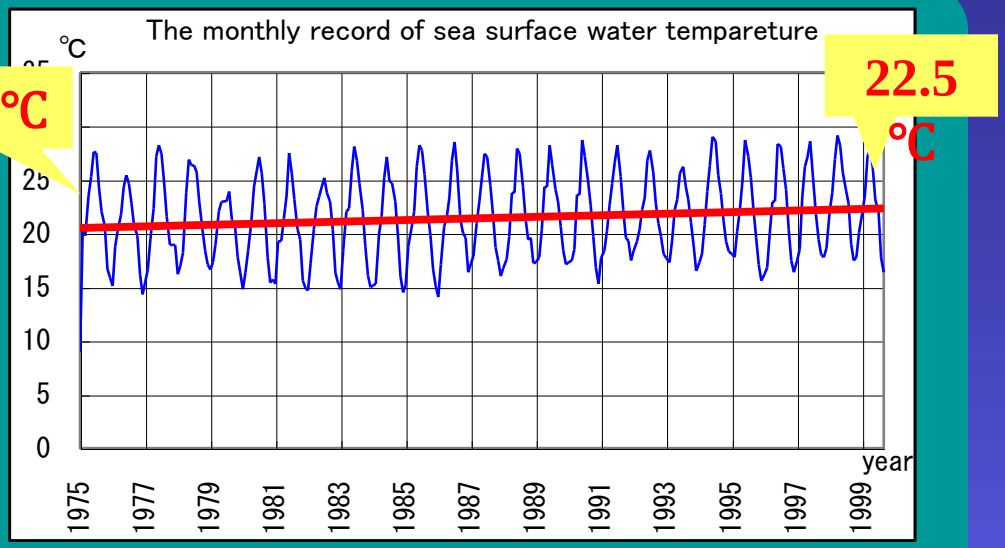


Fig.3-B

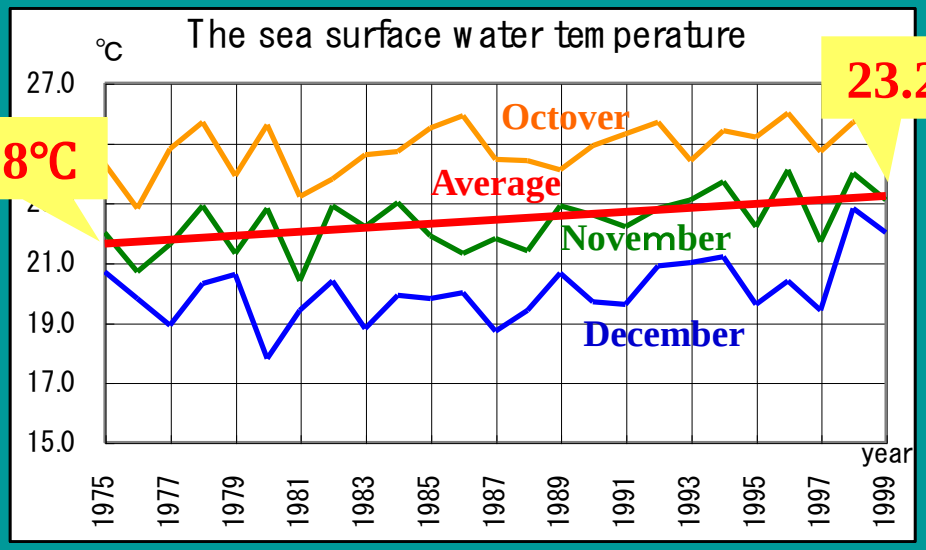


Fig.3-C

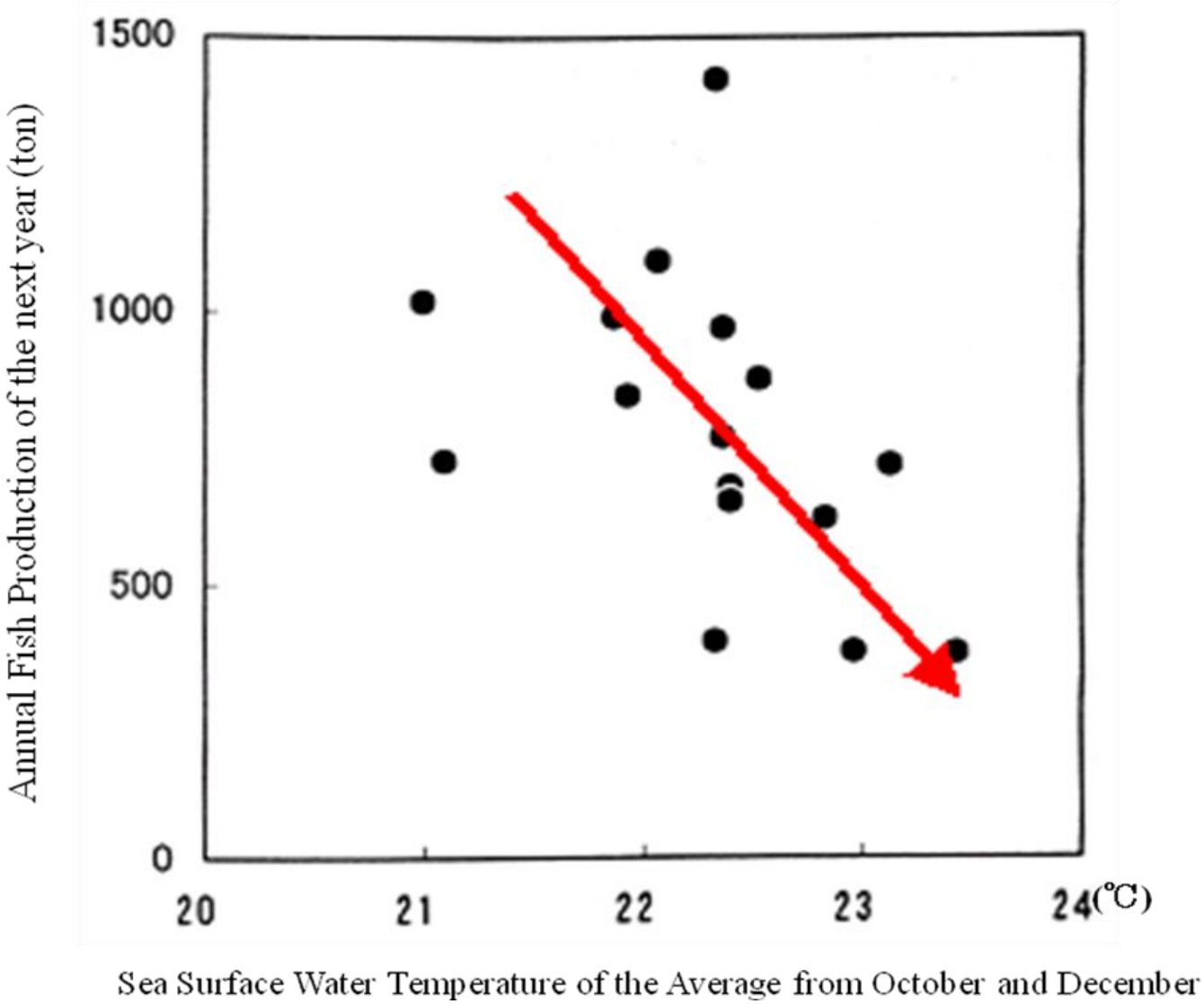


Fig. 8 Correlation between annual fish production of *Ayu* (*Plecoglossus altuvelis*) and sea surface water temperature from October to December

Summary

River Improvement Works

dam, weirs, embankment, dykes
for flood protection and water use

Amount of AYU
（Plecoglossus altivelis）
and Salmon

River Restoration Works

(Naturnaher Wasserbau)

Global Warming

El Nino and La Nina
sea surface water temperature

Shimanto River

Concluding Remarks

Vulnerability assessment of water resources and prediction of future climatic changes in a framework of the basin scale downscale modeling under the influence of global scale climate change is a new agenda for the integrated water resources policy to manage the future natural disasters including floods, drought and eco-system.

Thank you for your attention