

# Environment and Ecology



# Class Objectives / Class Outline

This class aims to provide basic knowledge concerning the causes and present status of **environmental issues** and their countermeasures.

This class is the English version of *Kankyō to Ecology* (環境とエコロジー), but modified for students who are not familiar with environmental issues in Japan.

# Class Schedule 2024

Lesson 1: Introduction: History of environmental issues in

Japan 10/2

Lesson 2: Water pollution 10/9

No lecture on 10/16 (Substitute class day )

Lesson 3: Waste management 1 10/23

Lesson 4: Waste management 2 10/30

Lesson 5: Climate change 11/6

Lesson 6: Energy supply and consumption 11/13

Lesson 7: Biodiversity 1 11/20

Lesson 8: Biodiversity 2 11/27



# Natural environment of Japan

Data SIO, NOAA, U.S. Navy, NGA, GEBCO

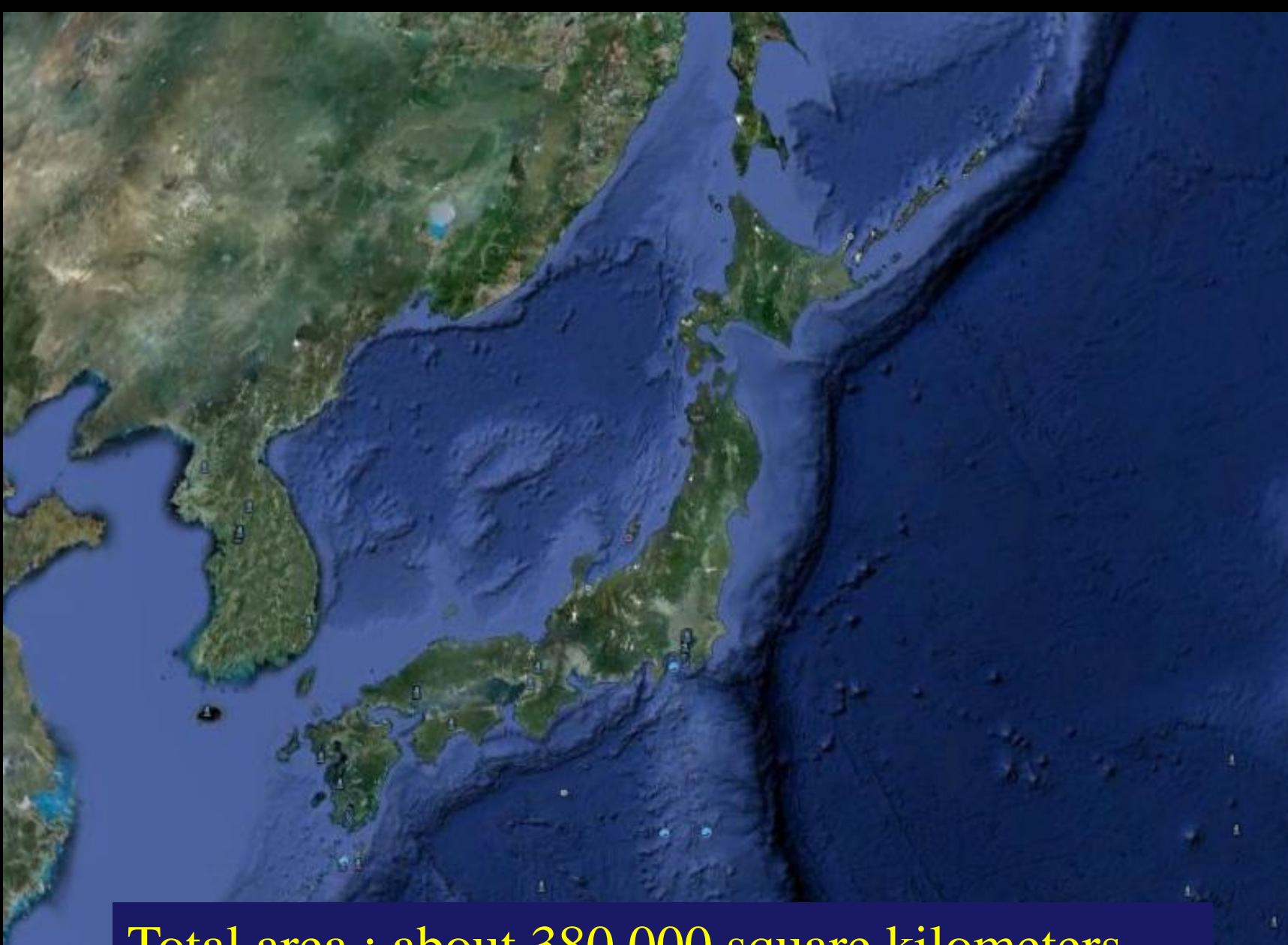
Image © 2012 TerraMetrics

© 2012 Cnes/Spot Image

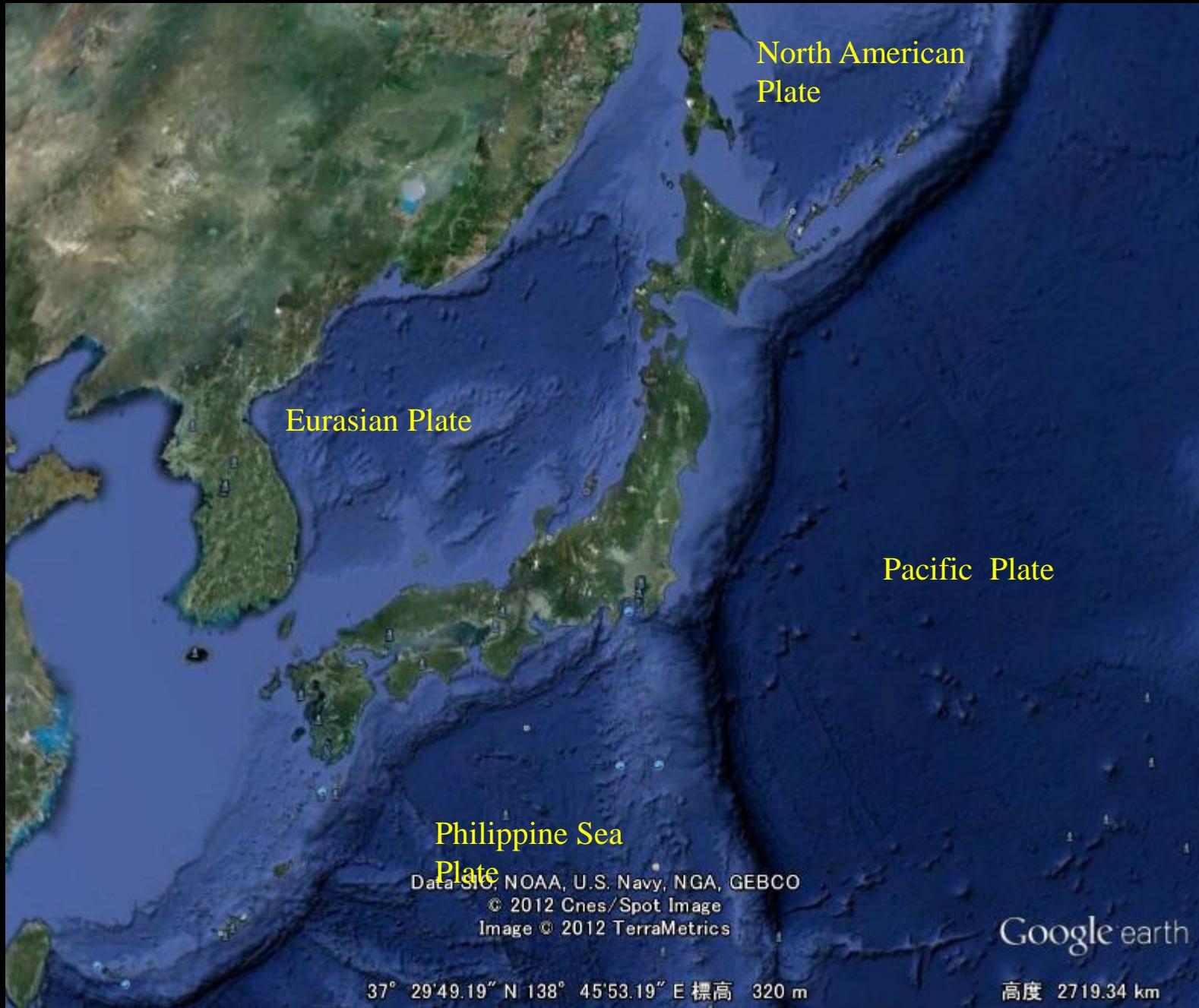
Google earth

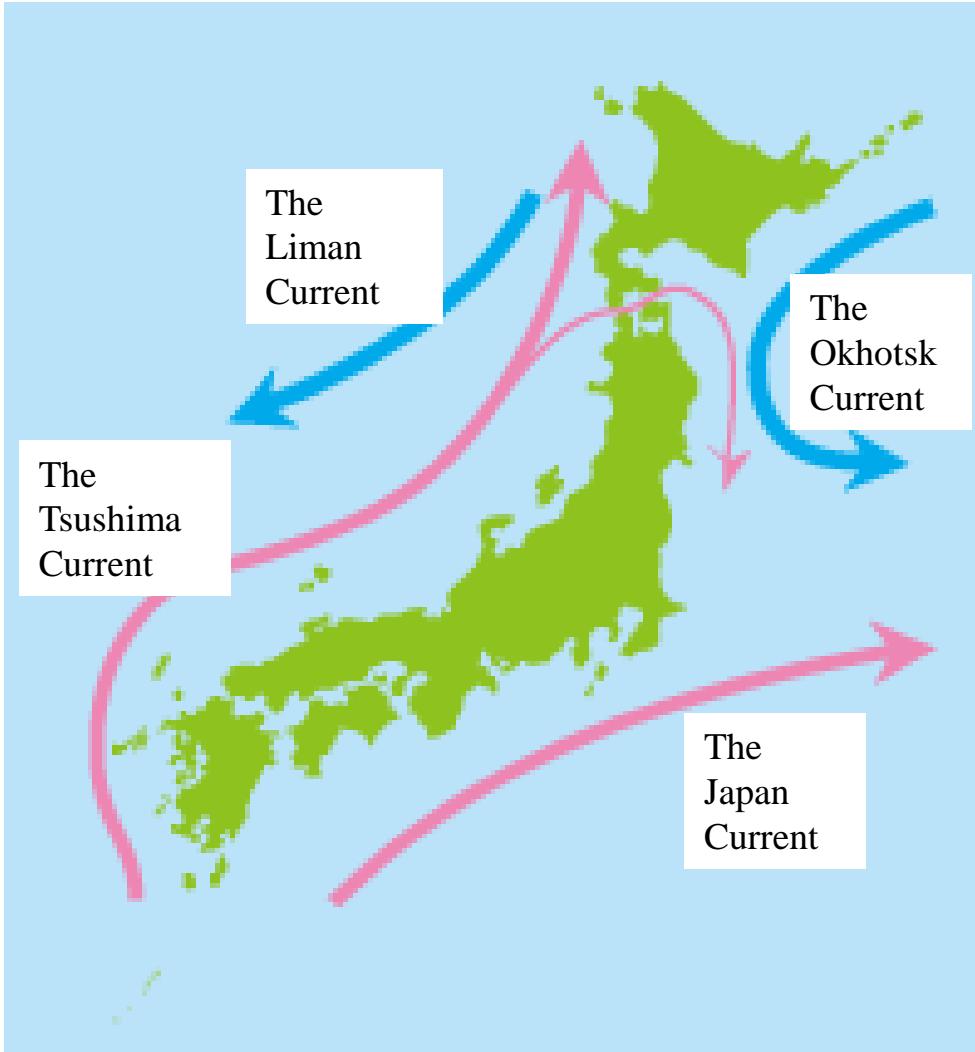
37° 22'39.93" N 138° 47'18.00" E 標高 261 m

高度 8894.57 km



Total area : about 380,000 square kilometers  
About 3,000 km from north to south

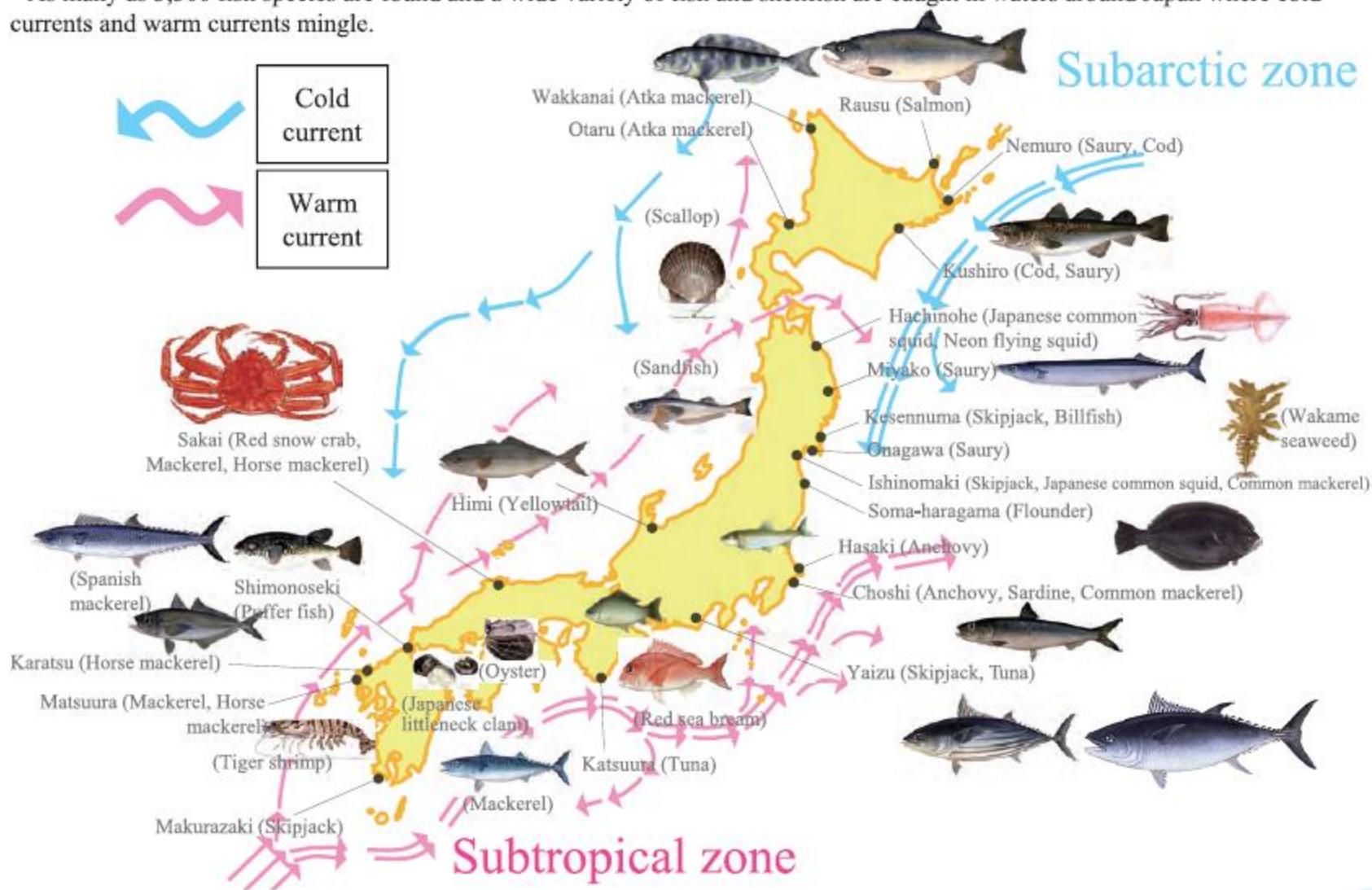




Two cold currents and two warm currents mingle around Japan.

## (2) Wide Variety of Fish and Shellfish Caught in Fishing Grounds around Japan

As many as 3,300 fish species are found and a wide variety of fish and shellfish are caught in waters around Japan where cold currents and warm currents mingle.



A photograph of a dense forest of tall evergreen trees, likely pines or firs, growing on a steep, rocky hillside. The trees are dark green and form a tight canopy. The background shows more of the forested mountain range under a clear blue sky.

Japan is a mountainous country

With little flat land available, peoples in mountainous regions have made terrace paddy fields for rice cultivation.



Terrace paddy field

# Japan is a volcanic country.



**Explosive Eruption at the Sakurajima Showa Crater**

**August 27, 2011, 21:53 - Taken from Kurokami Riverbed – Taken by the Japan Meteorological Agency**  
An explosive eruption at the Sakurajima Showa crater.

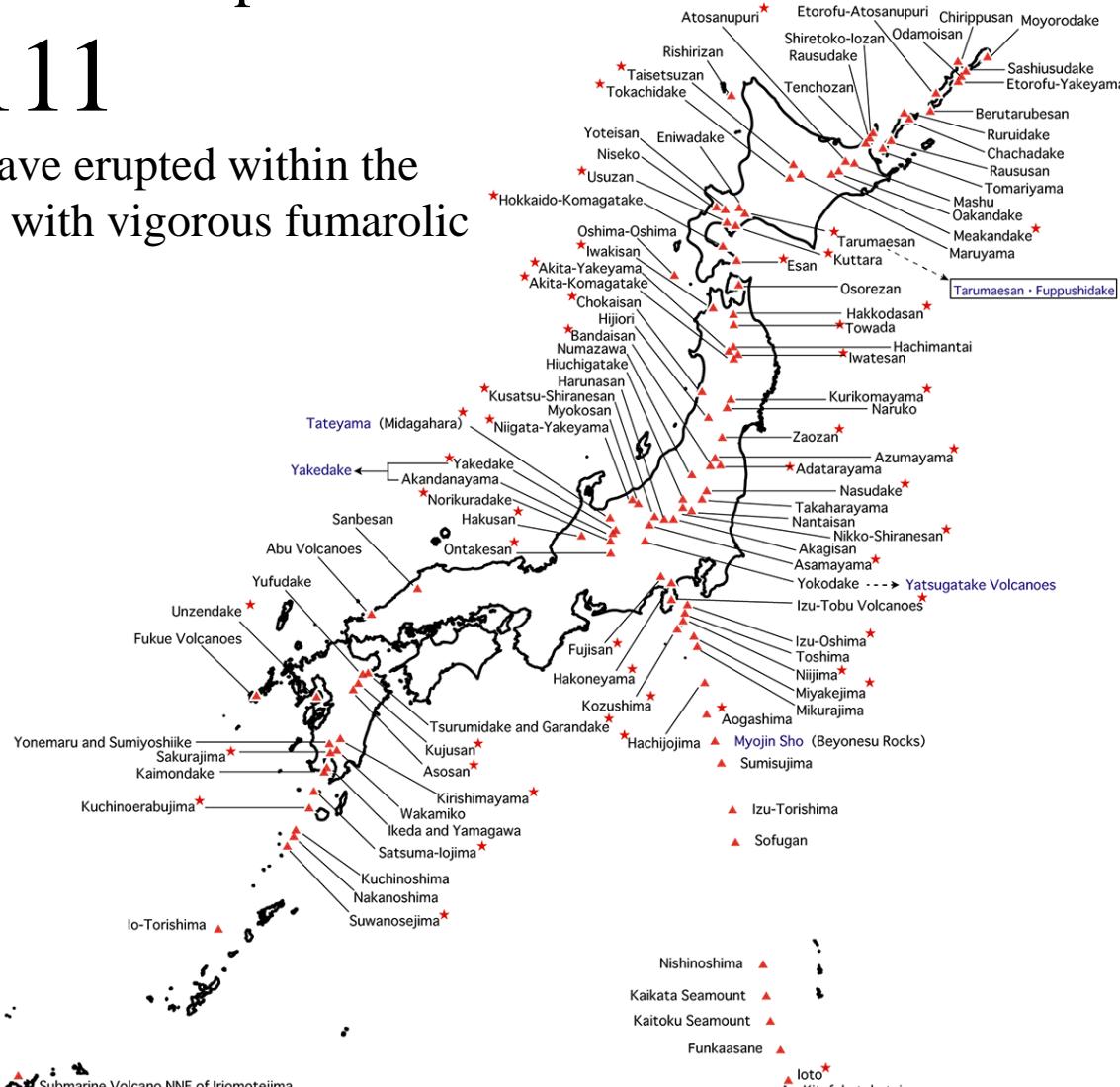
This photo clearly shows bright red volcanic blocks being scattered in every direction at night.

[http://www.data.jma.go.jp/svd/vois/data/tokyo/STOCK/souran\\_eng/intro/frontispiece.pdf](http://www.data.jma.go.jp/svd/vois/data/tokyo/STOCK/souran_eng/intro/frontispiece.pdf)

# Active volcanoes of Japan

# 111

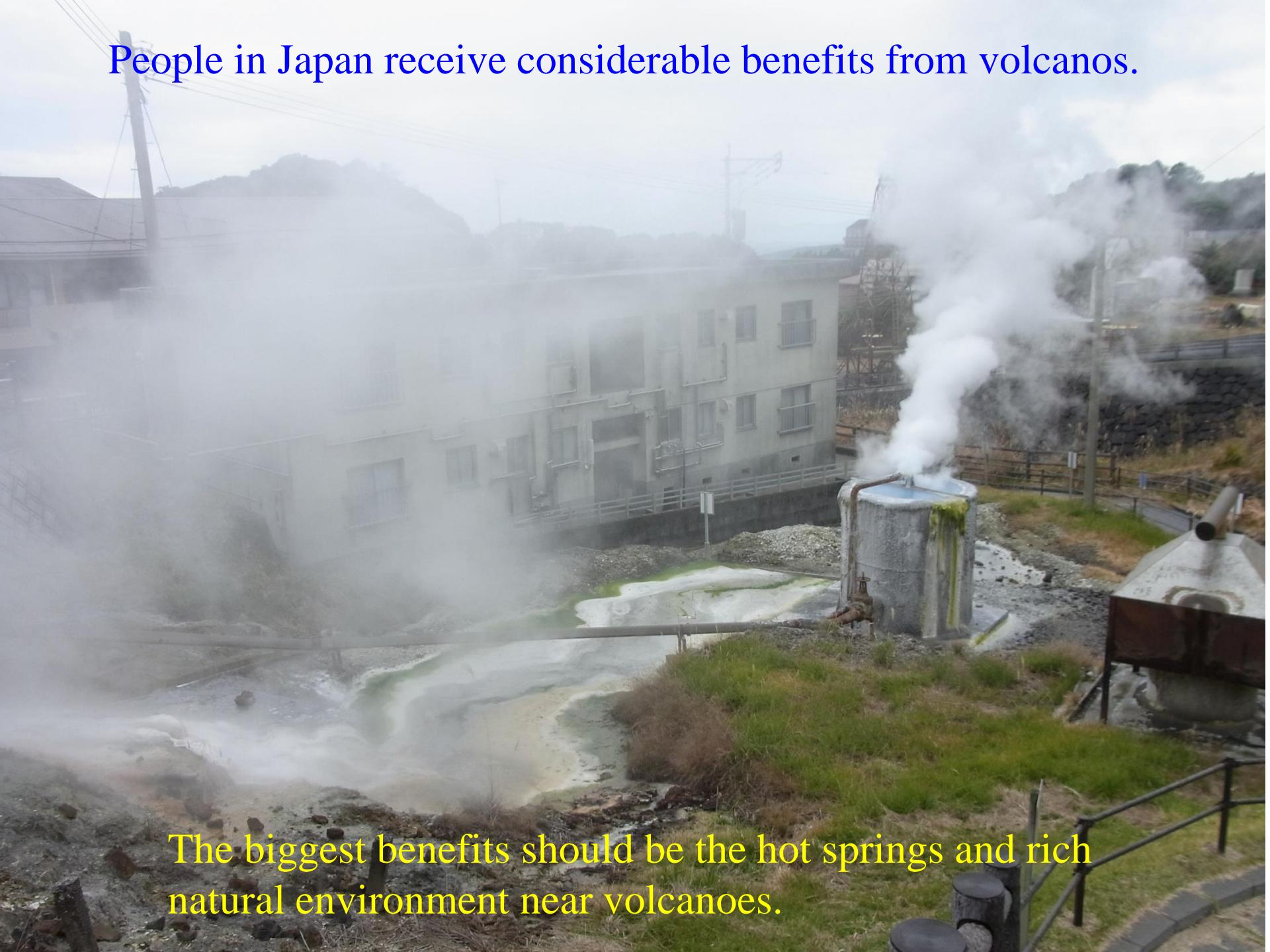
<volcanoes which have erupted within the past 10,000 years or with vigorous fumarolic activity>



Active volcanoes continuously monitored by JMA.

[https://gbank.gsj.jp/volcano/Quat\\_Vol/act\\_map\\_e.html](https://gbank.gsj.jp/volcano/Quat_Vol/act_map_e.html)

People in Japan receive considerable benefits from volcanoes.



The biggest benefits should be the hot springs and rich natural environment near volcanoes.

Geothermal energy is also one of the benefits from active volcanos.



Ogiri Geothermal Power Plant (Kagoshima Pref.)

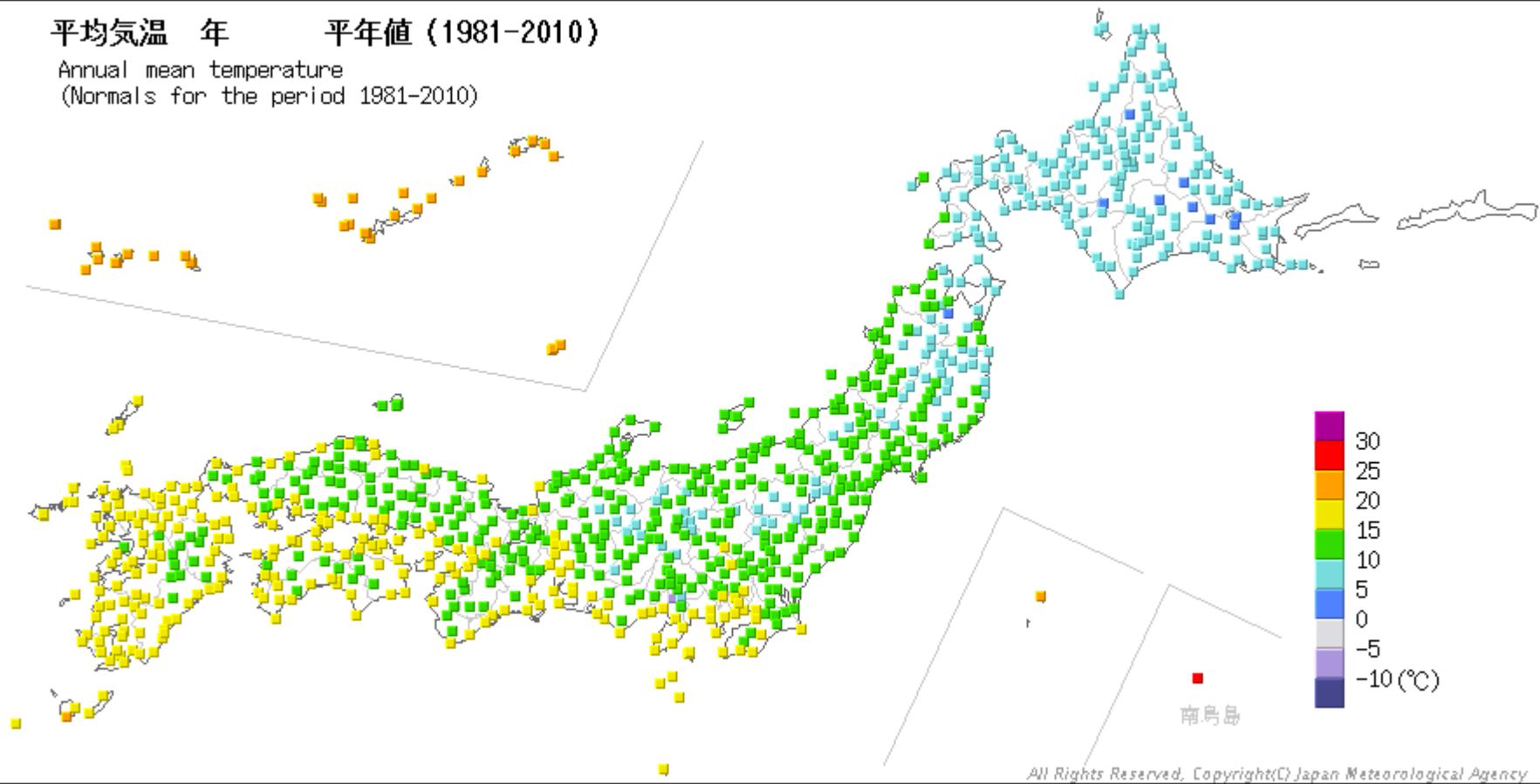
九州電力 大霧発電所(鹿児島県霧島市)

Generating Capacity 出力 30MW

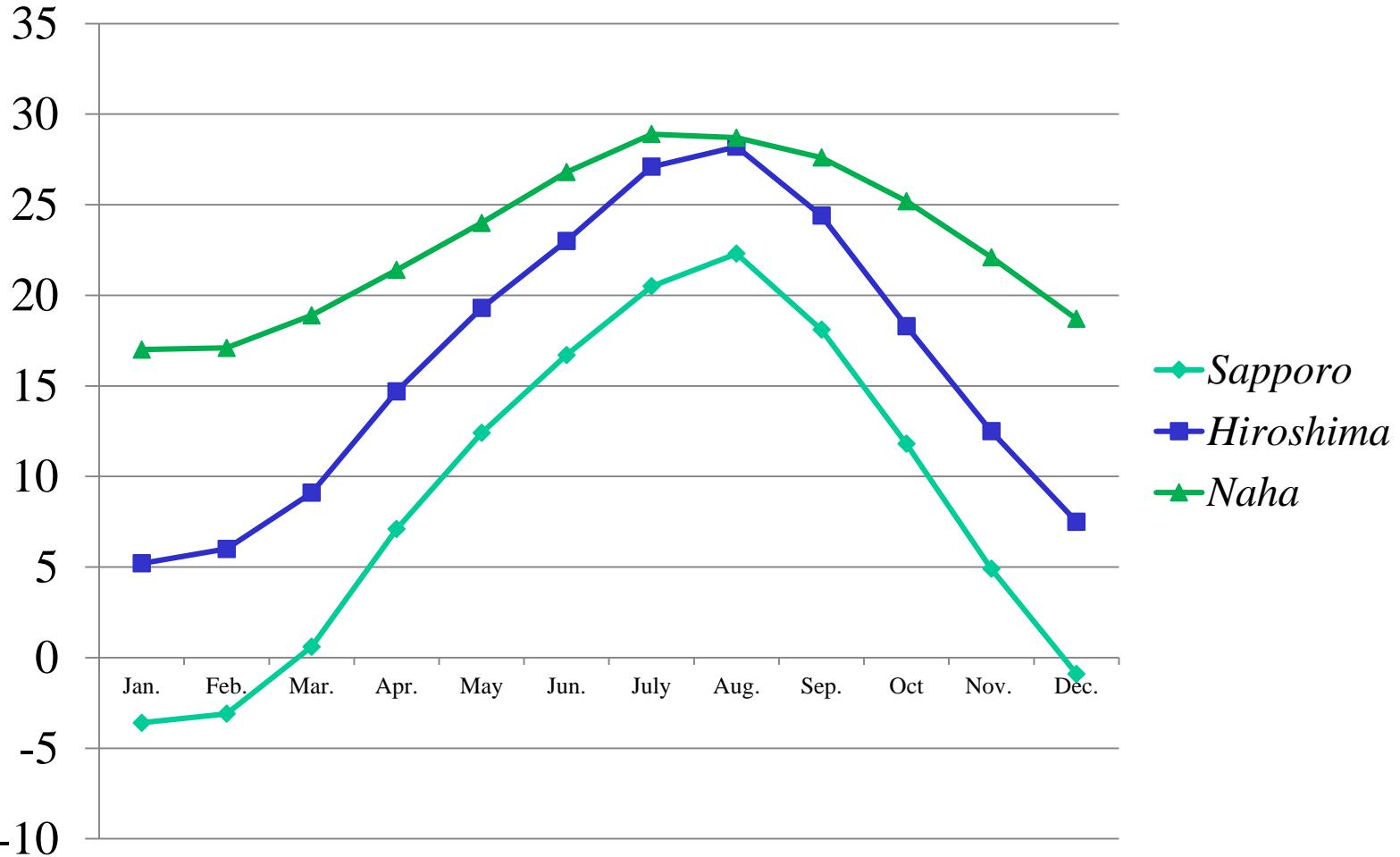
# Climate

## 平均気温 年 平年値 (1981-2010)

Annual mean temperature  
(Normals for the period 1981-2010)



Monthly mean air temperature



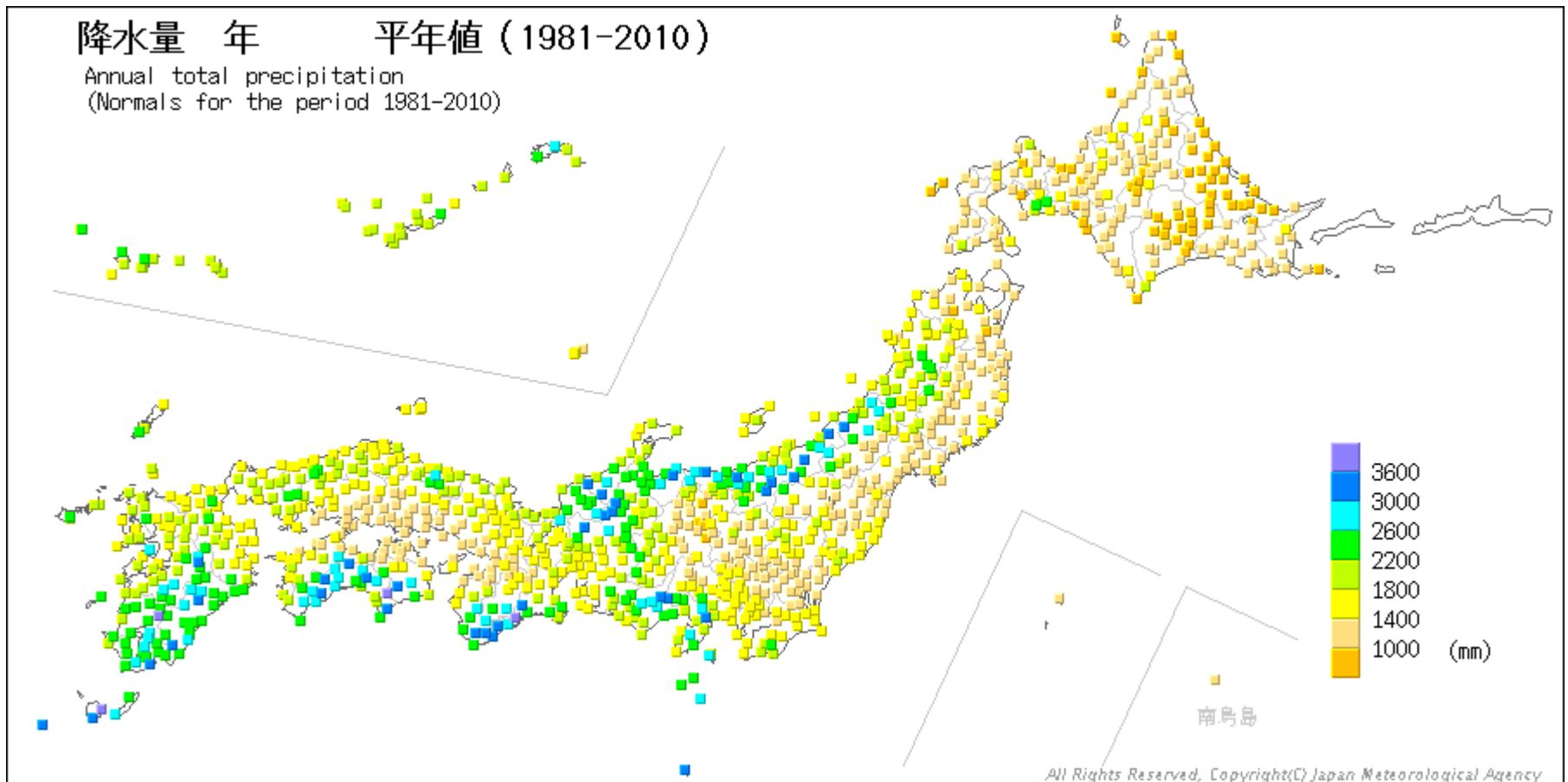
Annual mean air temperature

*Sapporo* 8.9°C

*Hiroshima* 16.3°C

*Naha* 23.1°C

The average yearly rainfall is about 1,700 mm, roughly twice the worldwide yearly average.

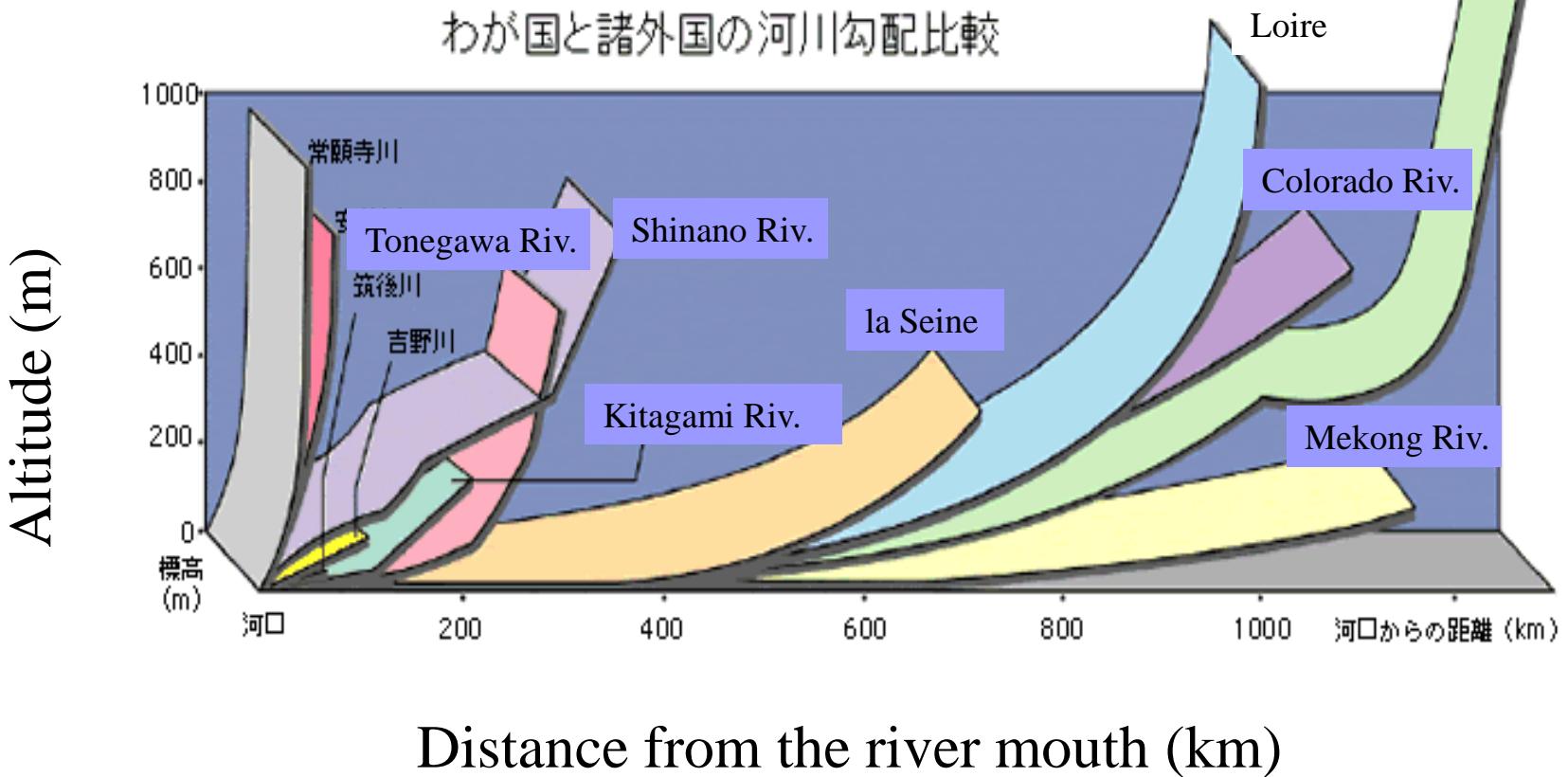


The average yearly rainfall is about 1,700 mm, roughly twice the worldwide yearly average of about 970 mm.

The average yearly rainfall per capita, however, is only about 5,100 m<sup>3</sup>, around one fourth the worldwide average of 22,000 m<sup>3</sup>/person.

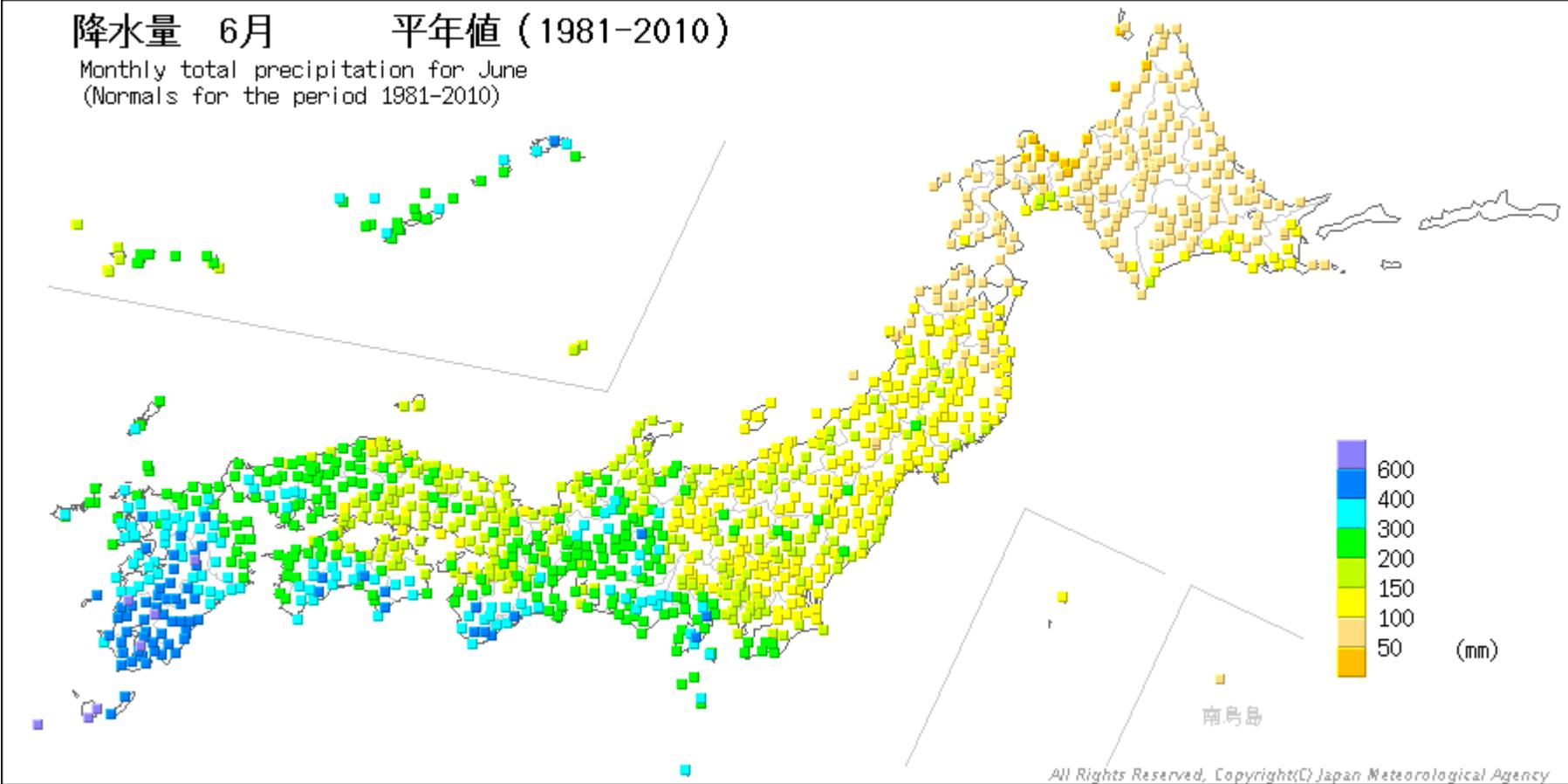
Water availability is relatively low!

# Rivers in Japan: Steep and Short



## 降水量 6月 平年值 (1981-2010)

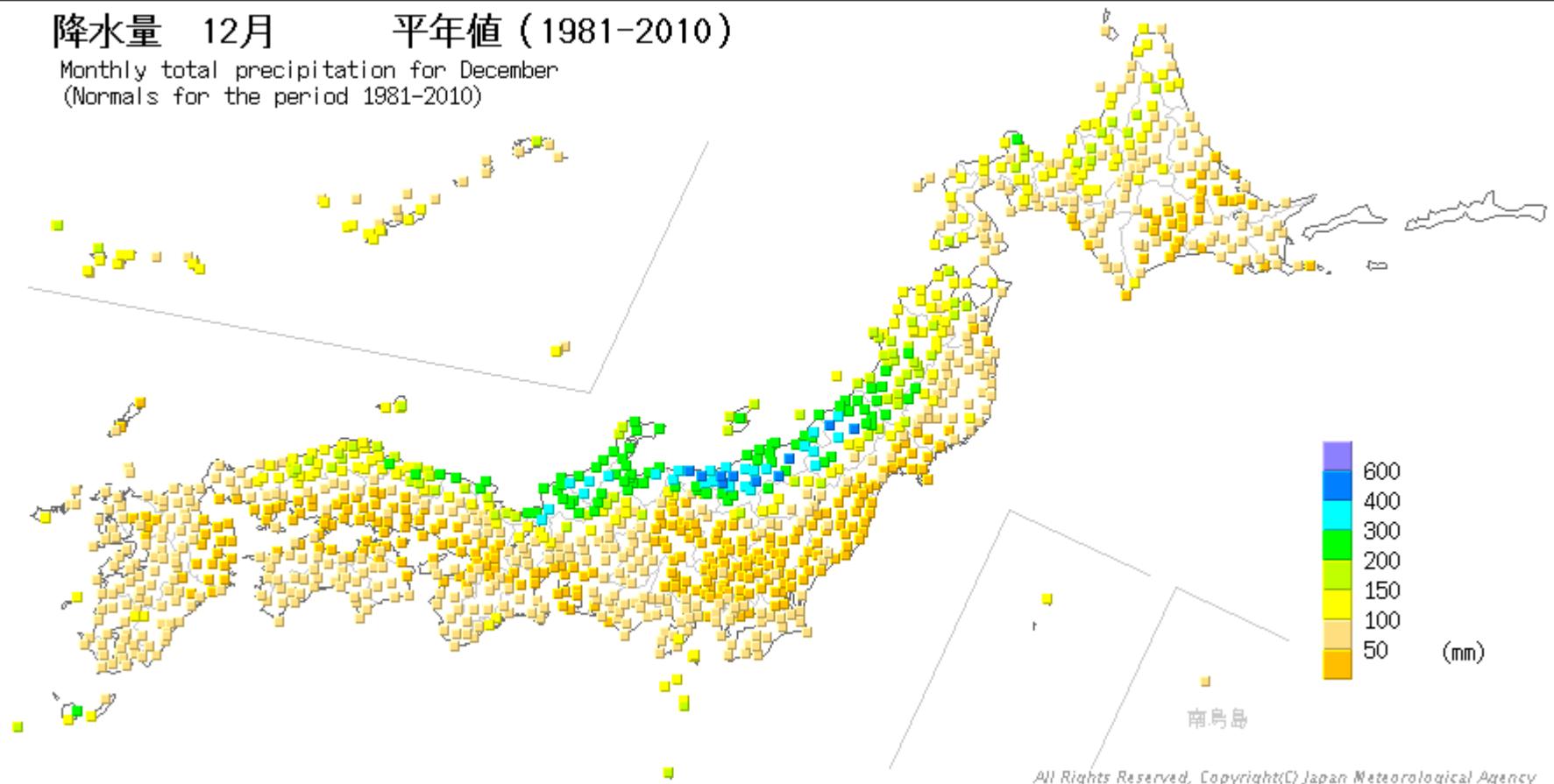
Monthly total precipitation for June  
(Normals for the period 1981-2010)



The rainy season in the Pacific Ocean side is  
June (- July). 梅雨 Tsuyu

## 降水量 12月 平年値 (1981-2010)

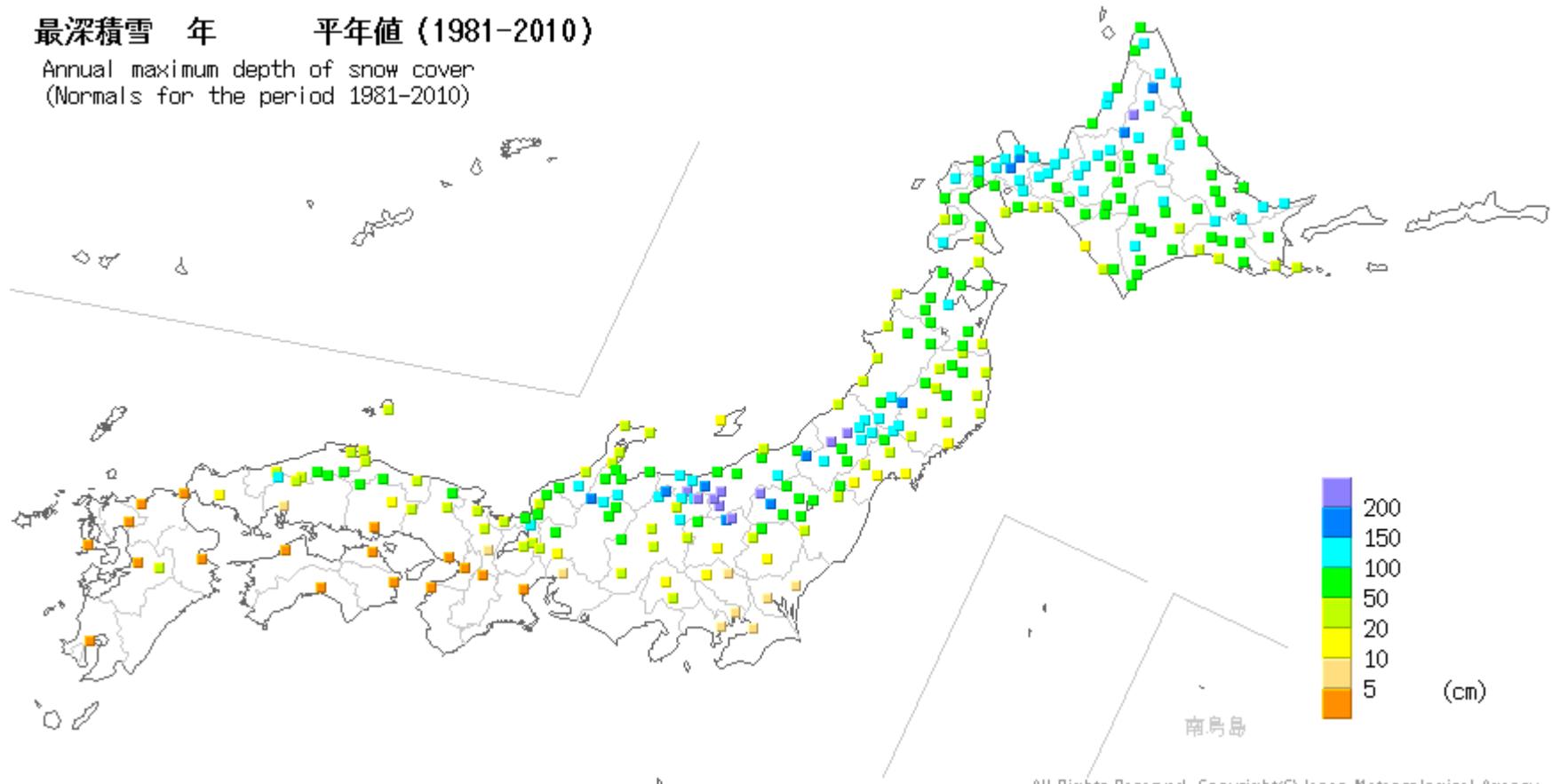
Monthly total precipitation for December  
(Normals for the period 1981-2010)

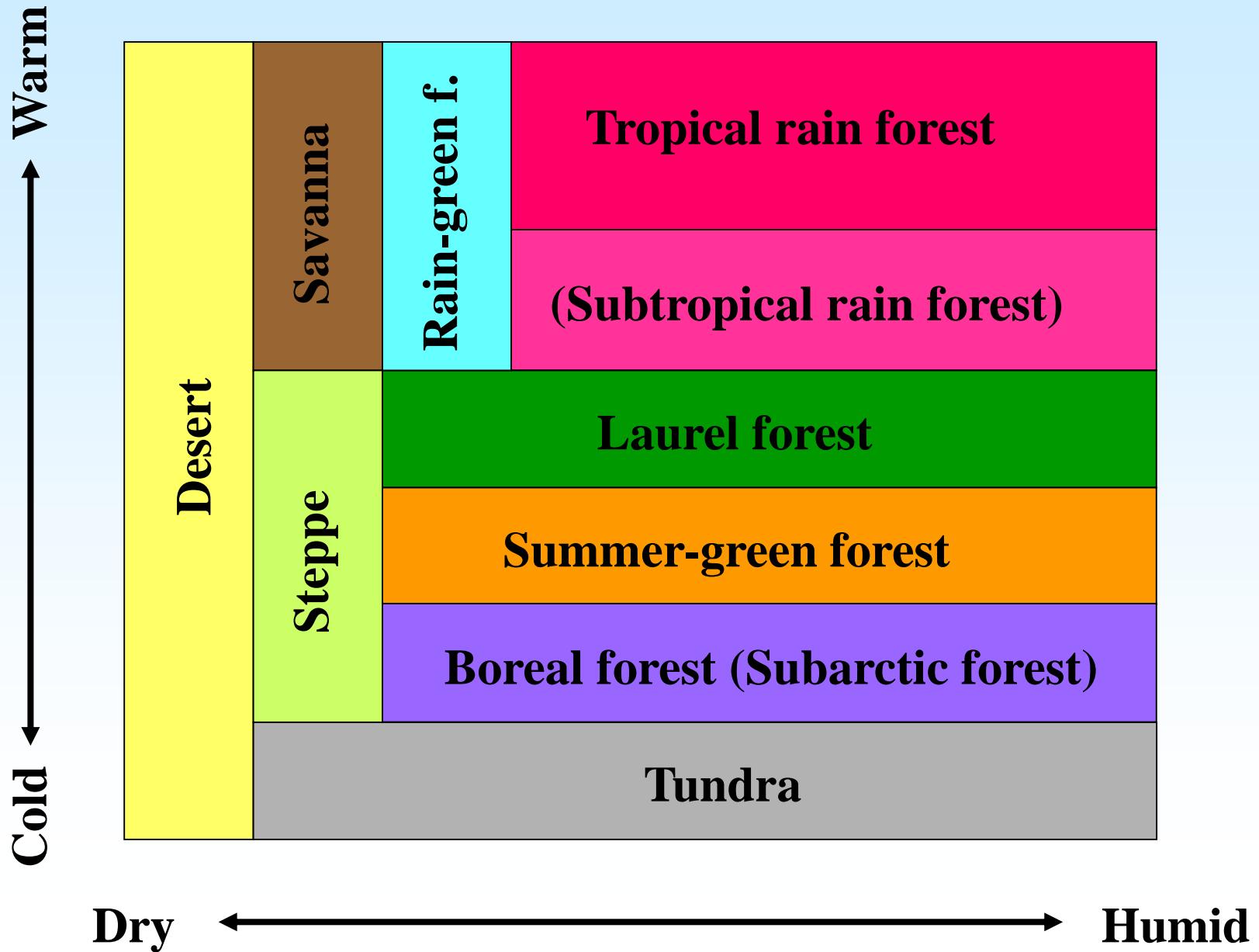


In the Japan Sea side, a large proportion of the annual precipitation is snowfall in winter.

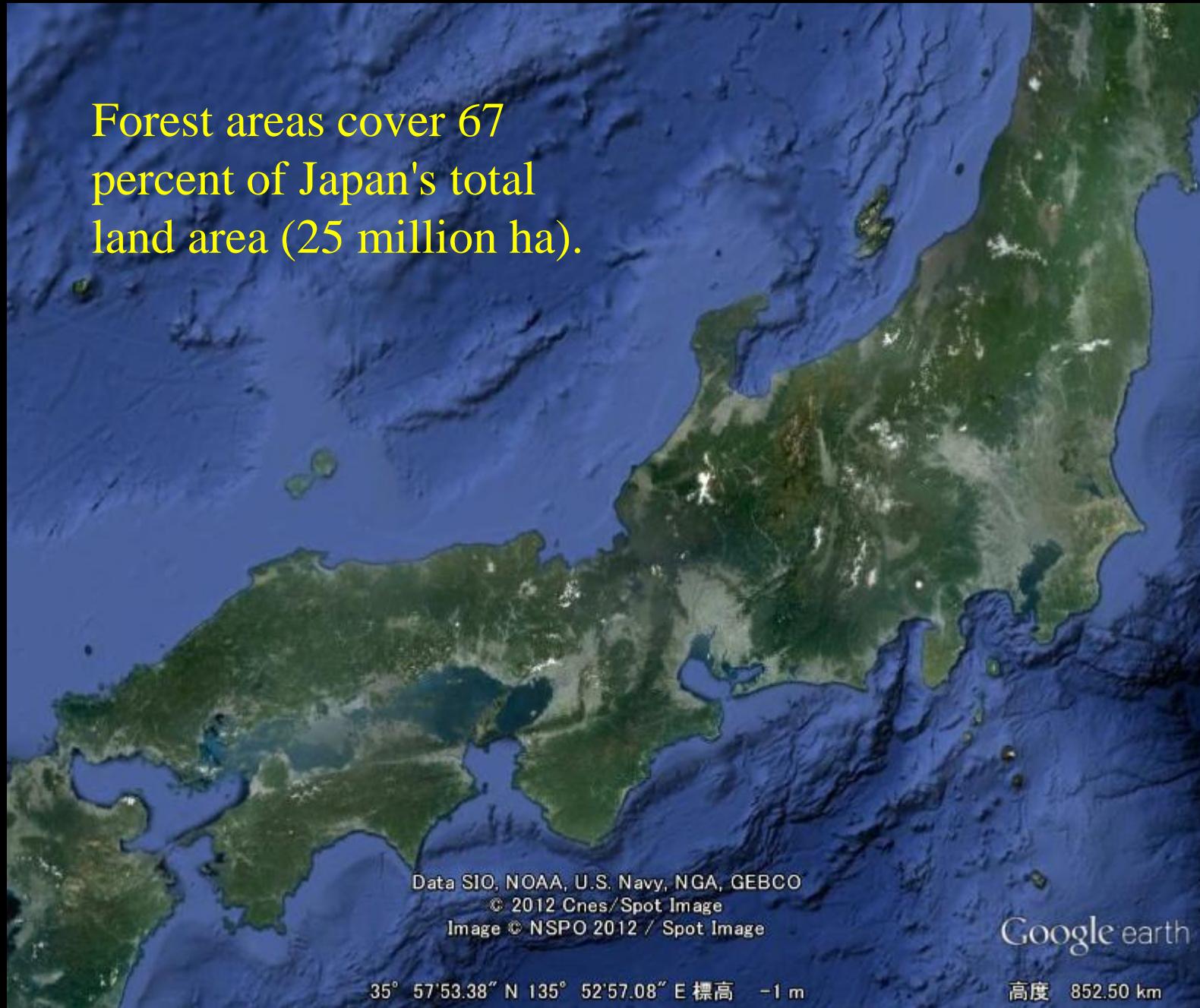
## 最深積雪 年 平年値 (1981-2010)

Annual maximum depth of snow cover  
(Normals for the period 1981-2010)





Forest areas cover 67 percent of Japan's total land area (25 million ha).



Data SIO, NOAA, U.S. Navy, NGA, GEBCO

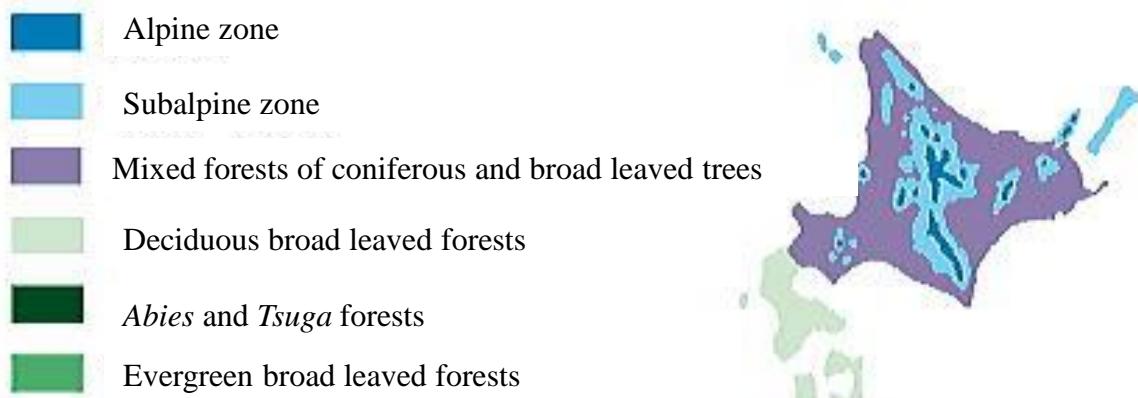
© 2012 Cnes/Spot Image

Image © NSPO 2012 / Spot Image

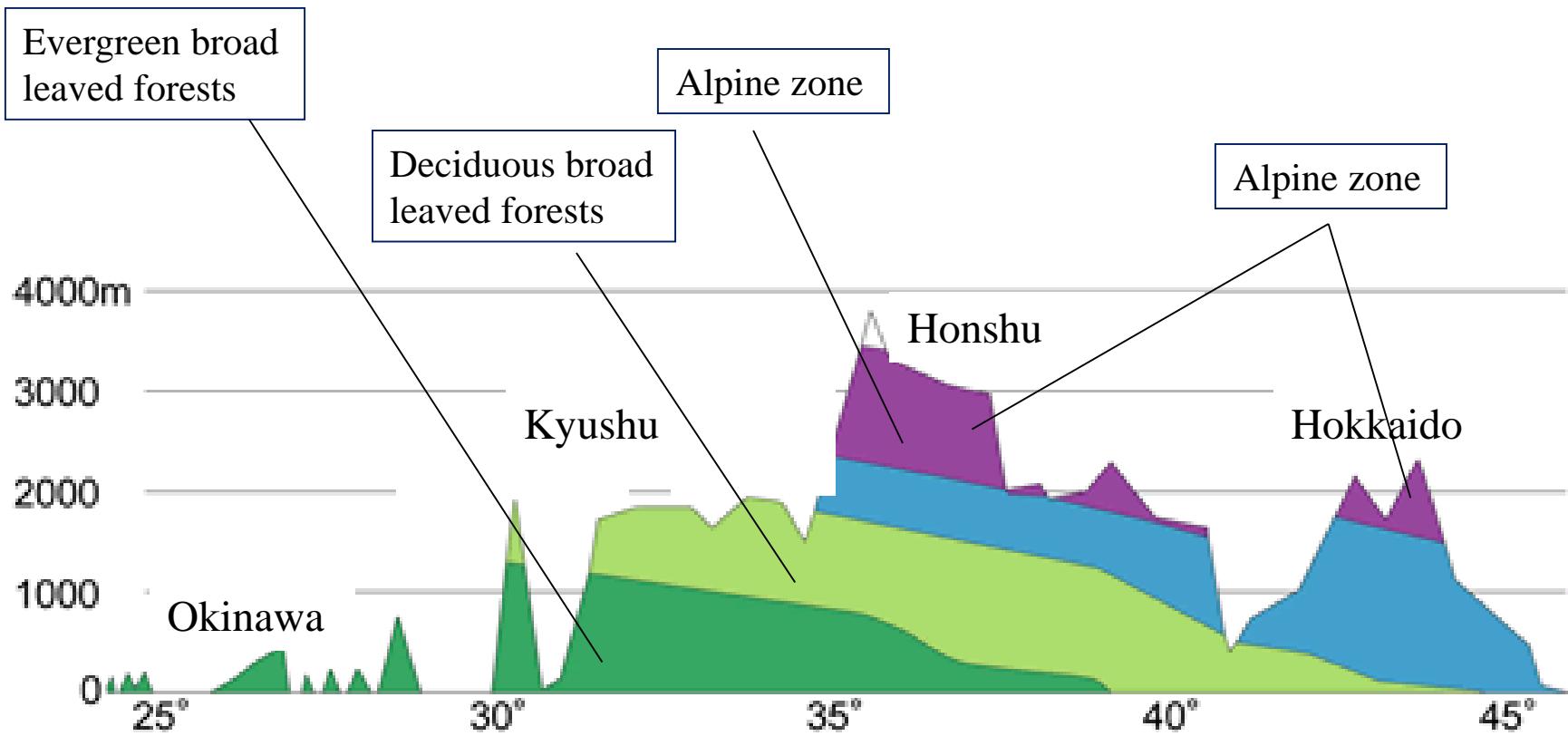
Google earth

35° 57'53.38" N 135° 52'57.08" E 標高 -1 m

高度 852.50 km



Vegetation in Japan ( after Yoshioka, 1973)



## Vertical and horizontal distribution of natural vegetation in Japan

「Natural and semi-natural vegetation in Japan. Blumea, 20」

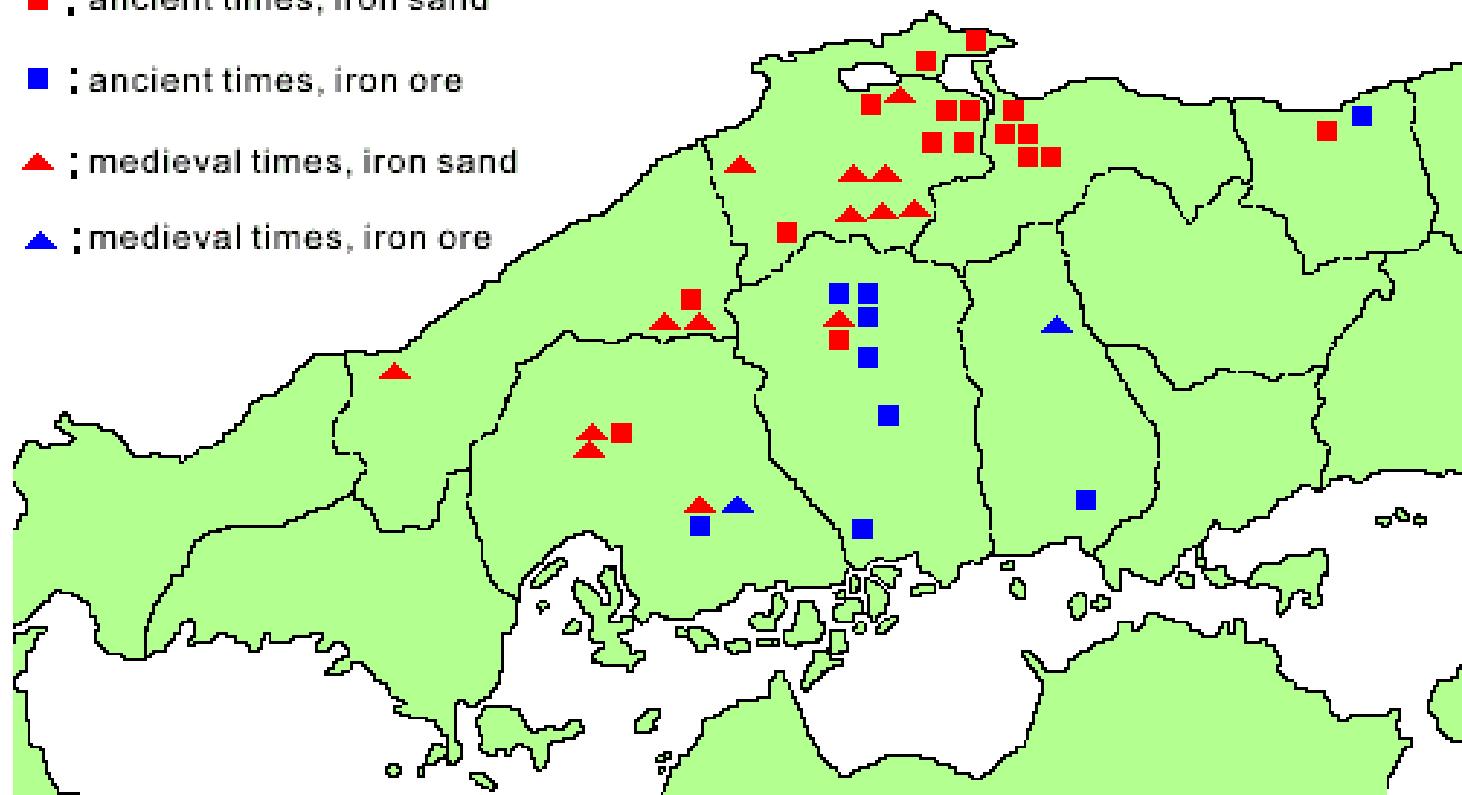
(Numata, M., Miyawaki, A and Ito, S, 1972)を改変

# History of Environmental Issues in Japan



*Tatara* iron manufacturing is a method that involves the use of iron sand as the source material. The **iron sand** is reduced through the heat of combustion of **charcoal** in order to obtain iron.

- : ancient times, iron sand
- : ancient times, iron ore
- ▲ : medieval times, iron sand
- ▲ : medieval times, iron ore

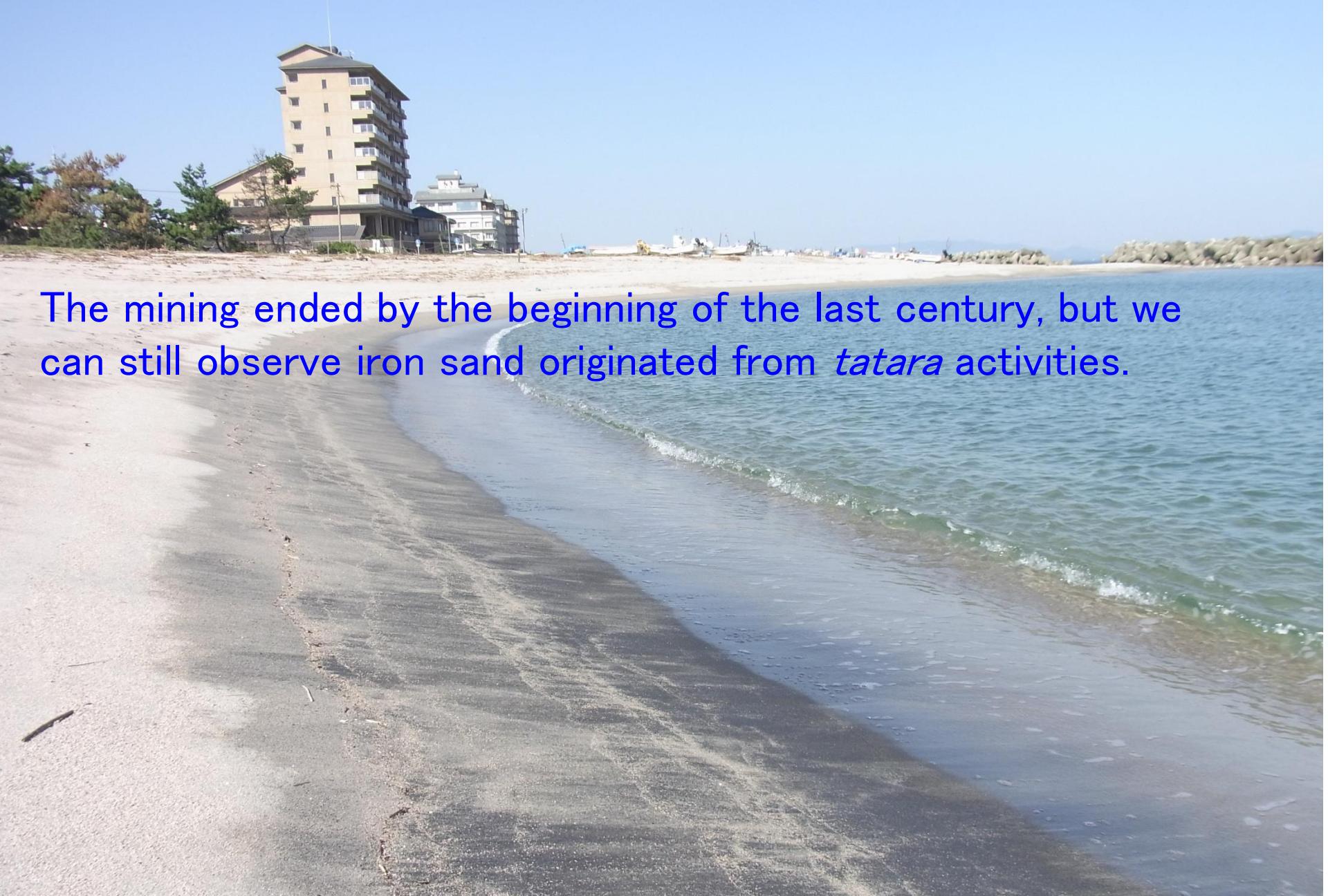


## Source of Iron in Ancient to Medieval Period Ironworks Sites

<http://www.hitachi-metals.co.jp/e/tatara/nnp0202.htm>



About 14 tons of charcoal are needed to make a ton of steel.



The mining ended by the beginning of the last century, but we can still observe iron sand originated from *tatara* activities.

Iron sand in *Yumigahama* coast, Tottori Pref.

# 1880s

## 足尾銅山鉱毒事件 Ashio Copper Mine Incident



Ashio\_Copper\_Mine\_circa\_1895

[http://ja.wikipedia.org/wiki/%E3%83%95%E3%82%A1%E3%82%A4%E3%83%AB:Ashio\\_Copper\\_Mine\\_circa\\_1895.JPG](http://ja.wikipedia.org/wiki/%E3%83%95%E3%82%A1%E3%82%A4%E3%83%AB:Ashio_Copper_Mine_circa_1895.JPG)

1950s ~70s

Rapid economic expansion 急速な経済発展

Environmental pollution 公害問題の深刻化

Four Big Pollution Diseases of Japan 4大公害

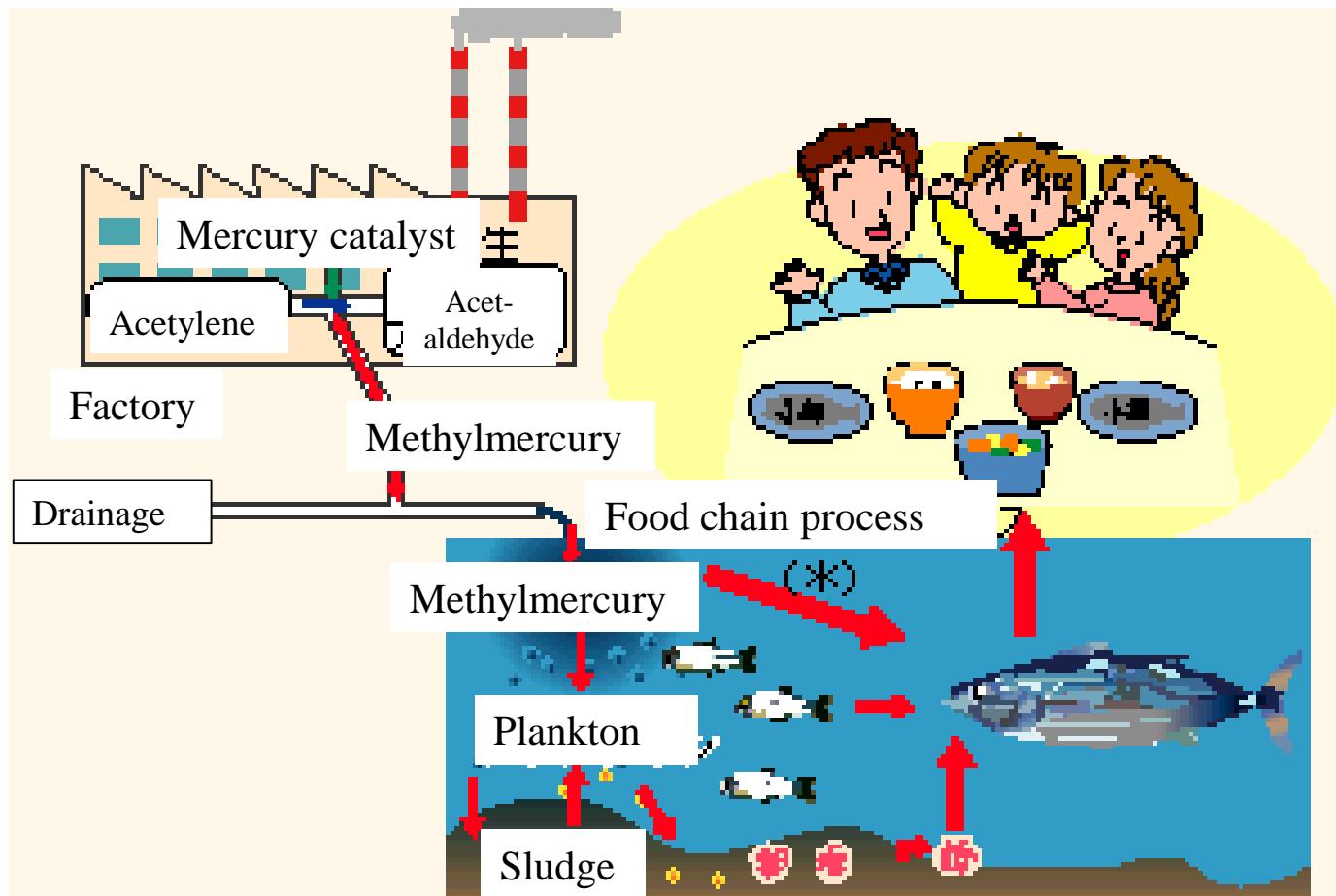
Minamata disease 水俣病 (Mercury poisoning)

Niigata Minamata disease 新潟水俣病 (Mercury poisoning)

Itai-itai disease イタイイタイ病 (Cadmium poisoning)

Yokkaichi Asthma 四日市喘息 (Sulfur dioxide and nitrogen dioxide)

# Pollution Pathway of Methylmercury (Bioconcentration)



(\*) 食物連鎖のほかに、えら呼吸による汚染経路があるという説もあります。

資料：環境省

1967 Basic Law for Environmental Pollution  
(The Pollution Countermeasures Basic Law)  
公害対策基本法

1971 Environment Agency 環境省発足

1972 United Nations Conference on the Human  
Environment 國際連合人間環境會議  
(Stockholm)

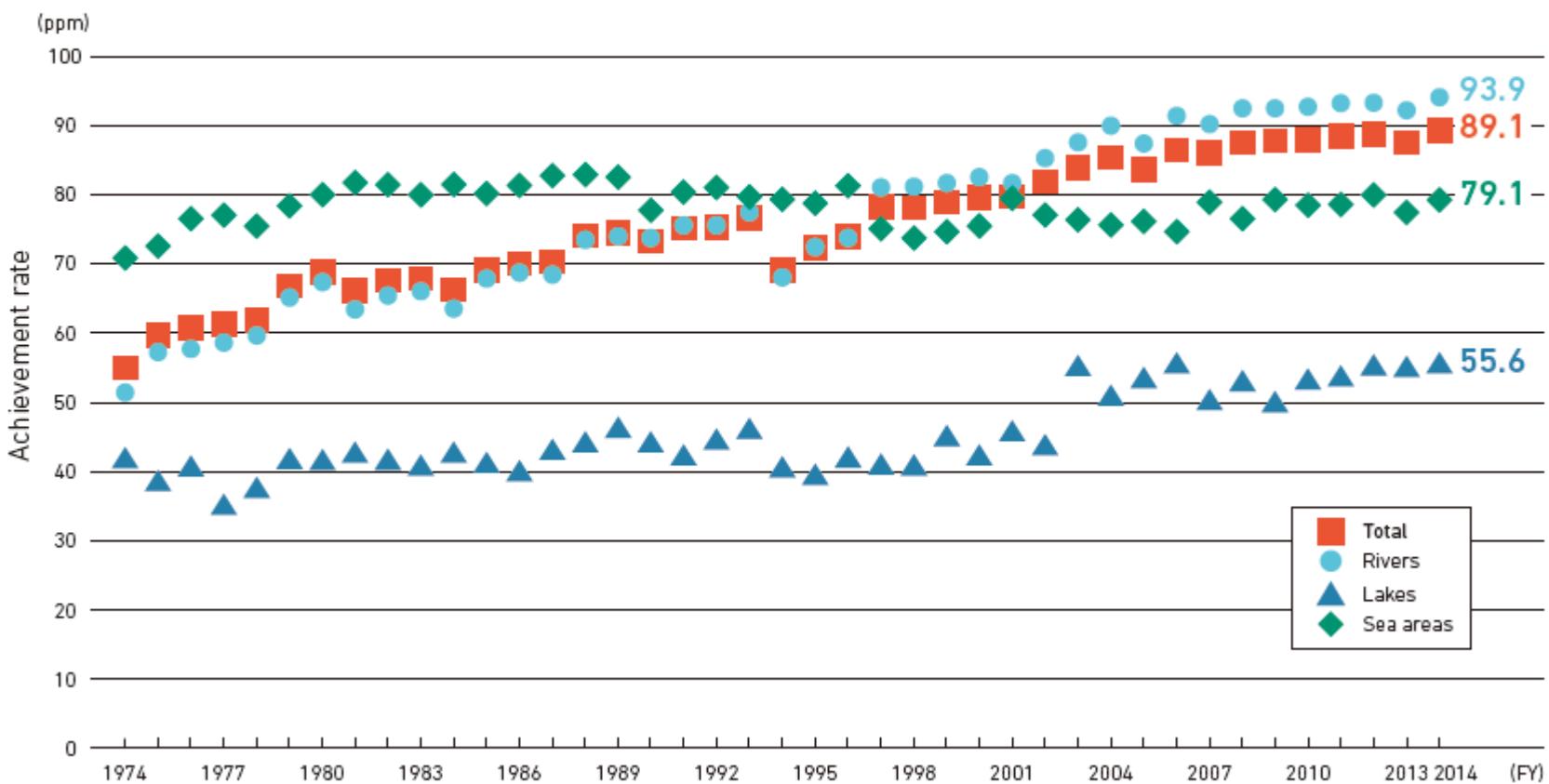
# Seven Major Types of Pollution 典型7公害

(Basic Law for Environmental Pollution 公害対策基本法)

- (1) Air pollution 大気汚染
- (2) Water pollution 水質汚濁
- (3) Soil contamination 土壤汚染
- (4) Noise 騒音
- (5) Vibration 振動
- (6) Ground subsidence 地盤沈下
- (7) Offensive Odor 悪臭

## Achievement of Environmental Standards (BOD or COD)

An overall level of 89.1% has been achieved for the biochemical oxygen demand (BOD) and chemical oxygen demand (COD) environmental standards relating to the maintenance of living environments. BOD and COD are leading indicators of water quality in respect of organic pollution.



Source: "Measurement Results of Water Quality in Public Waters FY 2014" Ministry of the Environment

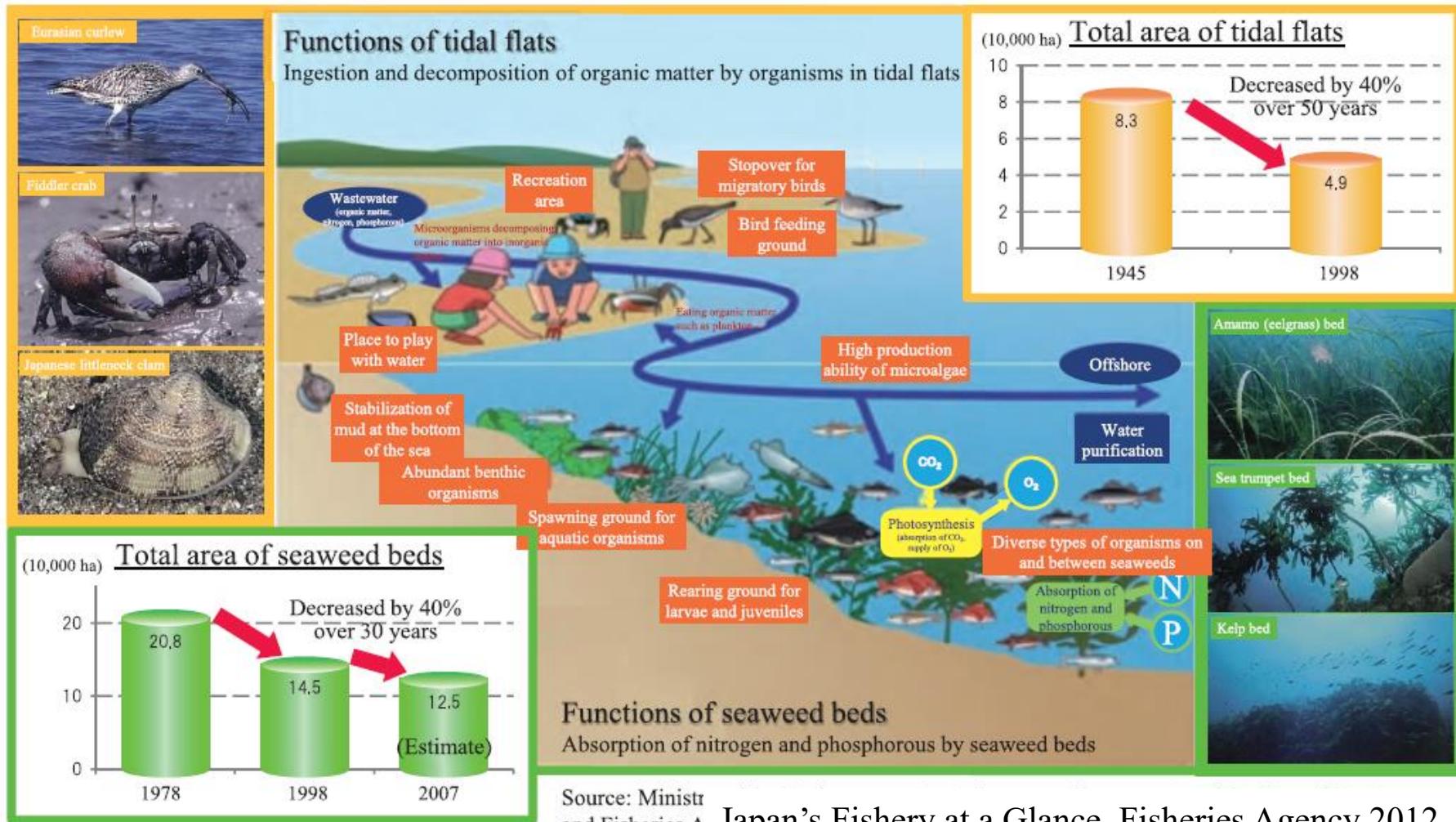
Annual Report on the Environment,  
the Sound Material-Cycle Society and Biodiversity  
in Japan 2016

Published by Ministry of the Environment

# The areas of sea weed beds and tidal flats have decreased substantially due to development of coastal areas.

## Decrease of Seaweed Beds and Tidal Flats

The areas of seaweed beds and tidal flats, which are grounds for fish spawning and growth as well as places that have water purification capabilities, have decreased substantially due to such reasons as development of coastal areas.



# 1980s ~90s

## Problems of Global Environment 地球環境問題

- 1988 Intergovernmental Panel on Climate Change  
気候変動に関する政府間パネル(IPCC)設立
- 1989 Montreal Protocol on Substances that Deplete the Ozone Layer モントリオール議定書発効
- 1992 United Nations Conference on Environment and Development リオ・デ・ジャネイロで地球サミット
- 1993 Basic Environmental Law 環境基本法制定
- 1997 Kyoto Protocol 京都議定書採択

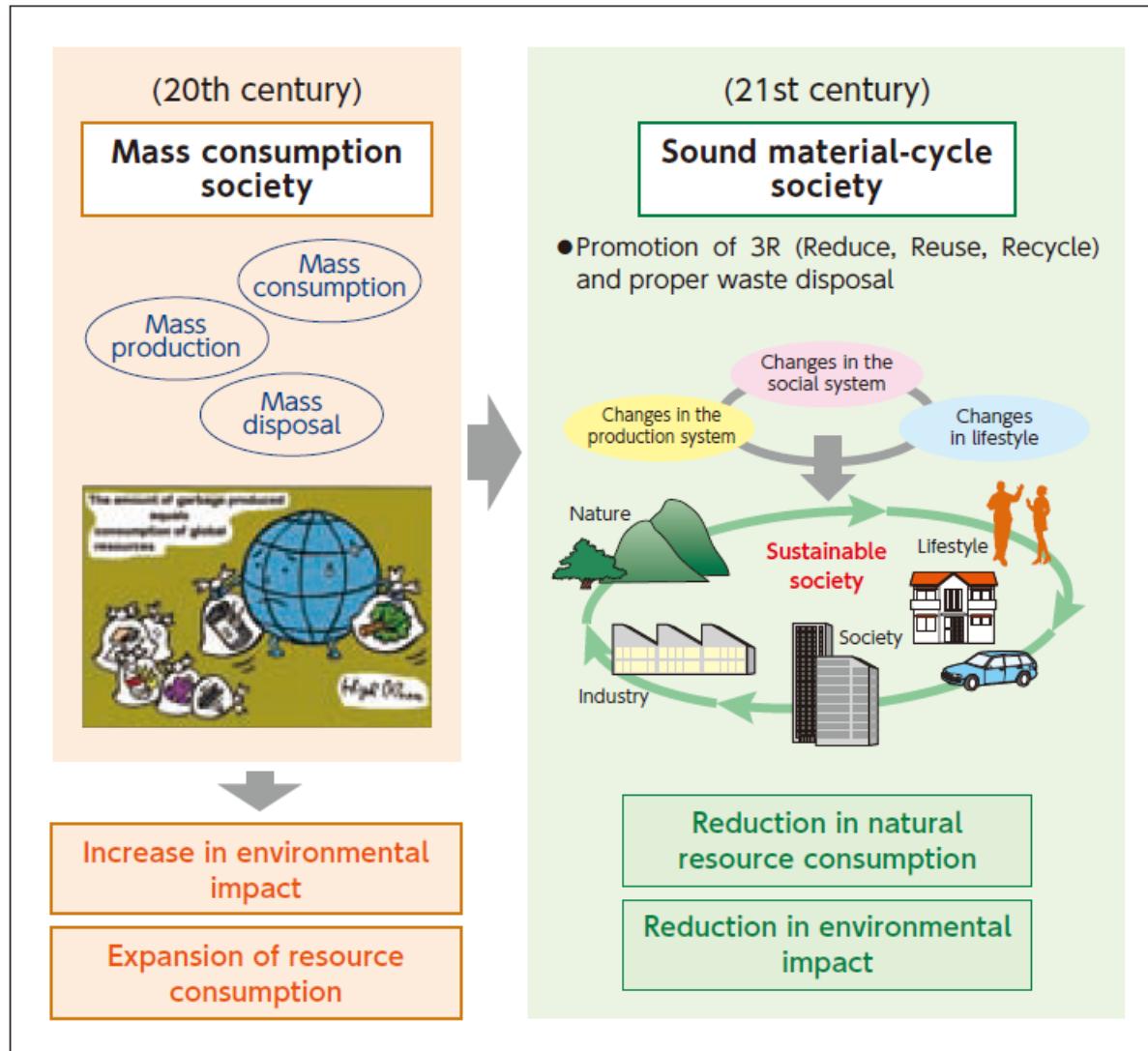
# Problem of Global Environment

## 地球環境問題

- (1) Global Warming 地球温暖化
- (2) Ozone-Layer Depletion オゾン層の破壊
- (3) Decline in Tropical Forests 热帯林の減少
- (4) Environmental Pollution in Developing Countries 開発途上国の公害
- (5) Acid Rain 酸性雨
- (6) Desertification 砂漠化
- (7) Decline in Biodiversity 生物多様性の減少
- (8) Marine Pollution 海洋汚染
- (9) Transboundary Movements of Hazardous Wastes 有害廃棄物の越境移動

# 2000 ~ 2010

- 2000 Basic Law for Establishing the Recycling-Based Society 循環型社会形成推進基本法
- 2001 Ministry of the Environment 環境庁発足
- 2005.2.16 Effectuation of the Kyoto Protocol  
京都議定書発効
- 2010.10 The tenth meeting of the Conference of the Parties (COP 10) of the Convention on Biological Diversity (Nagoya, Aichi Pref.)  
生物多様性条約第10回締約国会議



Source for the illustration: Website of the Miyako Ecology Center

History and Current State of Waste Management in Japan,  
Ministry of the Environment (2014)

2011 ~

- 2011.3.11 Tōhoku earthquake and tsunami 東日本大震災  
Damage of the Fukushima Daiichi Nuclear Power Plant 福島第二原子力発電所事故
- 2015.9 UN Sustainable Development Summit
- 2015.12 Paris Agreement at the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP 21) パリ協定

# Sustainable Development Goals (SDGs)

The 2030 Agenda for Sustainable Development (the 2030 Agenda) is a set of international development goals from 2016 to 2030, which was adopted by the UN Sustainable Development Summit held in September 2015 building on the success of Millennium Development Goals (MDGs).

The 2030 Agenda listed “Sustainable Development Goals” consisting of 17 goals and 169 targets in order to eradicate poverty and realize a sustainable world. The SDGs are universal goals applicable, not only to developing countries but also developed countries, and pledge “Leave no one behind.” through the implementation process.



# SUSTAINABLE DEVELOPMENT GOALS

1 NO POVERTY



2 ZERO HUNGER



3 GOOD HEALTH AND WELL-BEING



4 QUALITY EDUCATION



5 GENDER EQUALITY



6 CLEAN WATER AND SANITATION



7 AFFORDABLE AND CLEAN ENERGY



8 DECENT WORK AND ECONOMIC GROWTH



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



10 REDUCED INEQUALITIES



11 SUSTAINABLE CITIES AND COMMUNITIES



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



14 LIFE BELOW WATER



15 LIFE ON LAND



16 PEACE, JUSTICE AND STRONG INSTITUTIONS



17 PARTNERSHIPS FOR THE GOALS

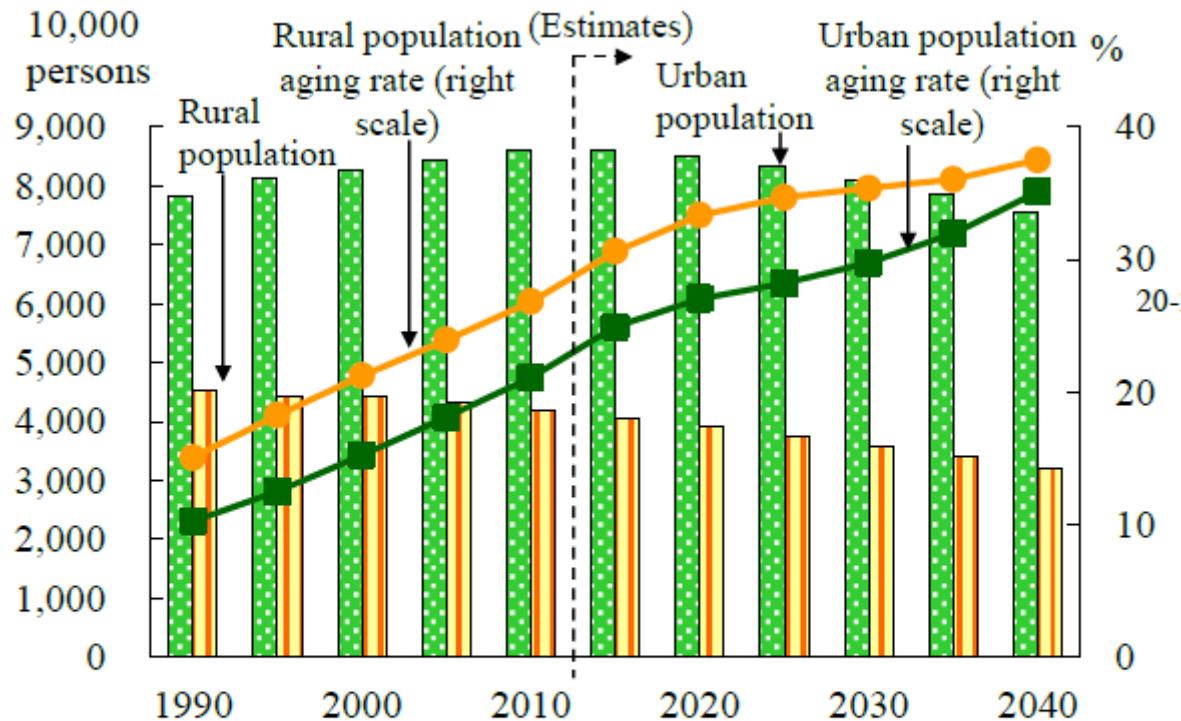


SUSTAINABLE DEVELOPMENT GOALS

# Urgent issues

1. Clean and sustainable energy  
(defossilisation and low carbon emission )
2. Aging population and low birth rate

## Population and aging trend and outlook in rural and urban areas



Sources: Estimated by MAFF based on MIC, "Population Census;" National Institute of Population and Social Security Research, "Estimates of Japan's Future Population by Region (estimated in March 2013)"

Note: Urban areas are densely inhabited districts as specified in the "Population Census" and rural areas are other districts.