

International Workshop - Session 1

Recent Development on Science-based Climate Change Policy in Japan



Recent Development on Science-based Climate Change Policy in Japan

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Keywords: Climate change, impact assessment, adaptation policy, mitigation pathway

The presentation will include information of IPCC-AR5, progress of researches supported by Environment Research and Technology Development Fund (e.g. S-8 project), situation of national adaptation plan, supports for developing countries (e.g. adaptation initiative), GOSAT and so on.

GOSAT (Greenhouse Gases Observing Satellite) is a Japanese earth observation satellite, launched in January 2009 by Ministry of the Environment (MOEJ), Japan Aerospace Exploration Agency (JAXA) and National Institute for Environmental Studies (NIES), dedicated to greenhouse gases measurement from space. It is successful in observing concentration and flux of greenhouse gases (CO₂ and methane) for more than 5 years, and provides the latest scientific knowledge which is beneficial for the climate change policy in the world. GOSAT related research was quoted in IPCC report, made presentation in side-event at COP, and GOSAT data is delivered all over the world. GOSAT-2, the successor of GOSAT, will be launched in FY 2017 with aim to observe atmospheric concentration of CO and greenhouse gas concentration in more detail.

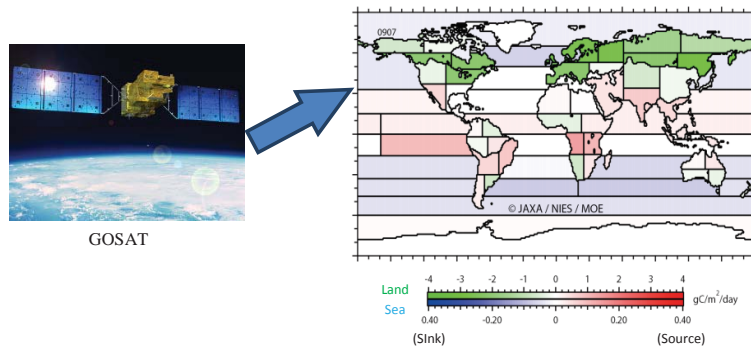


Fig. 1 GOSAT equipment and estimated global CO₂ results

Researches have been done to assess the **climate change effect in Japan**. It is projected that the annual mean temperature will increase towards the end of 21st century, in particular, in northern regions of Japan. Such climate change will cause a serial of impacts on human beings. First climate change will increase risk of drought. Some regions are expected to see an increase in the number of days without rain as well as increased occurrences of drought due to decreased snowfall. Second, climate change will increase risk of Heavy-Rain. It is predicted that the probability of floods exceeding the rivers' prescribed target flood safety level to be 1.8 to 4.4 times the current value. Thirdly, climate change will affect agriculture, with results that rice yields will increase but quality will decline.

Countermeasures for **adaptation to climate change** in Japan have been further implemented to response climate change. Two main research projects have been initiated, namely *comprehensive projection of climate change impacts (2005-09)* and *“Comprehensive research on climate change impact assessment and adaptation policies (2010-14, S-8 Global Warming Impact and Adaptation Research Project)*. And a lot of national and international adaptation actions have been done to promote climate change adaptation. In 2013, MOEJ established “Expert Committee on Climate Change Impact Assessment”. It is estimated to complete climate change impact assessment in 2015 and decided to formulate the National Adaptation Plan in the summer of 2015. Several knowledge sharing networks have been established for strengthening adaptive capacity:

- Global Adaptation Network (GAN), proposed by UNEP, supports to make vulnerable communities, ecosystems and economies more resilient against climate change, through knowledge sharing on adaptation.

- Asia-Pacific Adaptation Network (APN), established in 2009, supports adaptation actions in developing countries, through sharing information and knowledge on adaptation within the region.

- Asia-Pacific Network (APN), established in 1996 for Global Change Research, received financial support by Japan, USA, Republic of Korea and New Zealand.

Japan also assists developing countries' adaptation actions both in terms of their plans and implementation by applying Japan's Technology for adaptation measures and experiences. About 2.3 billion USD has already been invested from Jan. 2013 to Jun. 2014.

Mitigation to climate change is another important aspect for responding climate change and can be more cost-effective if using an integrated approach that combines measures to reduce energy use and the GHG intensity of end-use sectors, decarbonize energy supply, reduce net emissions and enhance carbon sinks in land-based sectors. There are multiple mitigation pathways that are likely to limit warming to below 2°C relative to pre-industrial levels. Japan's new greenhouse gas emission is set as 3.8% emission reduction in 2020 from the 2005 level in order to implement Cancun agreement. The new target will be achieved by implementing serials of measures such as 20% improvement in energy intensity, Improvement of emission factor of electricity by renewable energy, Joint Crediting Mechanism and Utilization of carbon sink of forest.

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- IPCC, (2014) CLIMATE CHANGE 2014 Synthesis Report.
- Tachikawa, Y., S. Takino, Y. Fujioka, K., Yorozu, S. Kim, M. Shiiba (2011) Projection of river discharge of Japanese river basins under a climate change scenario. Journal of Japan Society of Civil Engineers, Ser. B1 (Hydraulic Engineering), Vol. 67, No. 1, pp.1-15.
- Tomoya Watanabe (2012) What level does climate change make impacts on agricultural production, how to address and how should agriculture, forestry and fishery sector tackle climate change? Research project funded by the Ministry of Agriculture, Forestry and Fisheries.

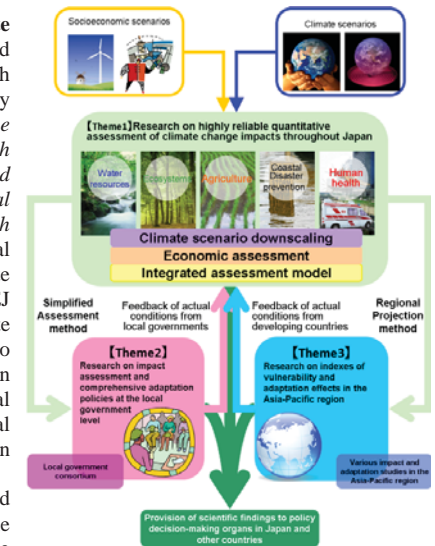


Fig. 2 Comprehensive Research on Climate Change Impact Assessment and Adaptation Policies

13 November 2014



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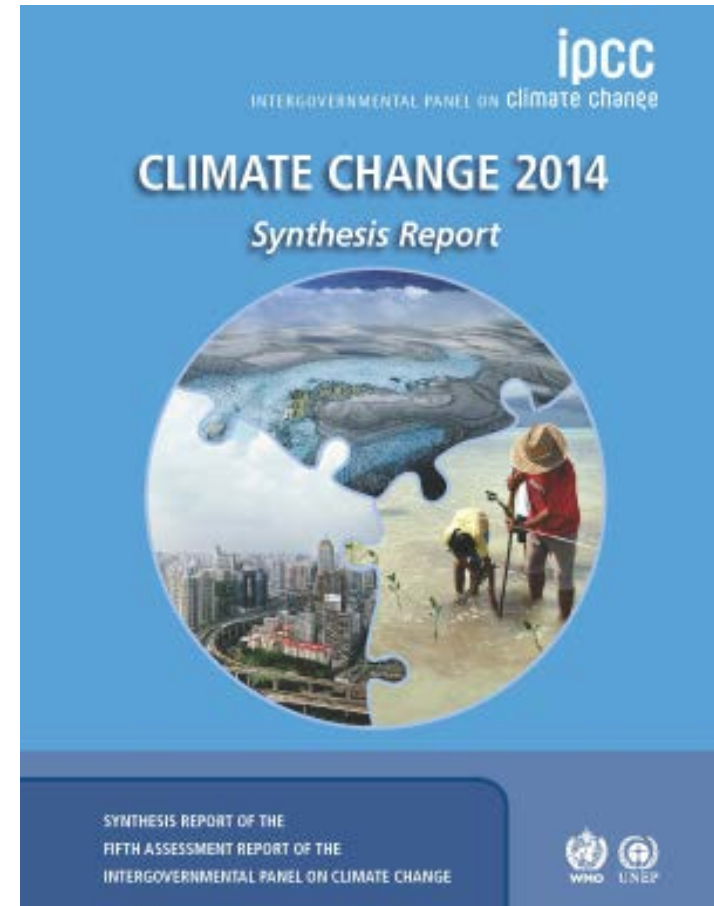
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Key messages



- ✓ Science is basis of and indispensable to climate change policy. Therefore, we should understand science on climate change.
- ✓ The IPCC 5th Assessment Report has just been published.
- ✓ Need to adjust our national and international climate change policies based on the IPCC/AR5.
- ✓ Need to take into account integrated climate risk management approach

IPCC AR5 Synthesis Report



40th Session of IPCC, 27-31 October 2014, Copenhagen

600 participants, government representatives from 120 countries



IISD Reporting Service
<http://www.iisd.ca/climate/ipcc40/1nov.html>
Accessed, 3 Nov 2014



1.1 Observed changes in the climate system

Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen. {1.1}

SYR SPM

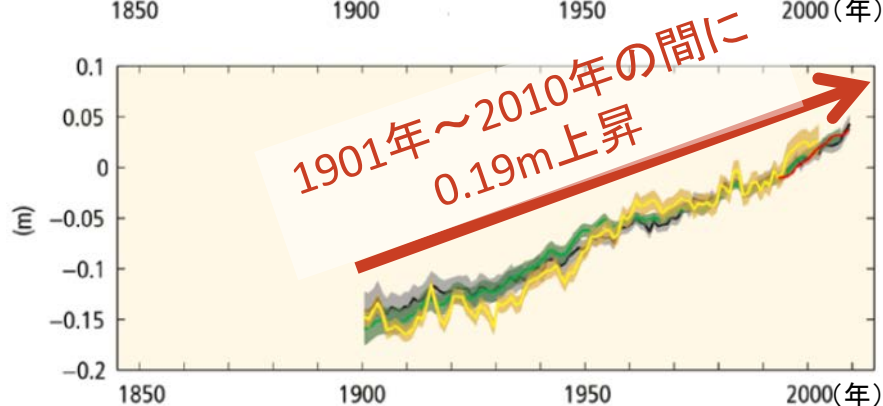
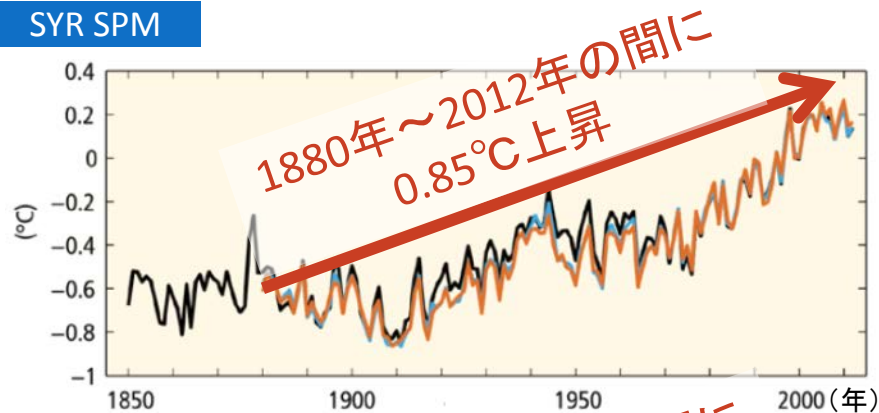


図. 陸域と海上を合わせた世界平均地上気温偏差 (上)
世界年平均海面水位の変化 (下)

※基準はどちらも1986-2005年の平均

出典: 図, IPCC AR5 SYR SPM Fig. SPM.1(a),(b)

WG I SPM

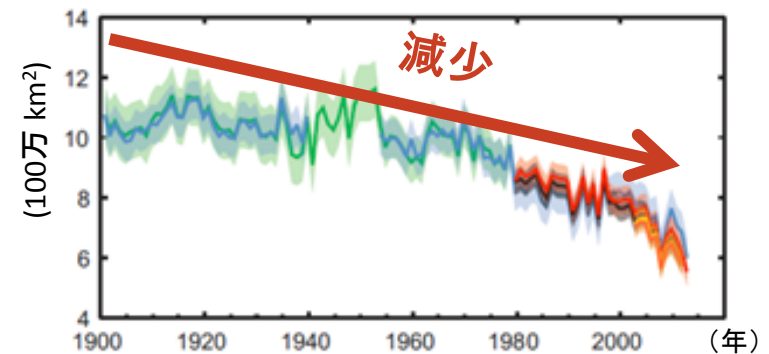
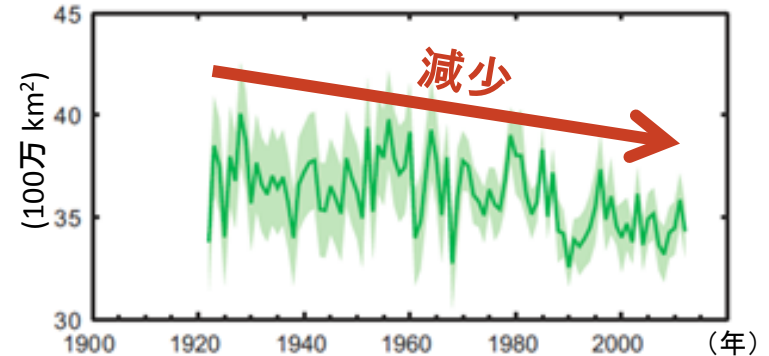


図. 北半球積雪面積の変化 (春季) (上)
北極域海氷面積の変化 (夏季) (下)

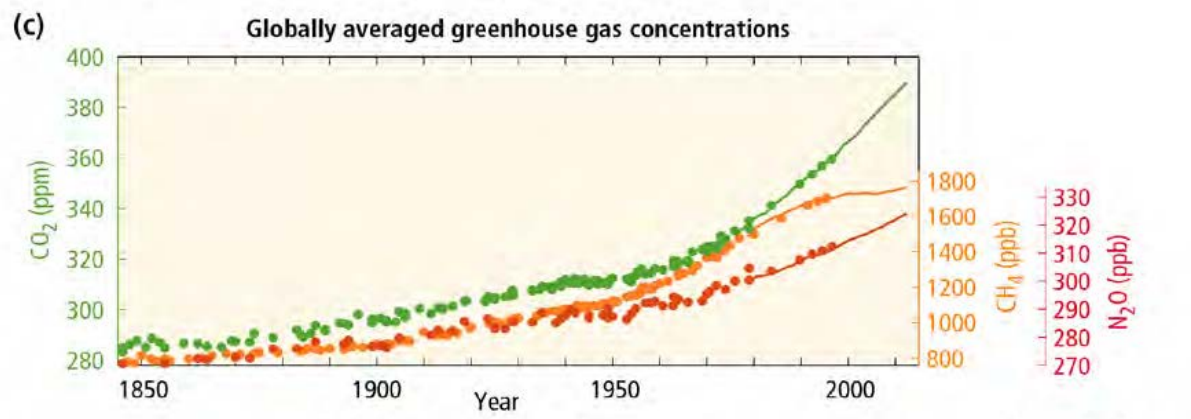
出典: 図, IPCC AR5 WG I SPM Fig. SPM.3(a),(b)

※図中の記号・文書(赤色)は原図に追加したもの

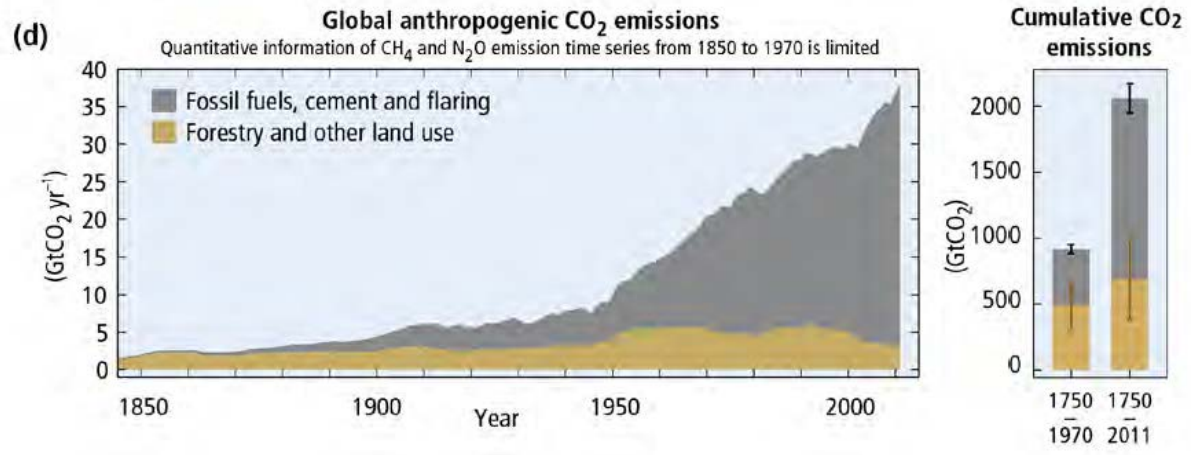
1.2 Causes of Climate Change

Anthropogenic greenhouse gas emissions have increased since the pre-industrial era, driven largely by economic and population growth, and are now higher than ever. This has led to atmospheric concentrations of carbon dioxide, methane and nitrous oxide that are unprecedented in at least the last 800,000 years. Their effects, together with those of other anthropogenic drivers, have been detected throughout the climate system and are *extremely likely* to have been the dominant cause of the observed warming since the mid-20th century. {1.2, 1.3.1}

SYR SPM



工業化以前からの人為起源のGHGの排出は、CO₂、NH₄、N₂Oの大気中濃度の大幅な増加を引き起こした
(IPCC AR5 SYR SPM, p.SPM-5, 3-4行目)



half of the anthropogenic CO₂ emissions between 1750 and 2011 have occurred in the last 40 years (high confidence)』
(IPCC AR5 SYR SPM, p.SPM-5, 8-9行目)

※図中の矢印は原図に追加したもの

図. 世界平均GHG濃度の変化(上)、世界の人為起源CO₂排出量（化石燃料、セメント、フレアリング及び林業と他の土地利用）の変化(左下)、累積CO₂排出量（右下）
出典: 図, IPCC AR5 SYR SPM Fig. SPM.1(c),(d)



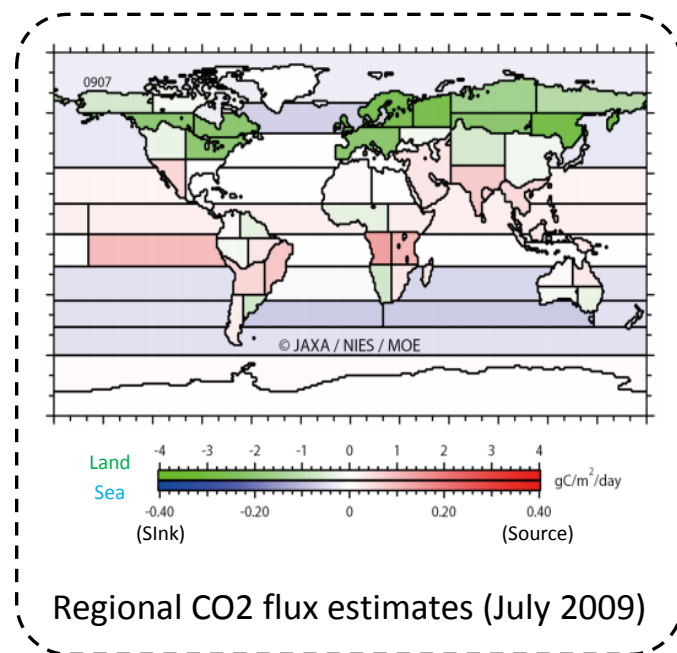
GOSAT and GOSAT-2



GOSAT (Jan. 2009 -)

GOSAT-2 (FY2017 -)

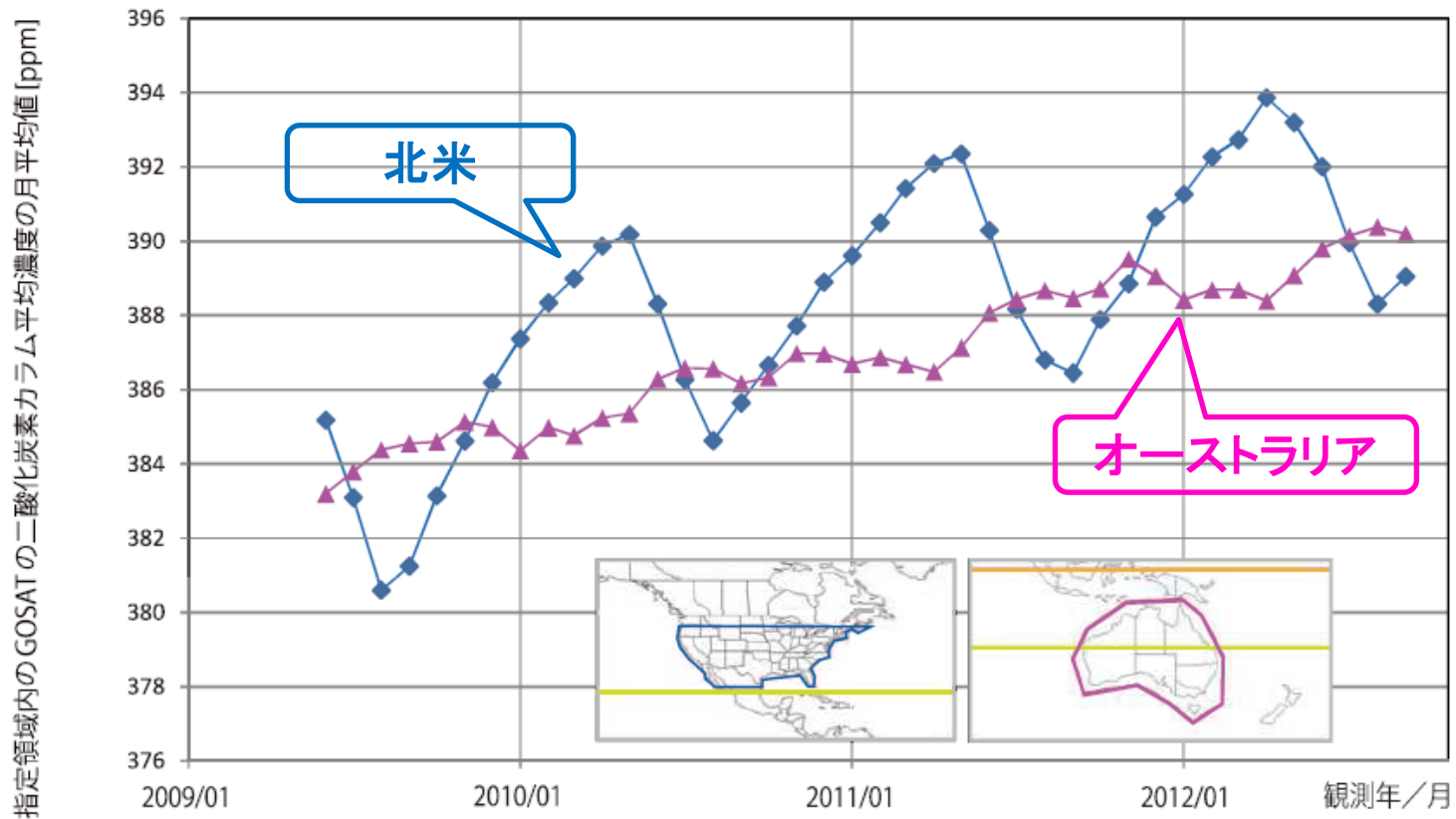
- GOSAT (Greenhouse Gases Observing Satellite) is a Japanese earth observation satellite, launched in January 2009, dedicated to greenhouse gases measurement from space.
- GOSAT is a joint effort by Ministry of the Environment, Japan Aerospace Exploration Agency (JAXA) and National Institute for Environmental Studies (NIES).
- GOSAT is successful in observing concentration and flux of greenhouse gases (CO₂ and methane) for more than 5 years, and provides the latest scientific knowledge which is beneficial for the climate change policy in the world.
- GOSAT contributes to the climate change science. GOSAT related research was quoted in IPCC report, made presentation in side-event at COP, and GOSAT data is delivered all over the world.
- The successor of GOSAT, GOSAT-2, will be launched in FY 2017.
- GOSAT-2 will aim to observe greenhouse gas concentration in more detail. It will also observe atmospheric concentration of CO, which could estimate contribution of anthropogenic CO₂ and black carbon, which is a major air pollutant in the global scale.



Regional CO₂ flux estimates (July 2009)

GOSATが捉えた年々変動

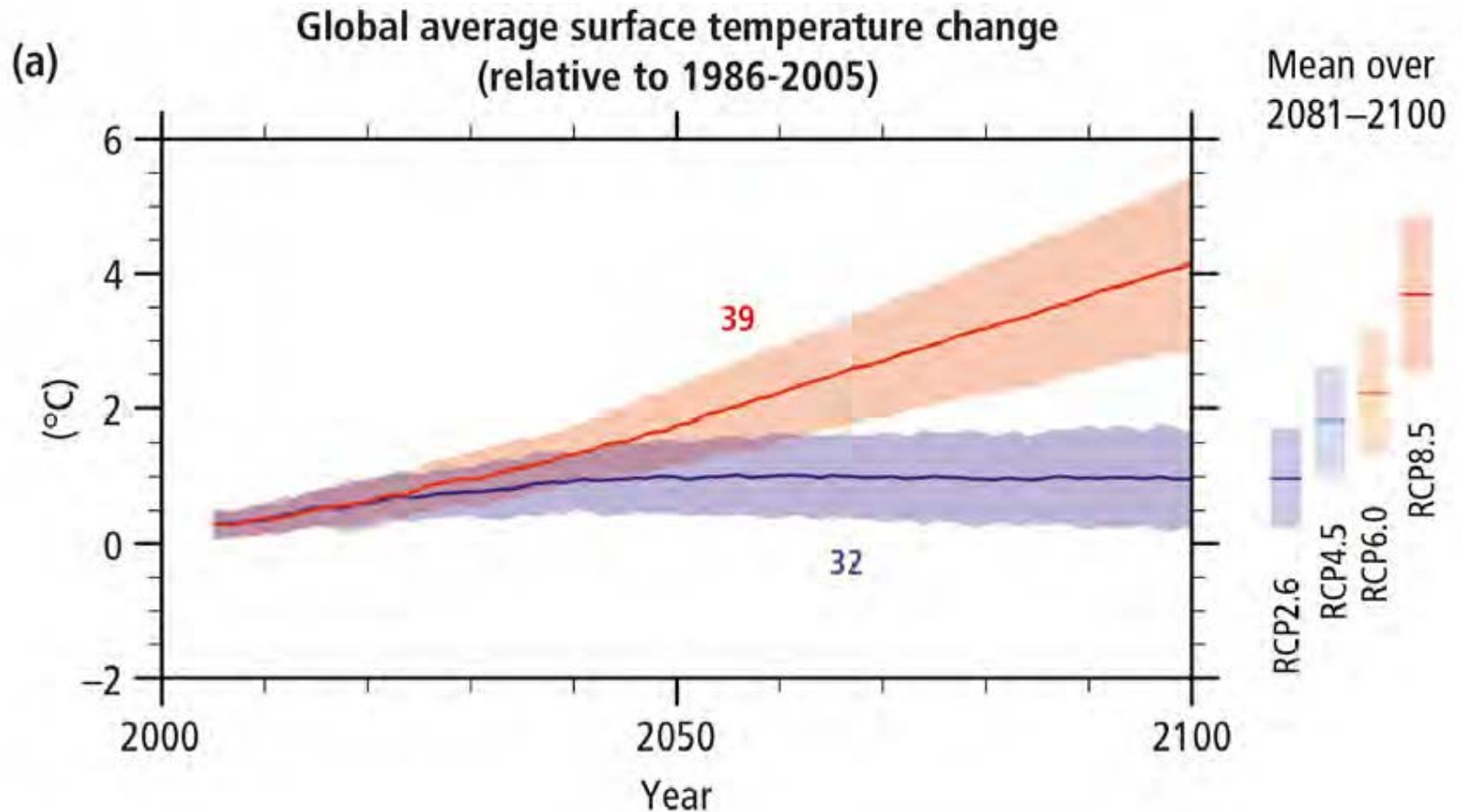
GOSAT現行機は平成21年1月に打ち上げられた。3年以上に渡るデータの蓄積により、二酸化炭素やメタンの平均濃度分布の季節変動や年々変動を全球的または地域的に捉えることが可能になった。



図：北米とオーストラリアの各地域における二酸化炭素カラム平均濃度の月平均値とその推移 (■：北米、▲：オーストラリア、グラフは領域別の各月平均値を直線で連結したもの)

2.2 Projected changes in the climate system

Surface temperature is projected to rise over the 21st century under all assessed emission scenarios. It is *very likely* that heat waves will occur more often and last longer, and that extreme precipitation events will become more intense and frequent in many regions. The ocean will continue to warm and acidify, and global mean sea level to rise. {2.2}



出典：図，IPCC AR5 SYR SPM Fig. SPM.6

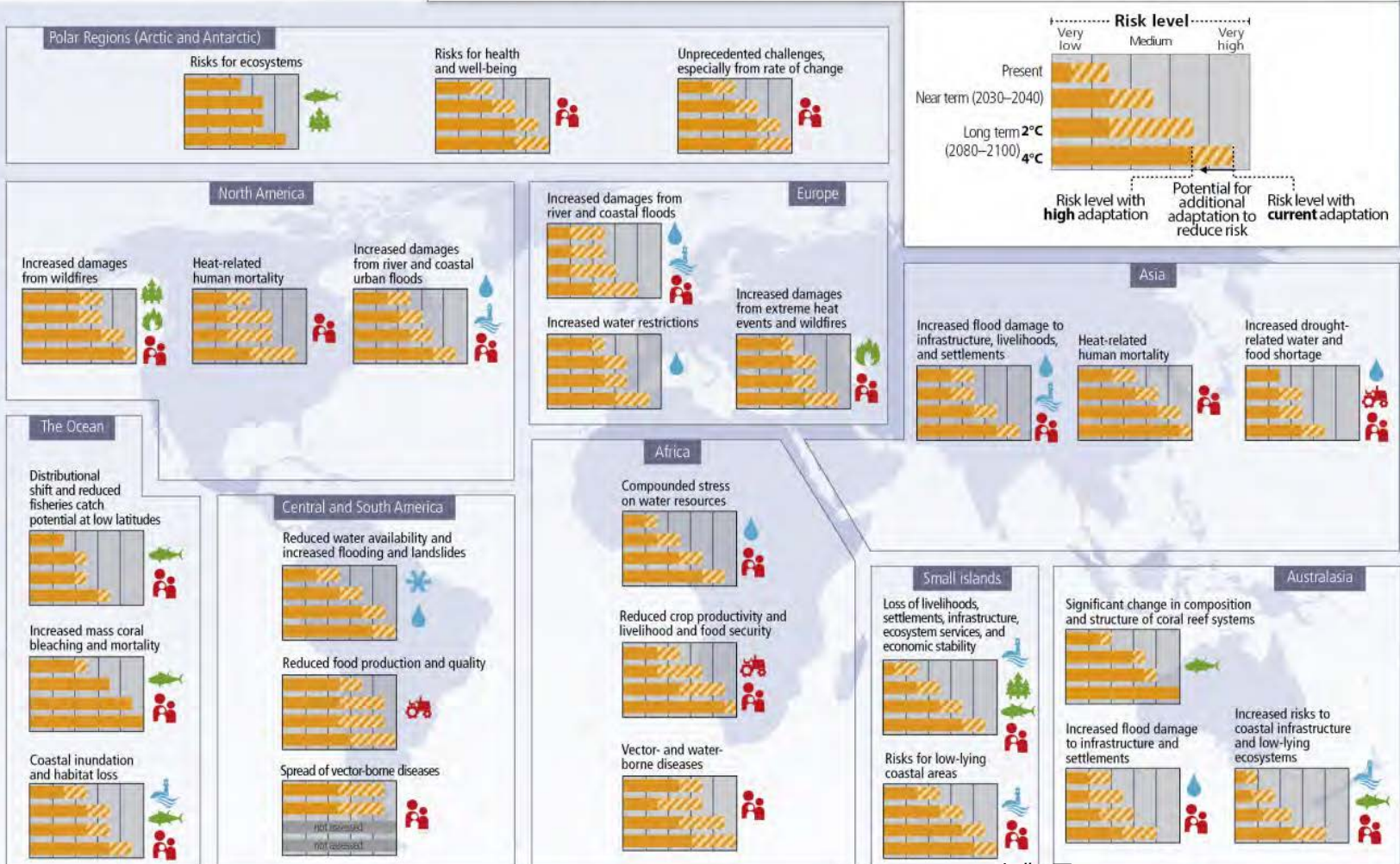
2.3 Future risks and impacts caused by a changing climate

Climate change will amplify existing risks and create new risks for natural and human systems. Risks are unevenly distributed and are generally greater for disadvantaged people and communities in countries at all levels of development. {2.3}

Regional key risks and potential for risk reduction

Representative key risks for each region for

Glaciers, snow, ice, and/or permafrost
Rivers, lakes, floods, and/or drought
Coastal erosion and/or sea level effects
Terrestrial ecosystems
Wildfire
Marine ecosystems
Food production
Livelihoods, health, and/or economics

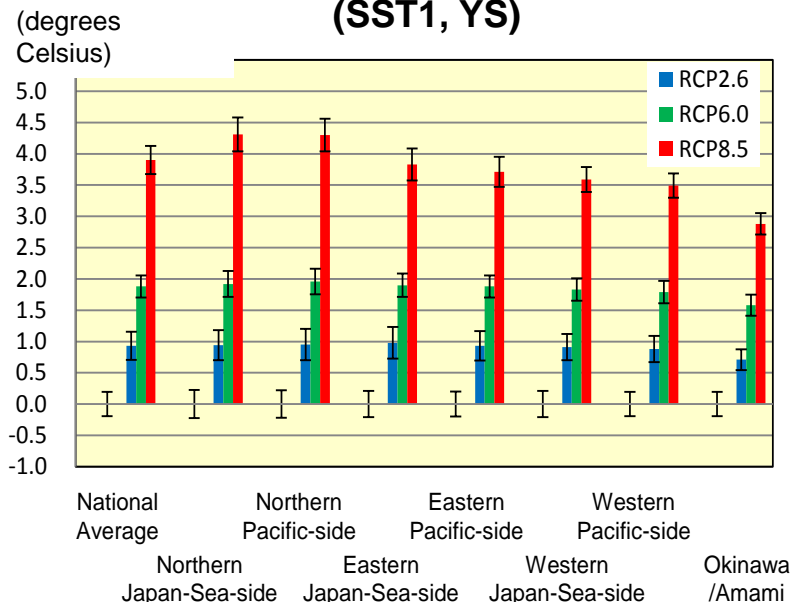


Climate Change and Impact Assessment in Japan

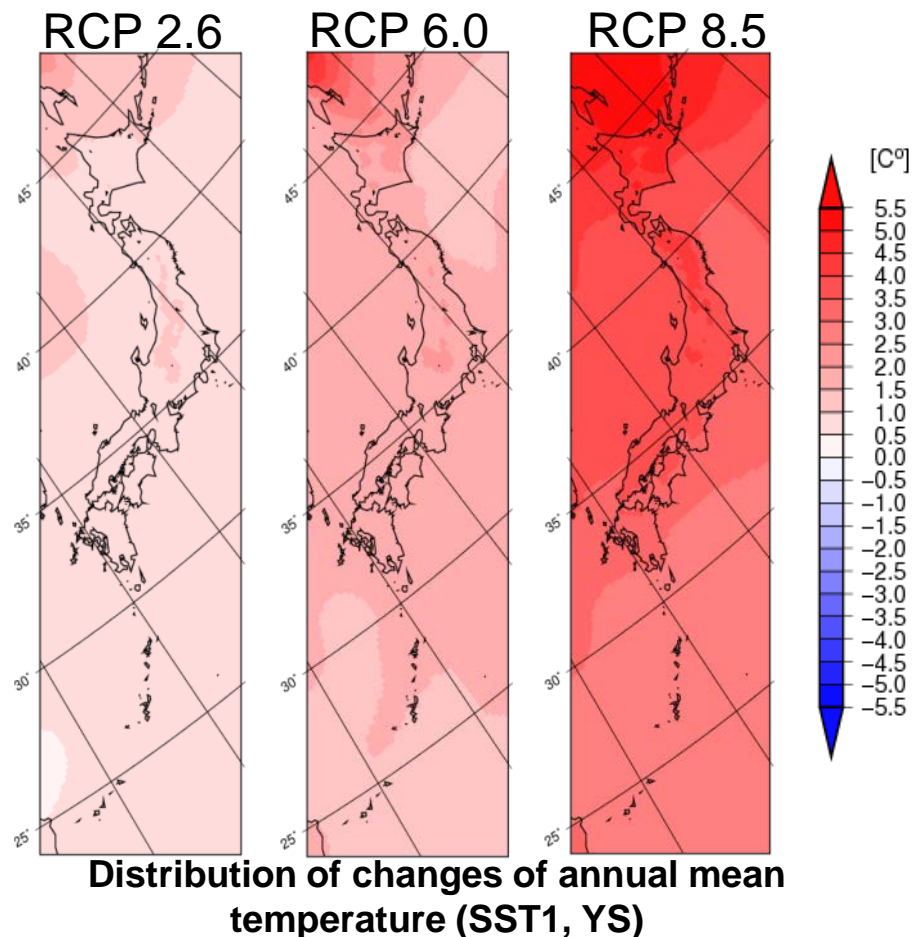
Climate Change Projection

- Projection of annual mean temperature with RCM (20km x 20km)
It is likely that annual mean temperature will increase towards the end of 21st century, in particular, in northern regions.

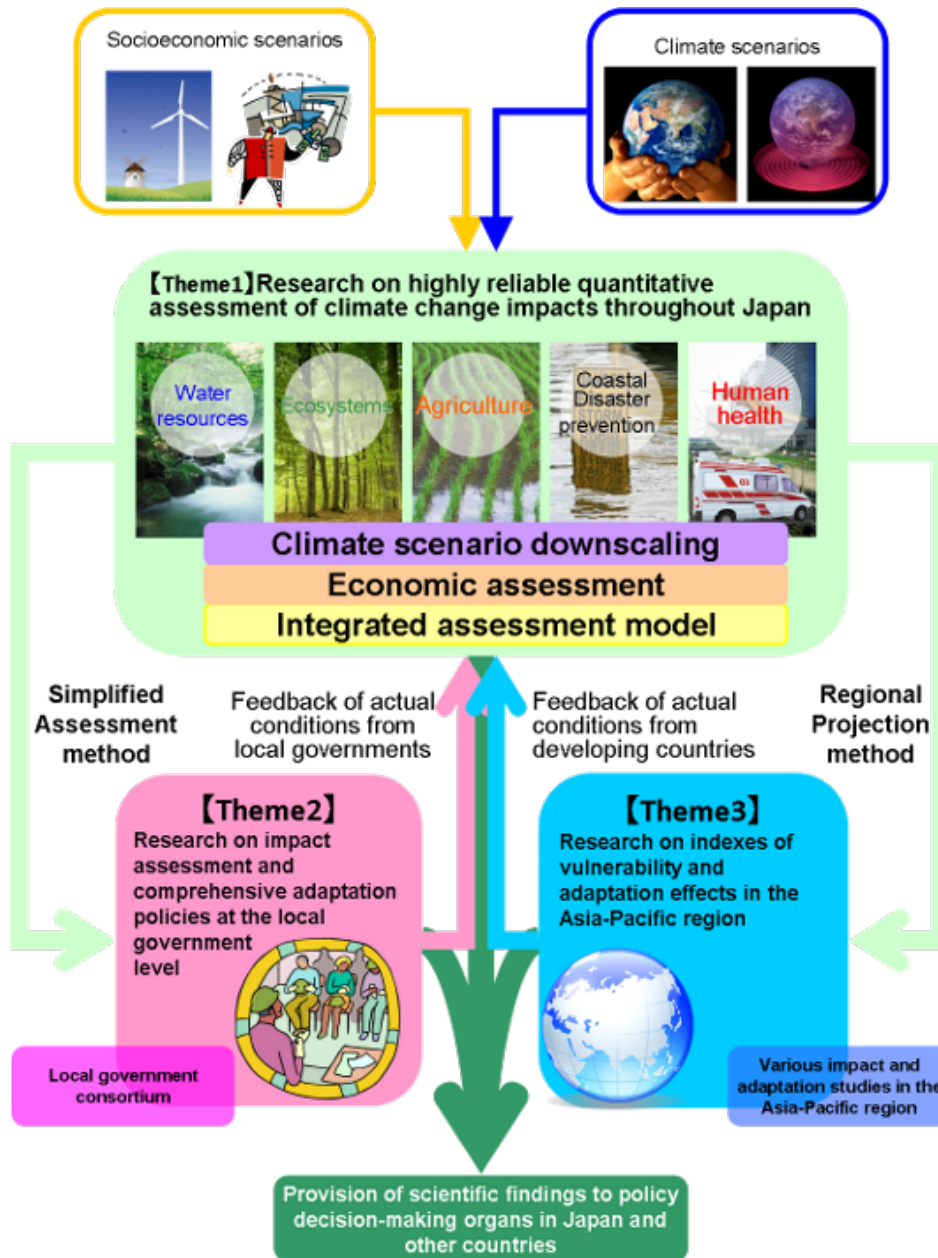
Changes of annual mean temperature (SST1, YS)



Column : Changes from present climate (Blue: RCP2.6, Green: RCP6.0, Red: RCP8.5)
 Error Bar : Standard deviation of interannual variation (Error bar with no column: SD of present climate)



Comprehensive Research on Climate Change Impact Assessment and Adaptation Policies (2010-14)



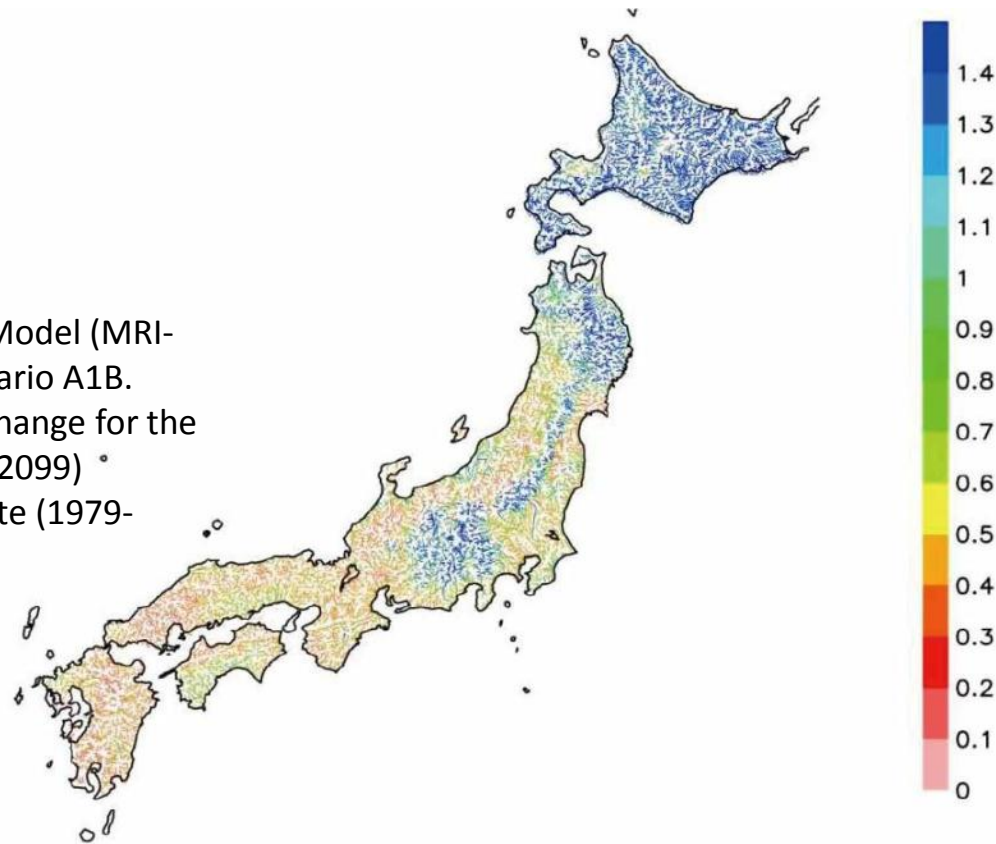
Project overview

- (1) Title: Comprehensive research on climate change impact assessment and adaptation policies (S-8 Global Warming Impact and Adaptation Research Project Team)
- (2) Research period: Initial period: 2010-2013 Latter period: 2014-2015
- (3) Project leader: Prof. Nobuo MIMURA, Ibaraki University
- (4) Participating institutions: 93 researchers from 28 institutions, including Ibaraki University and the National Institute for Environmental Studies
- (5) Project budget: 350 million yen

Climate Change Impacts (1) Water resources

- Increase Risk of Drought
- Due to climate change, some regions are expected to see an increase in the number of days without rain as well as increased occurrences of drought due to decreased snowfall.

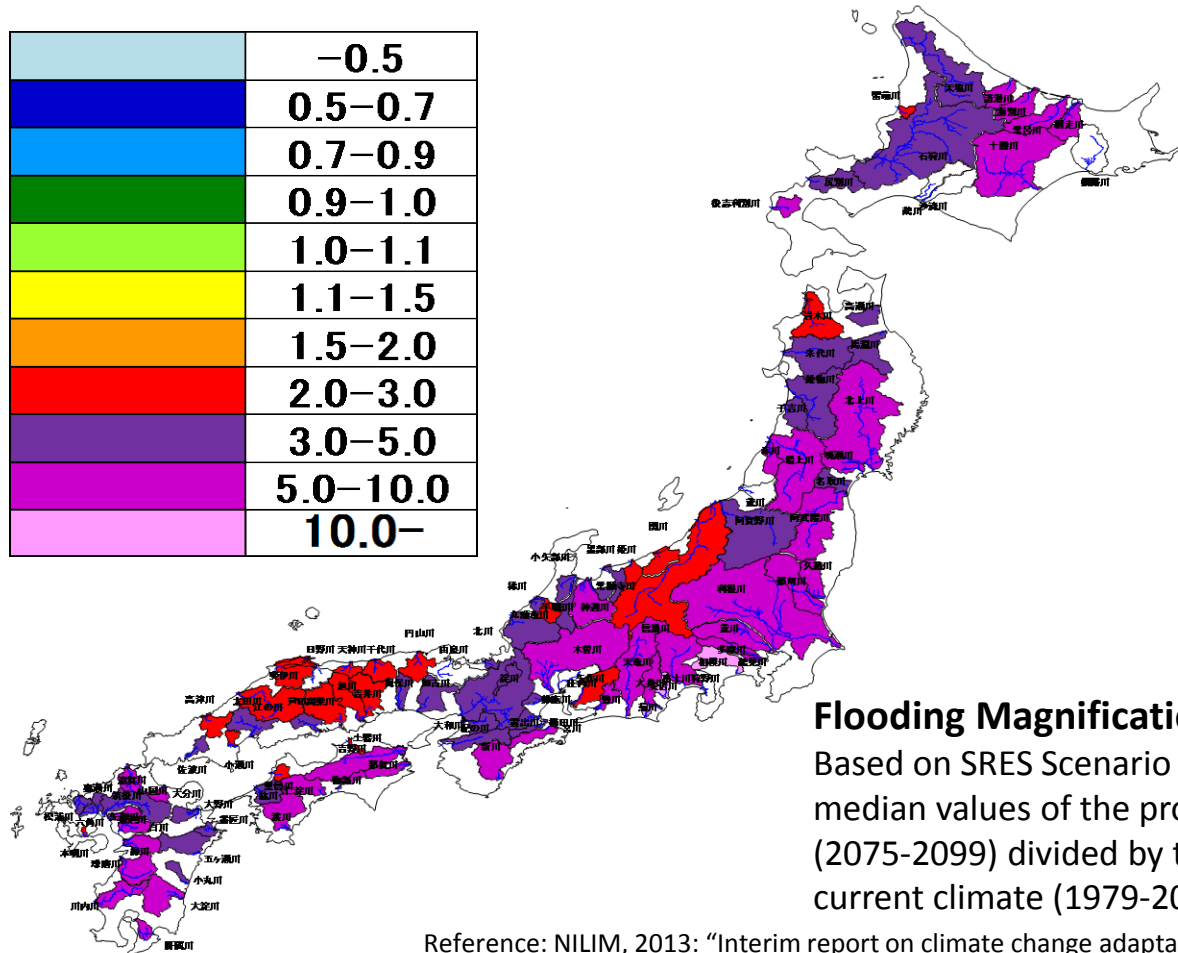
Based on MRI Global Climate Model (MRI-AGCM 20km) under SRES Scenario A1B. The figure shows the ratio of change for the end of the 21st century (2075-2099) compared to the current climate (1979-2003).



10-year return period Drought-time change (End of the 21st Century)

Climate Change Impacts (2) Heavy Rain Disaster

- Increasing Risk of Heavy-Rain Induced Disasters.
- One study of class A rivers throughout the country predicts the probability of floods exceeding the rivers' prescribed target flood safety level to be 1.8 to 4.4 times the current value.

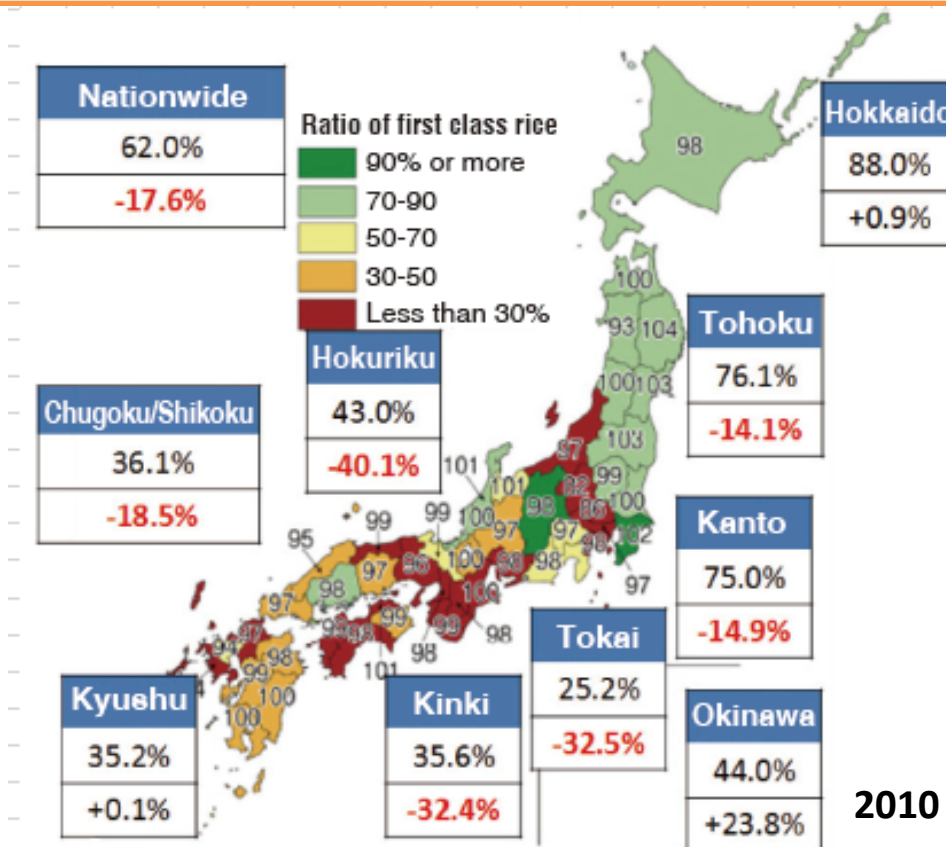


Flooding Magnification Factors by River Basin

Based on SRES Scenario A1B. Magnification factors are median values of the probability of floods in future climates (2075-2099) divided by the probability of floods in the current climate (1979-2003).

Climate Change Impacts (5) Agriculture

- Wet Rice Yields will Increase, but Quality will Decline
- In a rice cultivation experiment conducted with CO2 levels set at 200ppm higher than current levels, rice yields increased, but a large ratio of white immature kernels were produced. This marked the first time that elevated CO2 levels were shown to exacerbate high temperature damage.



The map shows prefectural harvest condition indicators (numbers in each prefecture) and ratios of first class rice (colors of each prefecture). The figures in boxes for each region indicate the first grade rice ratios in 2010 (top line) and the deviation from the annual average for the past five years (bottom line). Created based on Ministry of Agriculture, Forestry and Fisheries materials.

2010 Wet Rice Harvest Conditions and Quality

Adaptation to Climate Change in Japan

4.2 Response options for adaptation

Adaptation options exist in all sectors, but their context for implementation and potential to reduce climate-related risks differs across sectors and regions. Some adaptation responses involve significant co-benefits, synergies and trade-offs. Increasing climate change will increase challenges for many adaptation options. *{IPCC AR5 SYR 4.2}*

4.4 Policy approaches for adaptation and mitigation, technology and finance

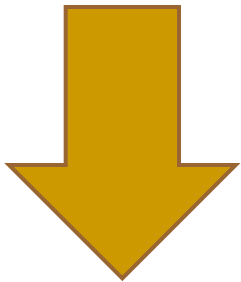
Effective adaptation and mitigation responses will depend on policies and measures across multiple scales: international, regional, national and sub-national. Policies across all scales supporting technology development, diffusion and transfer, as well as finance for responses to climate change, can complement and enhance the effectiveness of policies that directly promote adaptation and mitigation. *{IPCC AR5 SYR 4.4}*

Countermeasures for adaptation to climate change

	Research Projects	Reports
1994~ 2001		Climate change impact in Japan
2008	Project for comprehensive projection of climate change impacts (2005-09)	Wise adaptation to climate change
2009		Synthesis Report on Observations, Projections, and Impact Assessments of Climate Change “Climate Change and Its Impacts in Japan ”
2010	Comprehensive Research on Climate Change Impact Assessment and Adaptation Policies (2010-14)	Approaches to climate change adaptation
2011		Statistic report and portal site for climate change impact
2013		Consolidated Report on Observations, Projections and Impact Assessments of Climate Change “Climate Change and Its Impacts in Japan” FY2012

Process of NAP formulation in Japan

MOEJ established “Expert Committee on Climate Change Impact Assessment” at 114th Global Environmental Subcommittee, Central Environmental Council (2 July, 2013)



- Inter-Ministry coordination
 - MOEJ, MLIT, MAFF, JMA, MEXT, MHLW, METI, etc.
- To conduct impacts and vulnerability assessment in a wide range of sectors
- To identify prioritized areas to take actions for adaptation

To complete climate change impact assessment (around Feb, 2015)



GOJ will decide to formulate the National Adaptation Plan (summer, 2015)

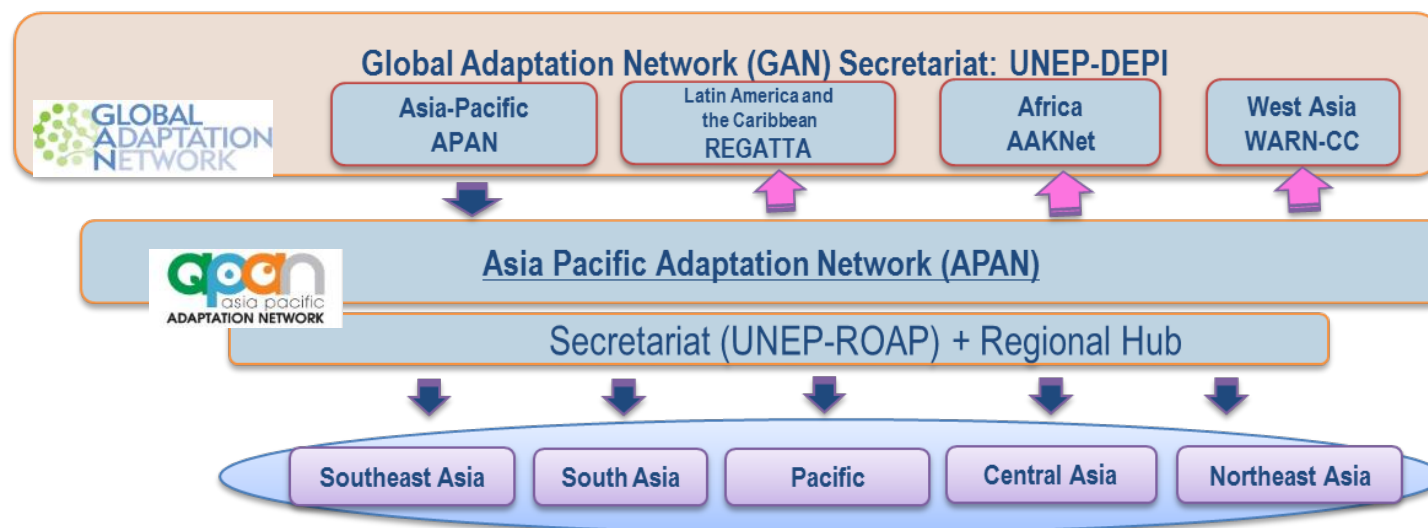
Knowledge sharing networks for strengthening adaptive capacity

[GAN: Global Adaptation Network]

- A global network for adaptation proposed by UNEP.
- Supports to make vulnerable communities, ecosystems and economies more resilient against climate change, through knowledge sharing on adaptation.
- Japanese Minister of the Environment assumed Honorary Co-Chair of GAN at the official launch at COP19 in Nov. 2013.

[APAN: Asia-Pacific Adaptation Network]

- Established in 2009, ahead of the rest of the world.
- Supports adaptation actions in developing countries, through sharing information and knowledge on adaptation within the region.
- Since its foundation, Japan has supported information sharing on the web, capacity-building training in developing countries and dialogue between scientists and policy-makers.



Asia-Pacific Network for Global Change Research

- Inter-governmental Network of 22 member countries
- Funding Agency for Global Change Research
- Established in 1996, Hyogo Prefecture hosted the Permanent Secretariat since 1999
- financial contribution support by Japan, USA, Republic of Korea and New Zealand



Australia



Bangladesh



Bhutan



Cambodia



China



Fiji



India



Indonesia



Japan



Lao DPR



Malaysia



Mongolia



Nepal



New Zealand



Pakistan



Philippines



Republic of Korea



Russian Federation



Sri Lanka



Thailand



USA



Viet Nam



Japan's Adaptation Initiatives to Support Adaptation Action

- Climate change has caused impacts on natural and human systems on all continents and across the oceans. There are risks resulting from sea level rise, storm surge in coastal areas, and inland flooding in urban regions.
- Japan will bring together the knowledge of the private sector, government and academia, and consistently assist developing countries' adaptation actions both in terms of their plans and implementation.

Assistance to Developing Countries in the field of Adaptation

(Approx. 2.3billion USD from Jan. 2013 to Jun. 2014)

Adaptation Policy Planning

Assist the mainstreaming of adaptation through formulation of national/local adaptation plans in developing countries vulnerable to climate change, based on Japan's experience in formulating its National Adaptation Plan to be published in the summer of 2015.

Implementing Adaptation Measures

Assist various adaptation measures against climate change risks from extreme weather events and slow onset events.

e.g.

- ✓ Water Resource/Disaster Risk Reduction
- ✓ Natural Environment/Biodiversity etc.

Vulnerabilities particular to small island states

Provide comprehensive assistance by sharing Japan's experience and knowledge and providing necessary equipments.

- Wide-area capacity development for climate change and natural disaster

Disaster Risk Reduction

Host the Third World Conference on Disaster Risk Reduction in Sendai, Japan in March 2015 and contribute to the formulation of the post-Hyogo Framework for Action (HFA2)

- Capacity development for DRR through both structural and non-structural measures
- Provision of swift assistance for recovery

Applying Japan's Technology for Adaptation Measures

- Data, technologies, and knowledge related to climate change

Human resources development of 5000* people in the field of adaptation in the next 3 years

Sharing experience and knowledge through international networks

(*as part of the pledge made by PM Abe for human resources development of 14,000 people in the next 3 years to address climate change)

Mitigation to Climate Change

4.1 Common enabling factors and constraints for adaptation and mitigation responses

Adaptation and mitigation responses are underpinned by common enabling factors. These include effective institutions and governance, innovation and investments in environmentally sound technologies and infrastructure, sustainable livelihoods, and behavioral and lifestyle choices. {4.1}

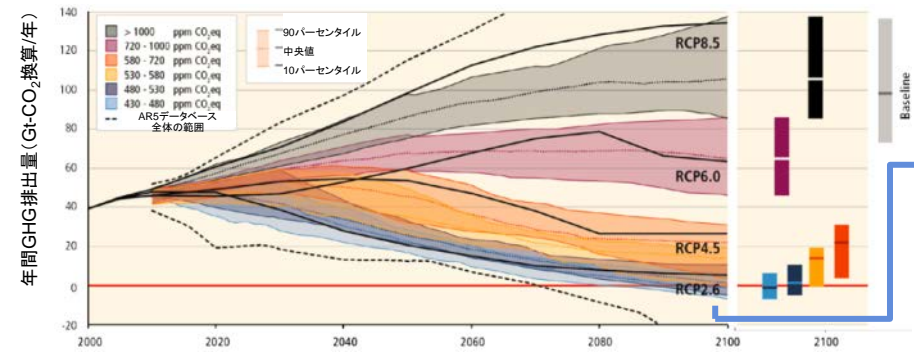
4.3 Response options for Mitigation

Mitigation options are available in every major sector. Mitigation can be more cost-effective if using an integrated approach that combines measures to reduce energy use and the GHG intensity of end-use sectors, decarbonize energy supply, reduce net emissions and enhance carbon sinks in land-based sectors. {IPCC AR5 SYR 4.3}

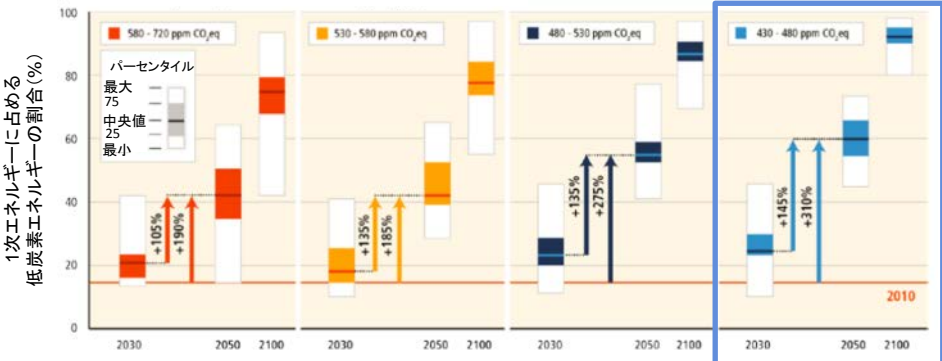
3.4 Characteristics of mitigation pathways

There are multiple mitigation pathways that are *likely* to limit warming to below 2° C relative to pre-industrial levels. These pathways would require substantial emissions reductions over the next few decades and near zero emissions of CO2 and other long-lived GHGs by the end of the century. Implementing such reductions poses substantial technological, economic, social, and institutional challenges, which increase with delays in additional mitigation and if key technologies are not available. Limiting warming to lower or higher levels involves similar challenges, but on different timescales. {3.4}

SYR SPM



2100年においてCO₂換算濃度が約450ppm以下の排出経路ならば、工業化以前と比較して、今世紀中の温暖化が2°C未満に維持される可能性が高い
(IPCC AR5 SYR SPM, p.SPM-15, 27-28行目)

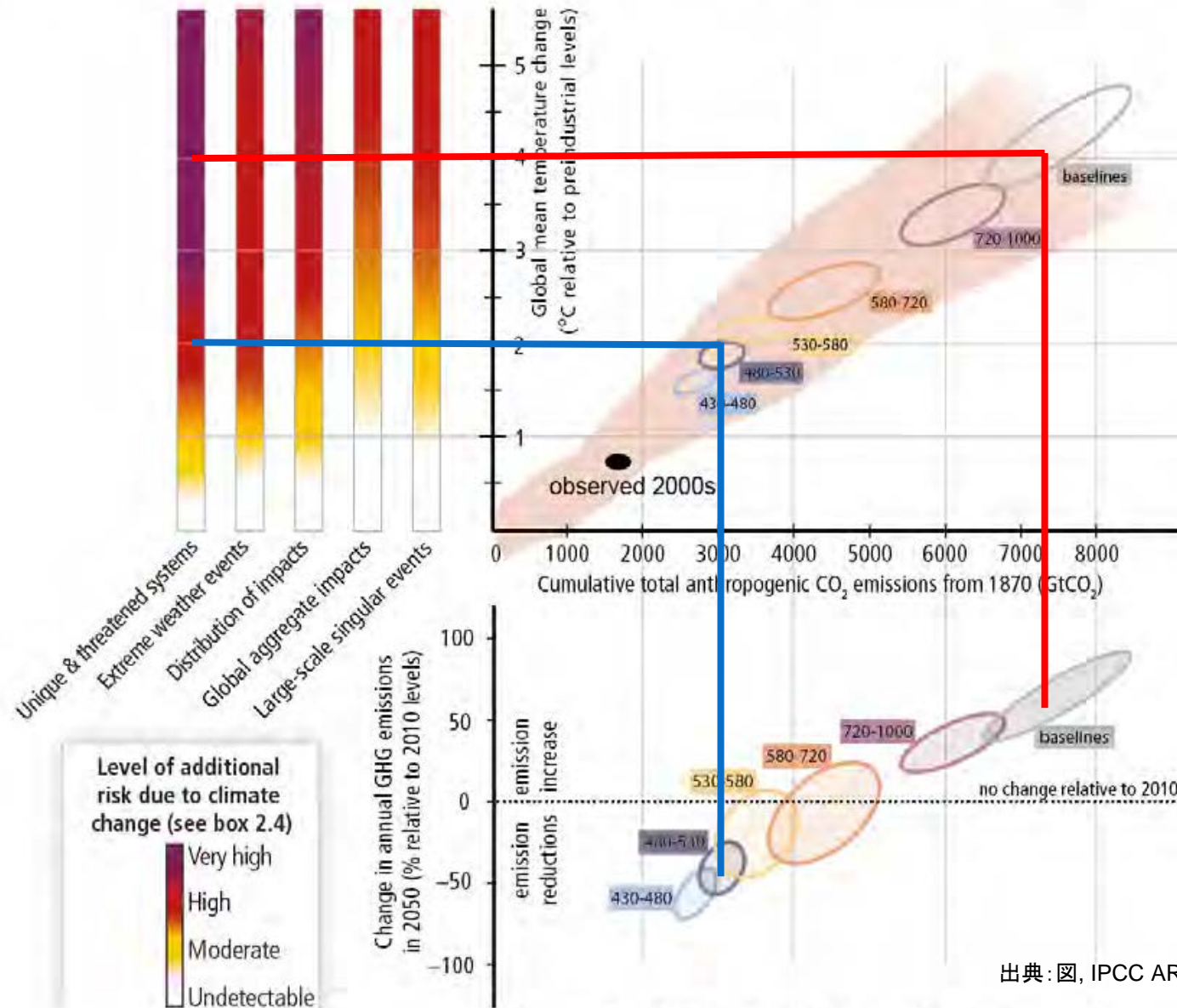


(2100年においてCO₂換算濃度を450ppm以下とするためには、低炭素エネルギーの大幅な導入などにより、)2050年までに人為起源のGHG排出量を40%~70%削減し、2100年までに排出をほぼゼロ、もしくはゼロ以下にする必要がある。
(IPCC AR5 SYR SPM, p.SPM-15, 28-30行目)

図：2000年から2100年までのAR5のシナリオ別GHG排出量経路（上）とシナリオ別低炭素エネルギーの規模の変化（下）

出典：図, IPCC AR5 SYR SPM Fig. SPM.11

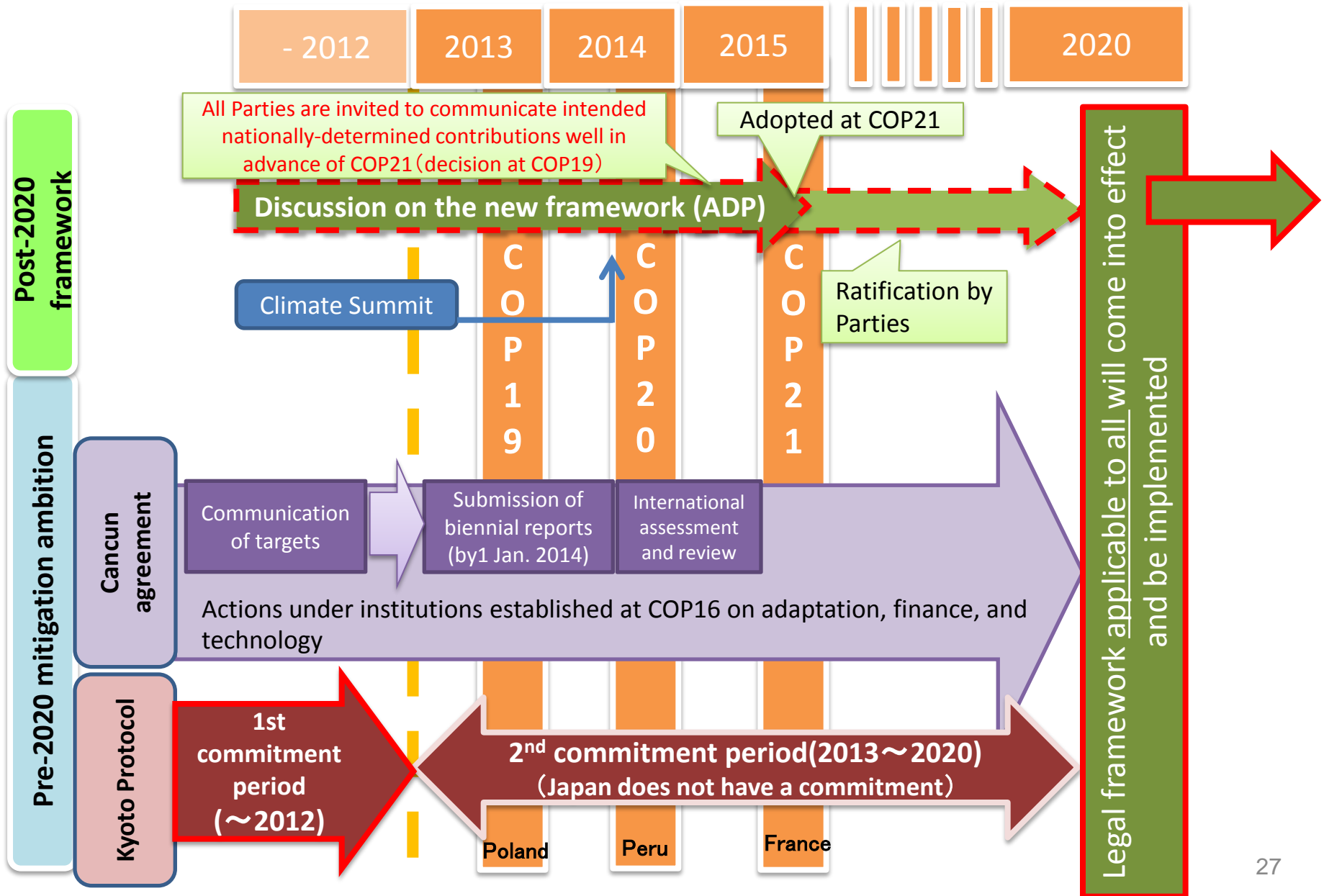
(A) Risks from climate change... (B) ...depend on cumulative CO₂ emissions...



出典：図，IPCC AR5 SYR SPM Fig. SPM.10

(C) ...which in turn depend on annual GHG emissions over the next decades

Timeline of International Negotiations



Japan's new emission reduction target in 2020

- Japan's greenhouse gas emission is set as **3.8% emission reduction in 2020 from the 2005 level** in order to implement Cancun agreement, and also based on prime minister's designation of zero-based review of 25% reduction target by COP19
- **This is a target at this point, which has not yet taken into account the emission reduction effect resulting from nuclear power**, given that the energy policy and energy mix, including the utilization of nuclear power are still under consideration
- A firm target, based on further review of the energy policy and energy mix will eventually be set.

【Principles of the new target】

The new target will be achieved by implementing the measures listed below comprehensively, while attaining the economic growth goal set by the current government

- (1) **20% improvement in energy intensity** which is at the world leading level
- (2) Improvement of emission factor of electricity by **renewable energy** etc
- (3) **Strengthening fluorocarbons countermeasures** based on amended law on fluorocarbons
- (4) Application of the "**Joint Crediting Mechanism (JCM)**"
- (5) Utilization of **carbon sink of forest**

【Actions in response to the new target】

Register the new target to United Nations Framework Convention on Climate Change Secretariat (29 Nov).
Implement mitigation measures steadily, through Biennial Report submission and International review based on Cancun agreement

**Thank you so much
for your attention!**