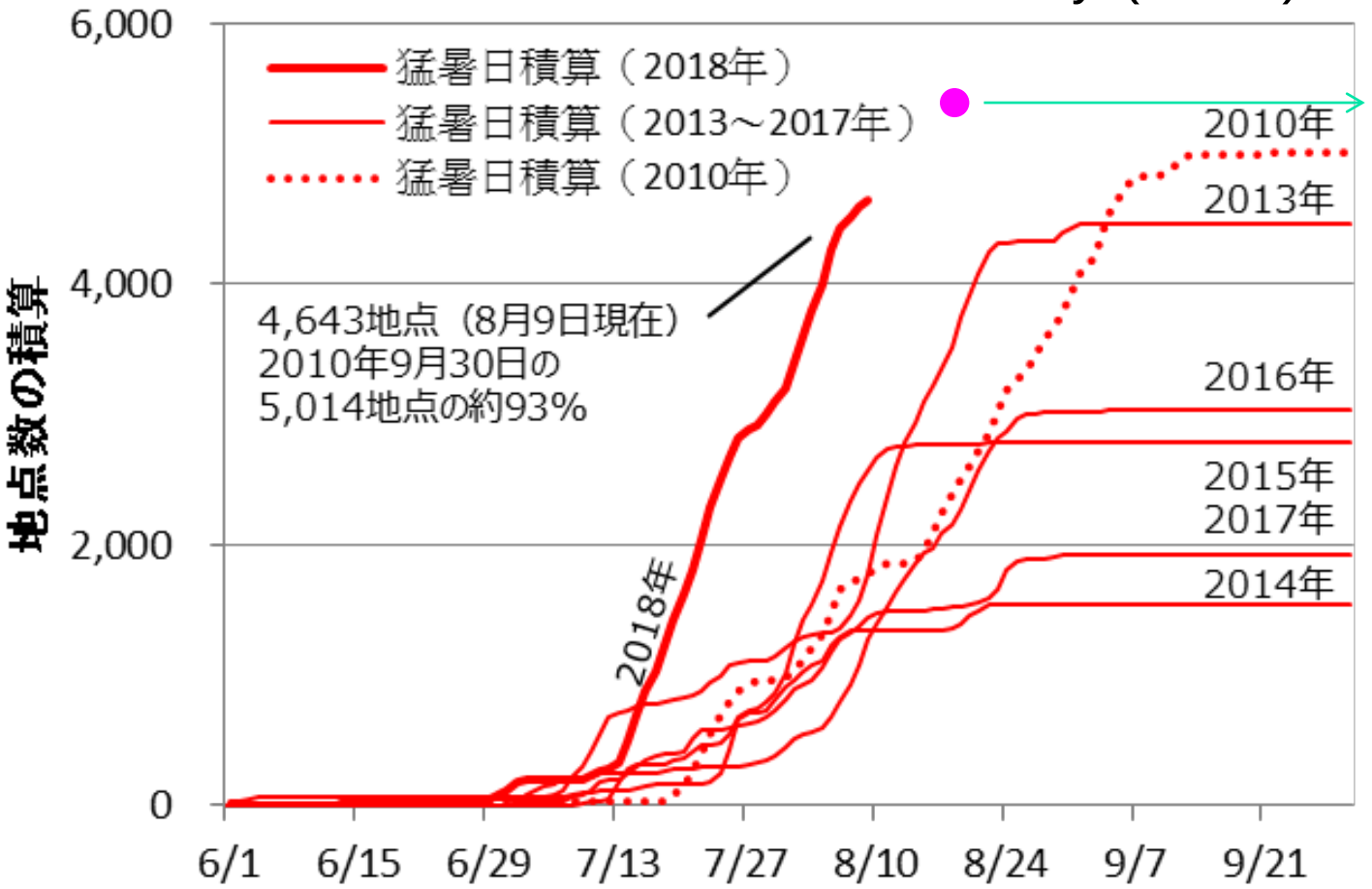
2018. 10.06 RACC10 at Kyoto

Climate Change－Now and Future

Akimasa Sumi
The University of Tokyo
（Ex-President of NIES)

This summer is “unusual hot summer” in Japan

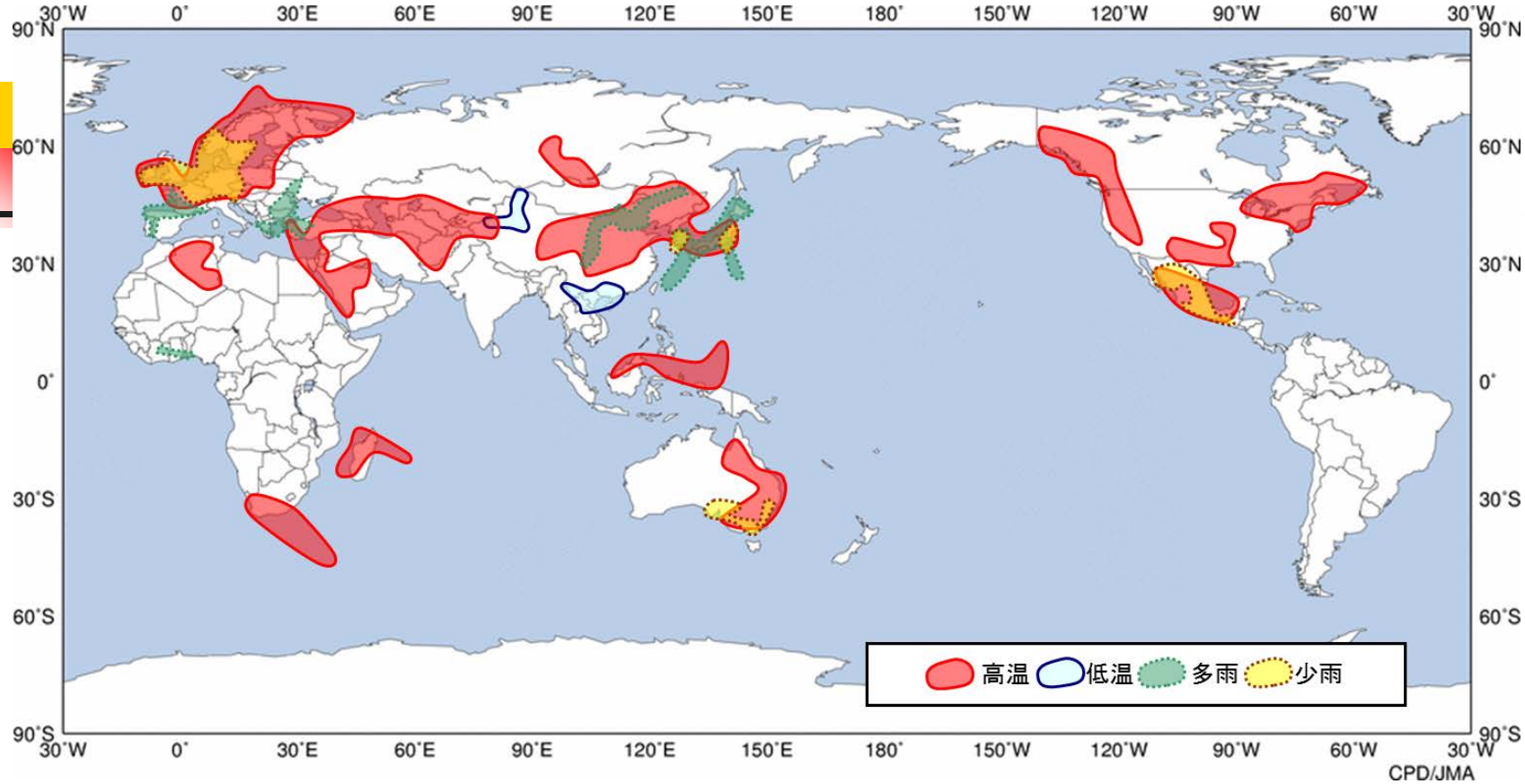
- Accumulated Extreme Hot summer days(>35C)



5469points (Aug.21) → over than 2010’s case

Severe Rainfall and Floods in the western part of Japan(July,2018)

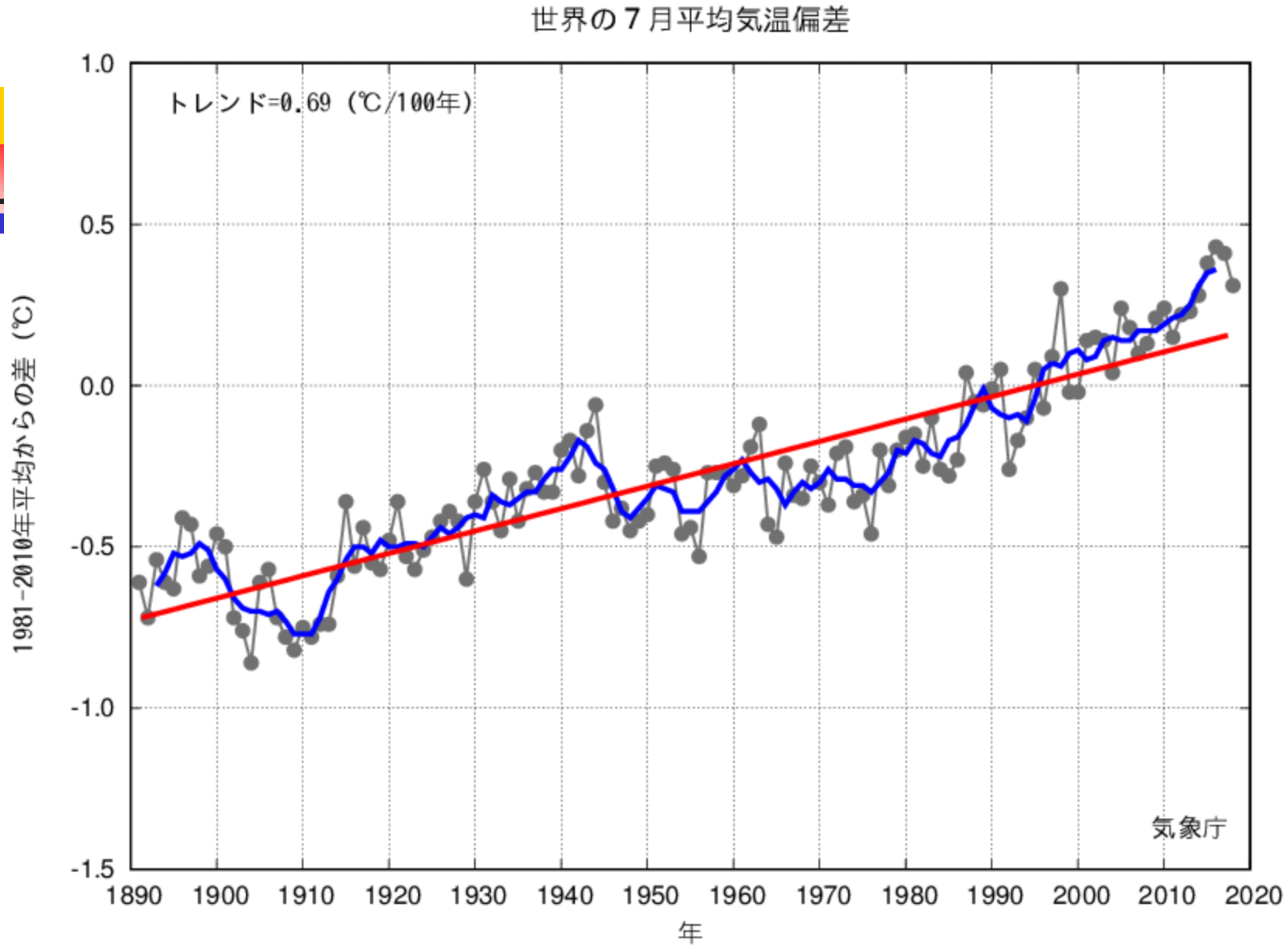
Extreme Weather worldwide(2018,July)



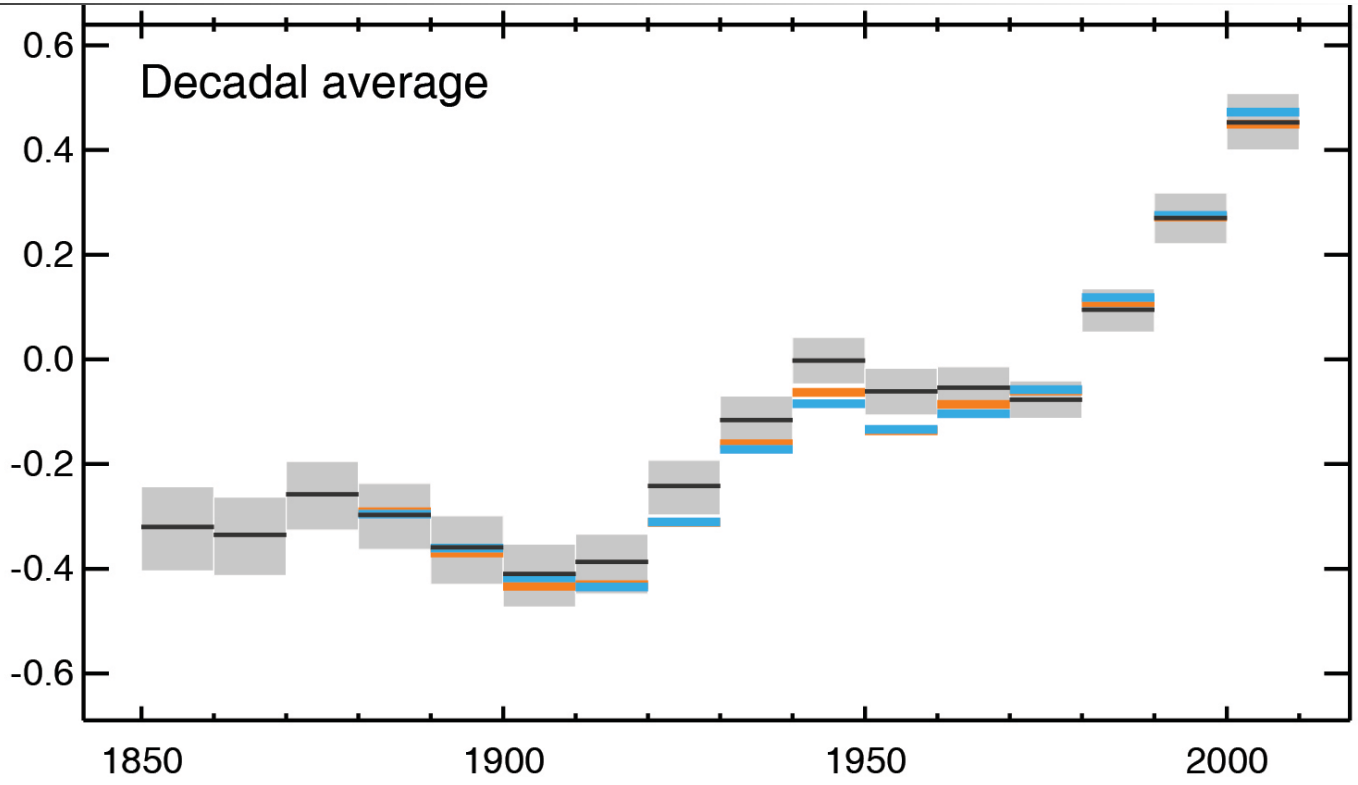
※1: https://www.data.jma.go.jp/gmd/cpd/monitor/weekly/

※2: https://public.wmo.int/en/media/news/july-sees-extreme-weather-high-impacts

Globally averaged Surface Temperature in July

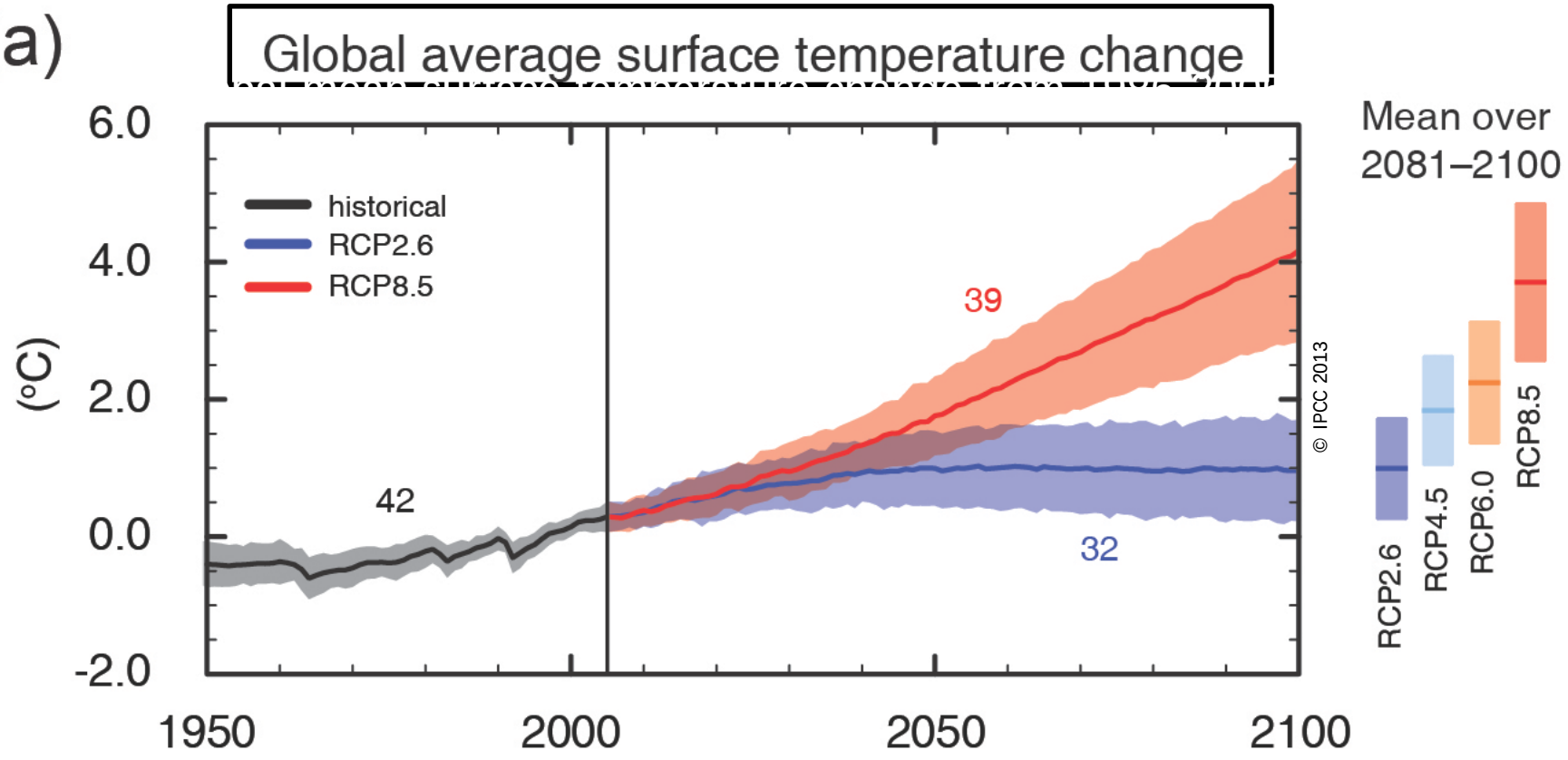


Decadal Average of Global mean Surafce Temperature



01)

IPCC AR5



Global surface temperature change for the end of the 21st century is *likely* to exceed 1.5˚ C relative to 1850−1900 for all scenarios except RCP2.6.

Are these events due to Global Warming?

- Many people has realized that climate may be changed!
- Then, are these extreme events due to global warming?
- Event Attribution Method
- Change of PDF in a warmer climate
- We are going to apply “this method” to a heavy rainfall issue.

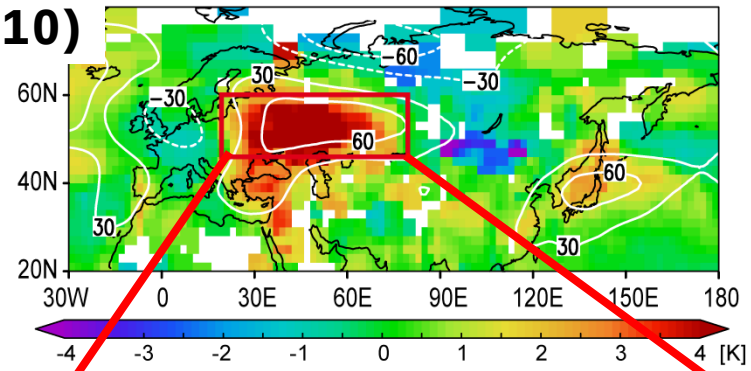
Event Attribution

- Using a Climate Model
- Simulations with global warming and without global warming
- A large number of samples in an ensemble simulation(~50)
- Estimate a PDF and its difference

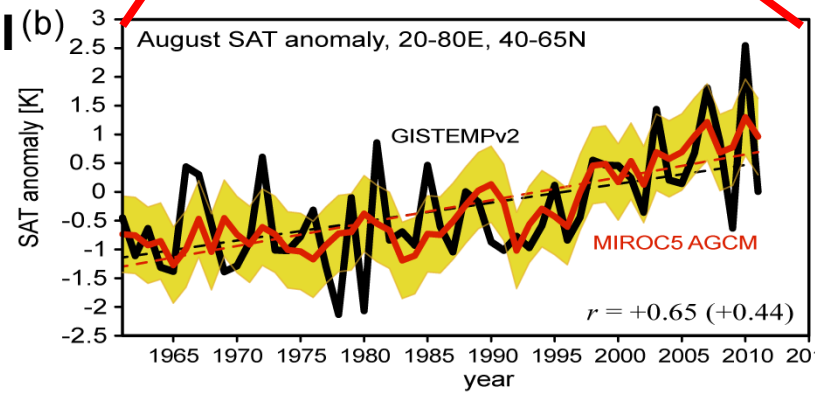
EA of Hot Summer in 2010

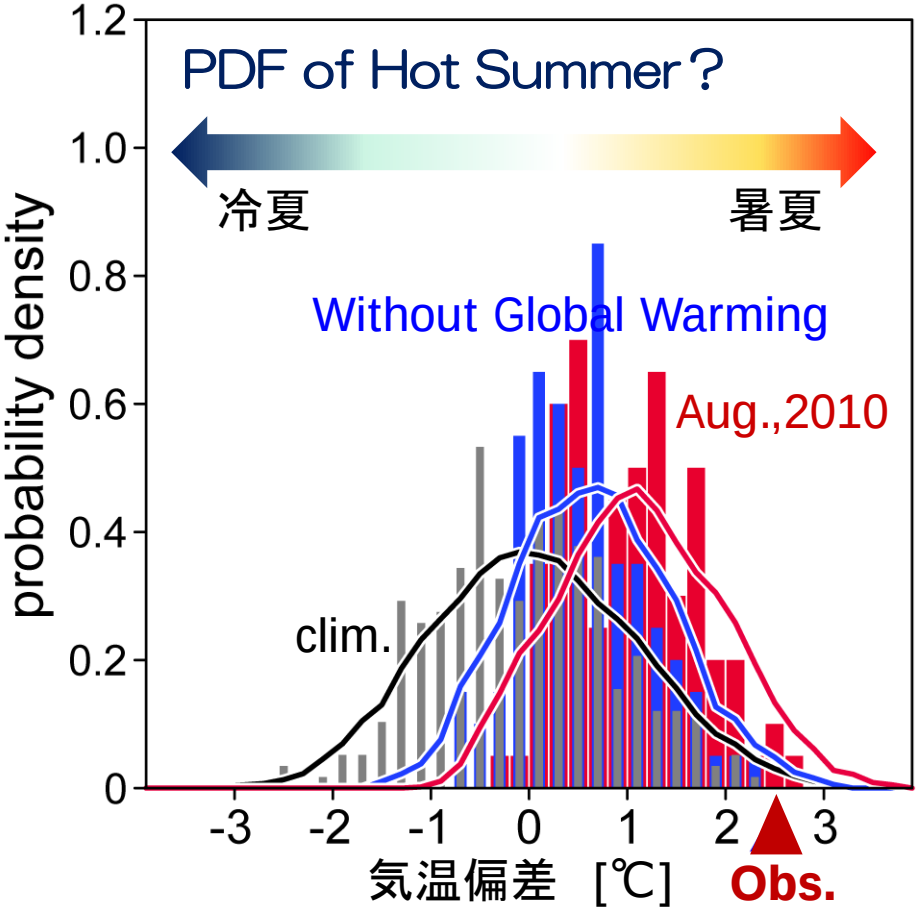
8月ロシア西部の地表気温偏差

Obs.(2010)



Model



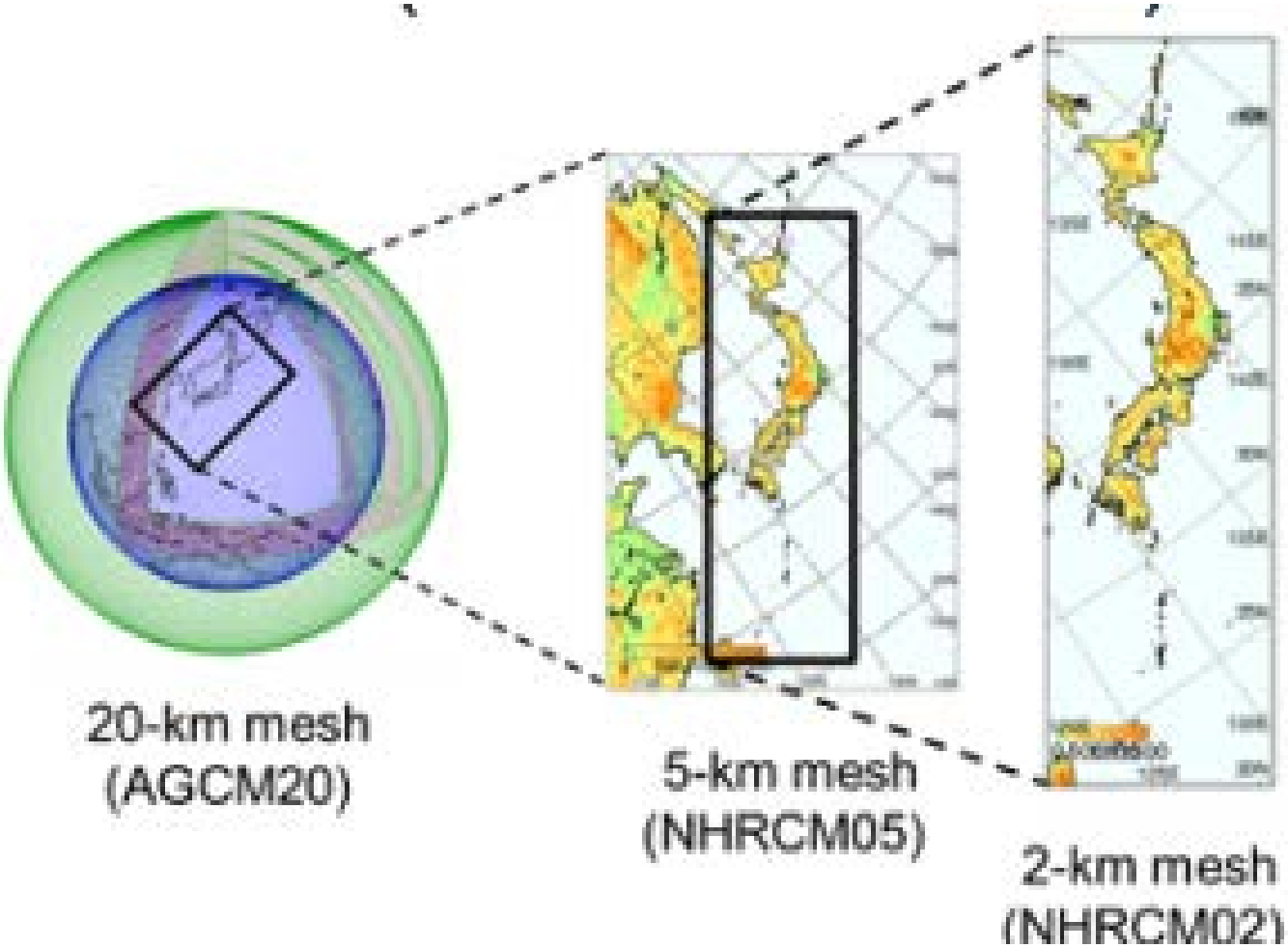


観測された猛暑は―

- ほとんどは自然の変動
- しかし、確率的には、温暖化していなければほとんど発生しなかった（発生確率　3.3% ⇒ 0.6%）

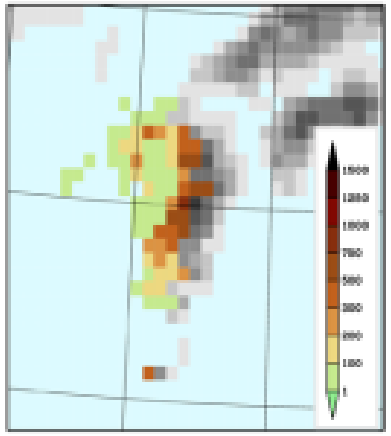
Watanabe et al. (2013a

Dynamical Downscaling（MRI）

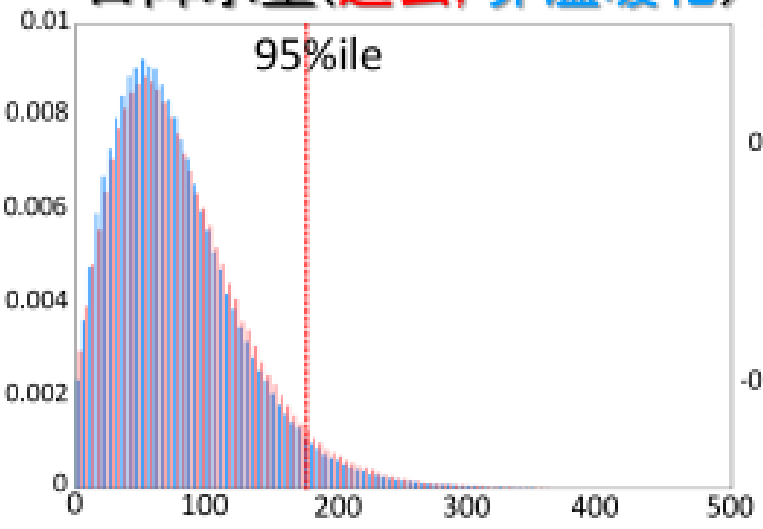


７月最大日降水量の頻度分布 1951-2010 100メンバー

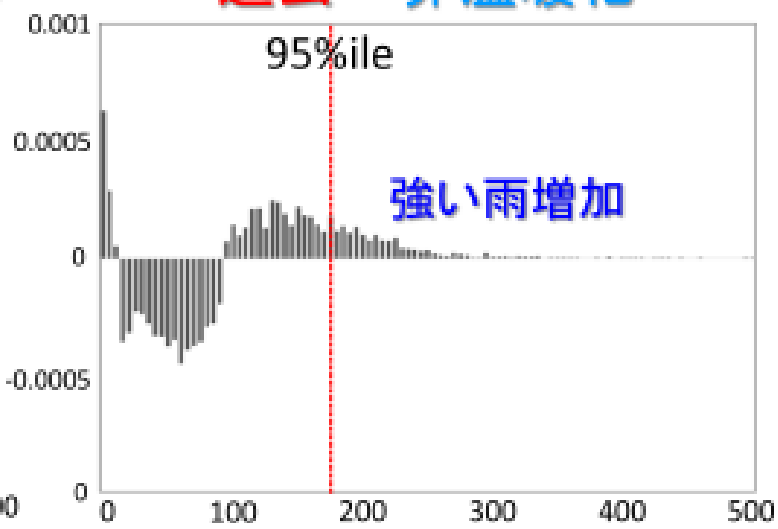
＜九州西部＞



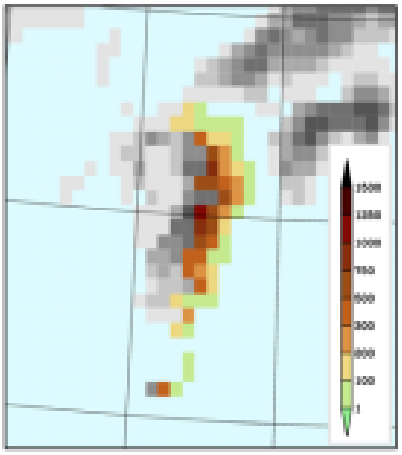
日降水量(過去, 非温暖化)



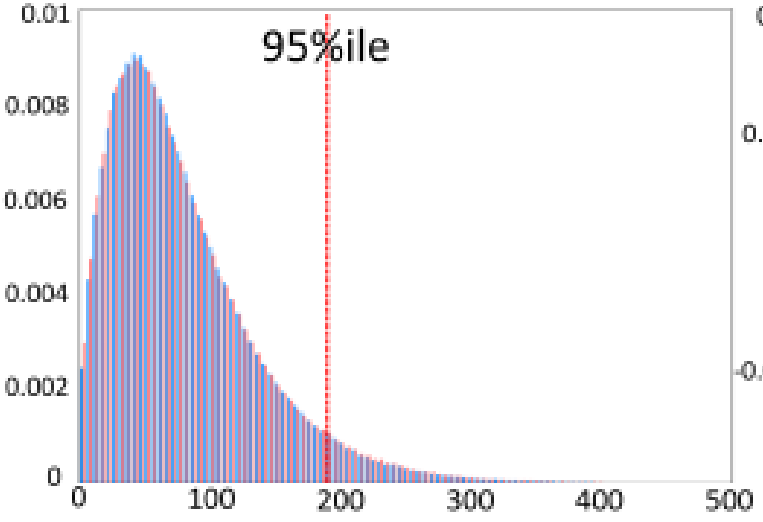
過去 － 非温暖化



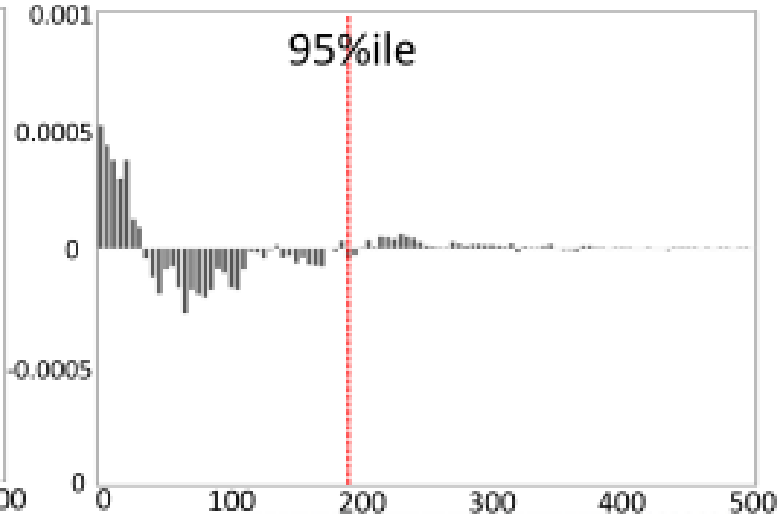
＜九州東部＞



日降水量(過去, 非温暖化)



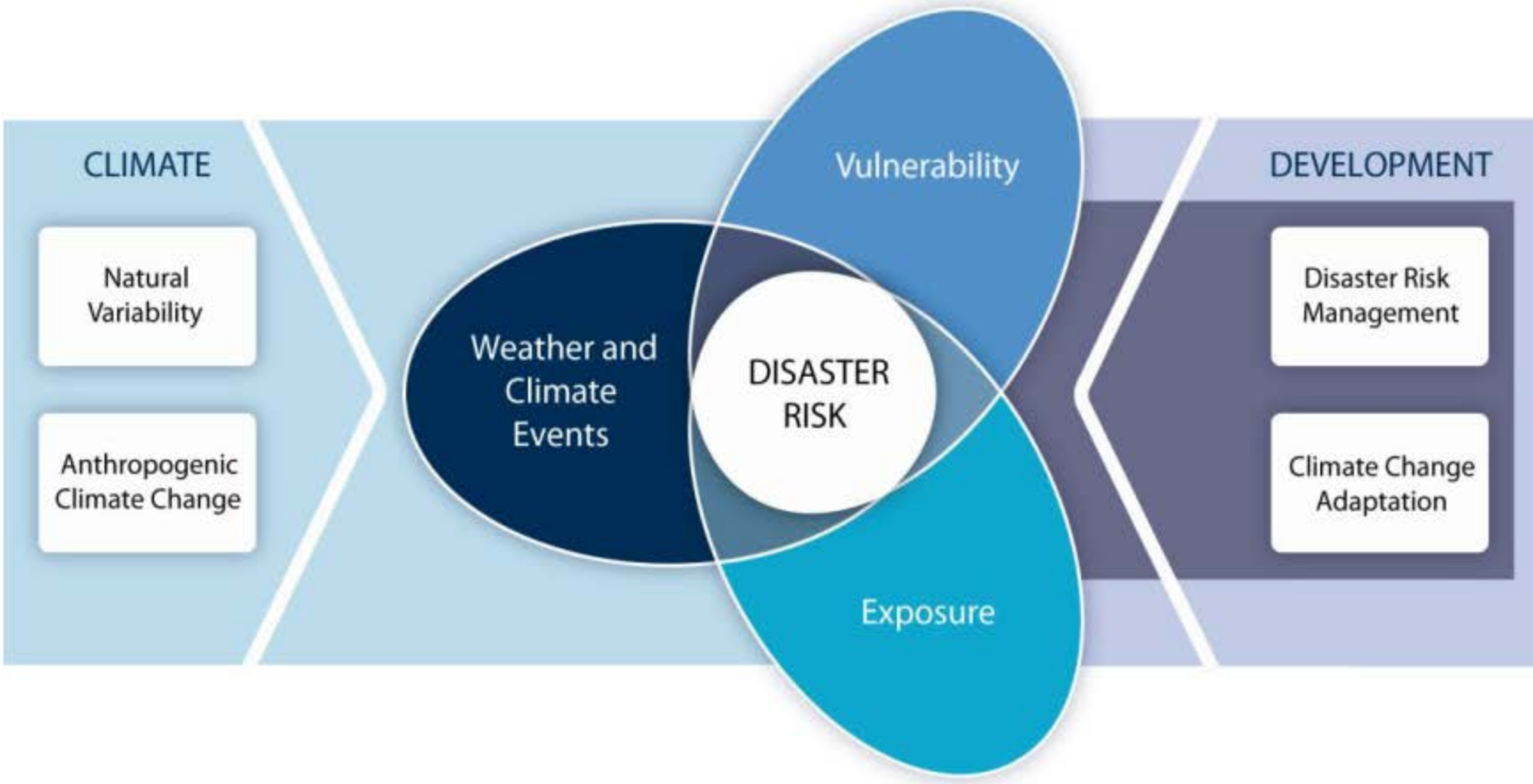
過去 － 非温暖化



We have to take actions!

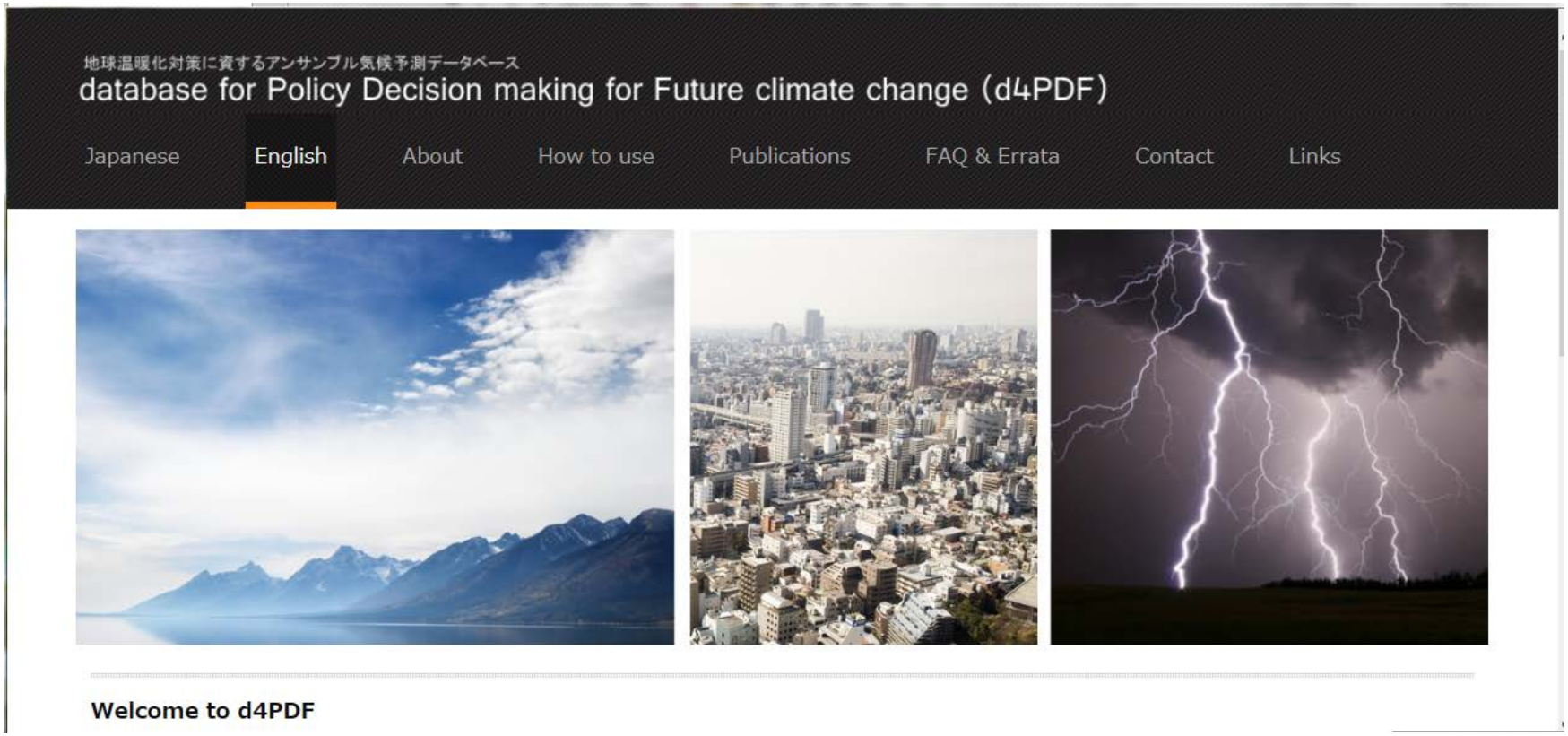
- Knowledge-Action Network(KAN) in Future Earth
- Action-related Research
- Mitigation and Adaptation
- Integration or synthesis

Increasing vulnerability, exposure, or severity and frequency of climate events increases disaster risk



Risk Information and Risk Management

- D4PDF

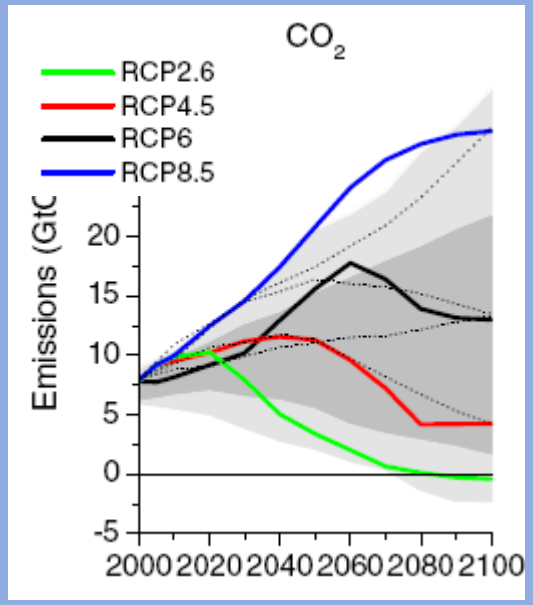


D4PDF(continued)

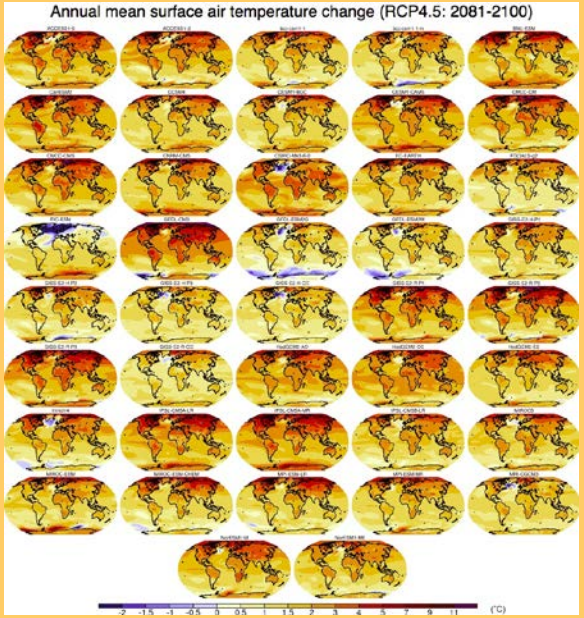
- 100 samples in a warmer climate(4xCO_2 climate)
- Internal variability is included
- 60km AGCM(MRI-GCM)
- 6 SSTs x 15 perturbation x 60 years
- 1951-2010 without warming
- RCP8.5 SST in 2090

A large Number of Ensembles

Emission Scenarios

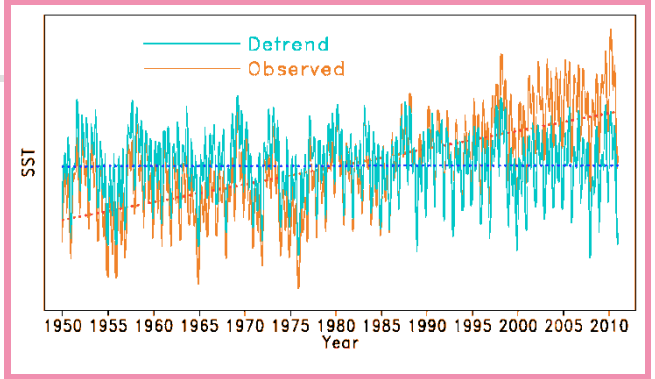


Climate Models



(IPCC AR5)

Internal Variability



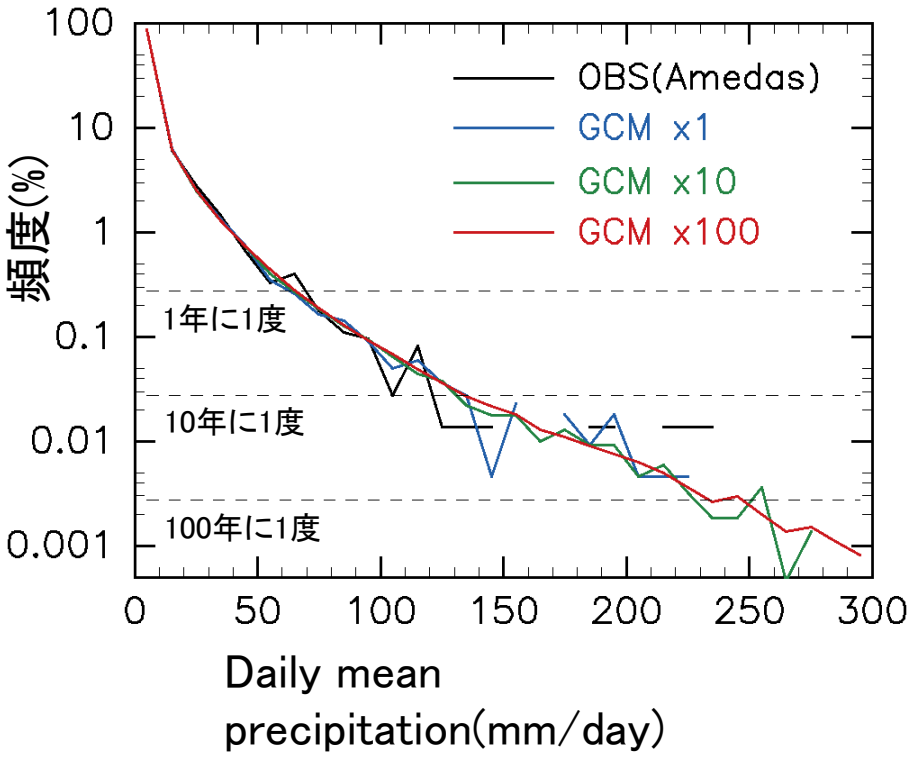
発生頻度の低い異常天候や極端気象の変化の不確実性を十分に評価できていない。

Global, Large-scale: CMIP5実験
Extremes, Regional-scale: 60kmモデル実験
(創生プロC実験 + 環境省・気象庁 気候変動予測データ)でカバー。

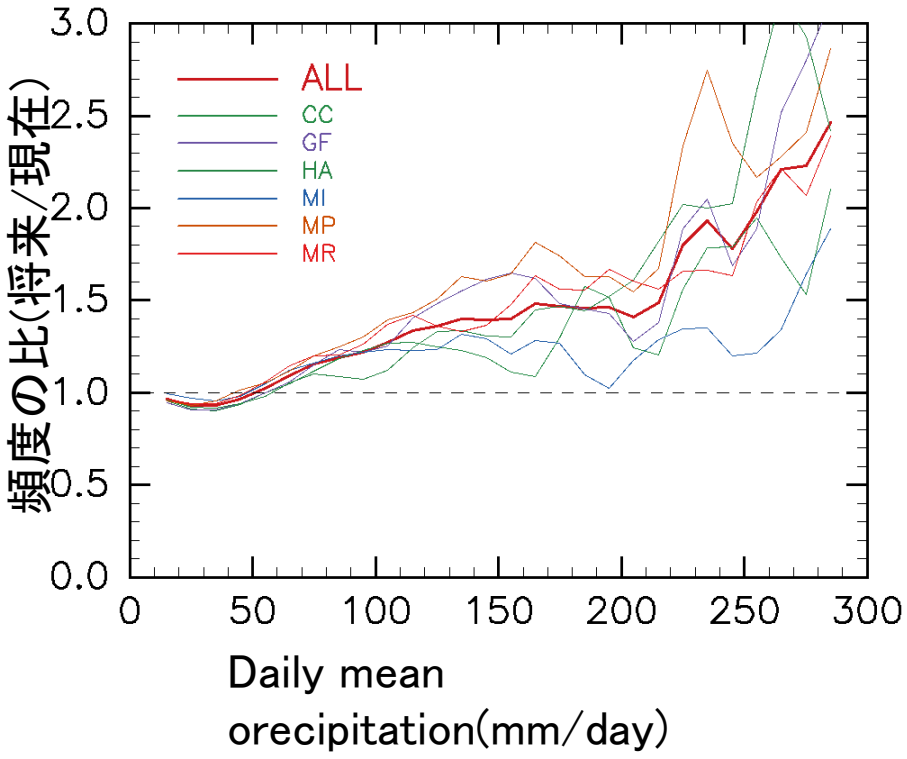
高解像度・大量アンサンブルで統計情報が必要

Freq. Distribution of daily precipitation at Tokyo (60km model)

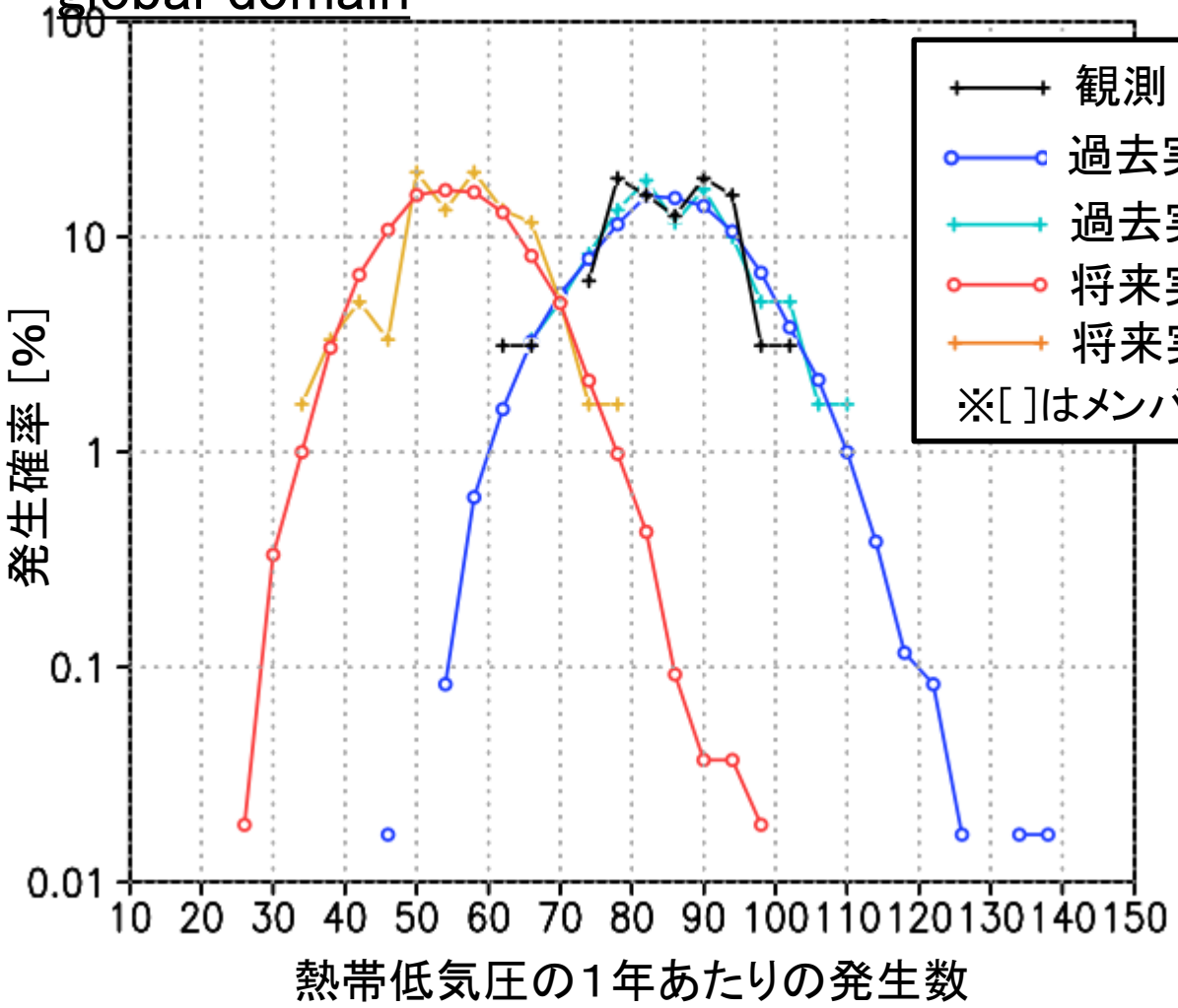
(a) At present



(b) Factors in a warmer climate(+4℃)



PDF of tropical cyclone generation in a global domain



観測 [1]	N=84.3 (32年)
過去実験 [100]	N=84.6 (60年)
過去実験 [1]	N=84.9 (60年)
将来実験 [90]	N=54.7 (60年)
将来実験 [1]	N=55.7 (60年)

※[ ]はメンバー数

年々変動の標準偏差

HPB(1951-2010): 10.35 (±0.90)

HPB(1979-2010): 9.74 (±1.24)

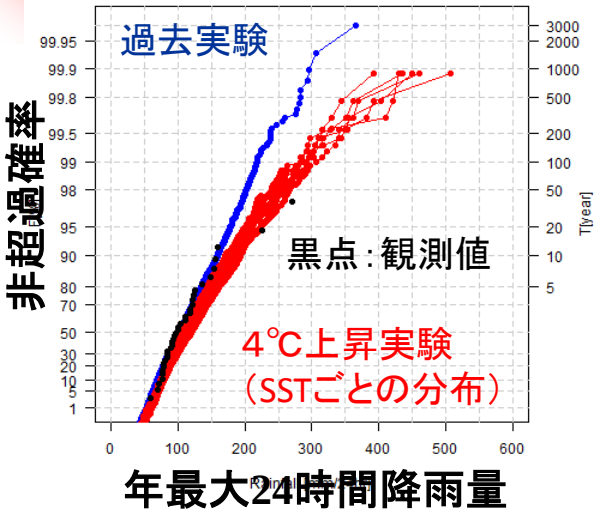
観測(1979-2010): 8.91

HFB(2051-2110): 8.76 (±0.88)

(by K. Yoshida)

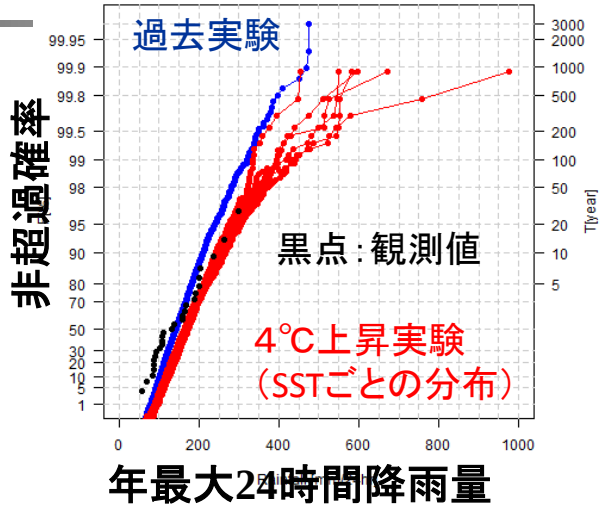
PDF of yealy maximum daily precipitation in river basins by using d4PDF

淀川流域（枚方上流域）



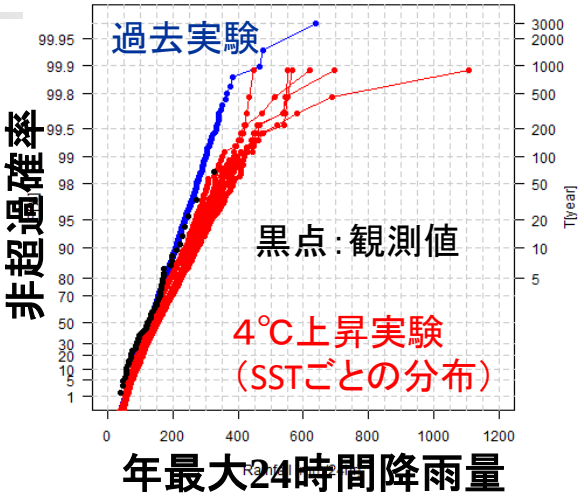
■計画降雨(1/200 24時間雨量)
261mm / 24hrs
■過去実験(1/200超過確率)
239mm / 24hrs
■将来実験(SSTごとの1/200超過確率の年最大24時間雨量の平均値)
329mm / 24hrs

庄内川流域（枇杷島上流域）



■計画降雨(1/200 24時間雨量)
376mm / 24hrs
■過去実験(1/200超過確率)
350mm / 24hrs
■将来実験(SSTごとの1/200超過確率の年最大24時間雨量の平均値)
474 / 24hrs

荒川流域（岩淵上流域）



■計画降雨(1/200 3日雨量)
548mm / 3 days
■過去実験(1/200超過確率)
480 mm / 72hrs
■将来実験(SSTごとの1/200超過確率の年最大72時間雨量の平均値)
610 / 72 hrs

■青色の折線：d4PDF（過去実験）を用いた流域平均24時間年最大雨量の頻度分布。3000個のデータ（60年×50アンサンブル）を用いて非超過確率（ワイブル公式）と年最大24時間雨量を表示した。
■赤色の折線：d4PDF（4℃上昇実験）を用いた流域平均24時間年最大雨量の頻度分布。SSTごとに900個のデータ（60年×15アンサンブル）を用いて非超過確率（ワイブル公式）と年最大24時間雨量を表示した。
■黒点：観測値

京大(工、立川ら)

Strategy for Adaptation for Climate Change

- （1）Mainstreaming in governmental policy
- （2）Increase of Scientific Knowledge
- (3) Provide risk information shared with people
- (4) Promotion of adaptation in local/regional scale
- (5) International Collaboration

Action in Japan

- (1) Adaptation Act
- (2) Regional Adaptation Consortium
- (3) Increase of NIES capability

Areas for Adaptation

- (1) Agriculture, forestry and fishery
- (2) Water resources and environments
- (3) Eco-system
- (4) Natural Disaster and Coastal Zone
- (5) Health
- (6) Daily Life

A-PLAT

気候変動適応情報プラットフォーム

Adaptation for the future.

CLIMATE CHANGE ADAPTATION PLATFORM, JAPAN

環境省 Ministry of the Environment

National Institute for Environmental Studies, Japan

Office for Coordination of Climate Change Observation

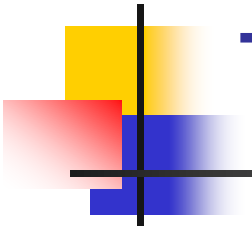
Adaptation Business in Japan

2017.6.9 Opened!

Featuring Japan's pioneer companies in the field of Adaptation Business.

LET'S ADAPT! Tips for Community and Society

IMPACT & ADAPTATION IN JAPAN



Thank you for your attention