Impact Assessment of Water Environment in the Future due to Global Warming

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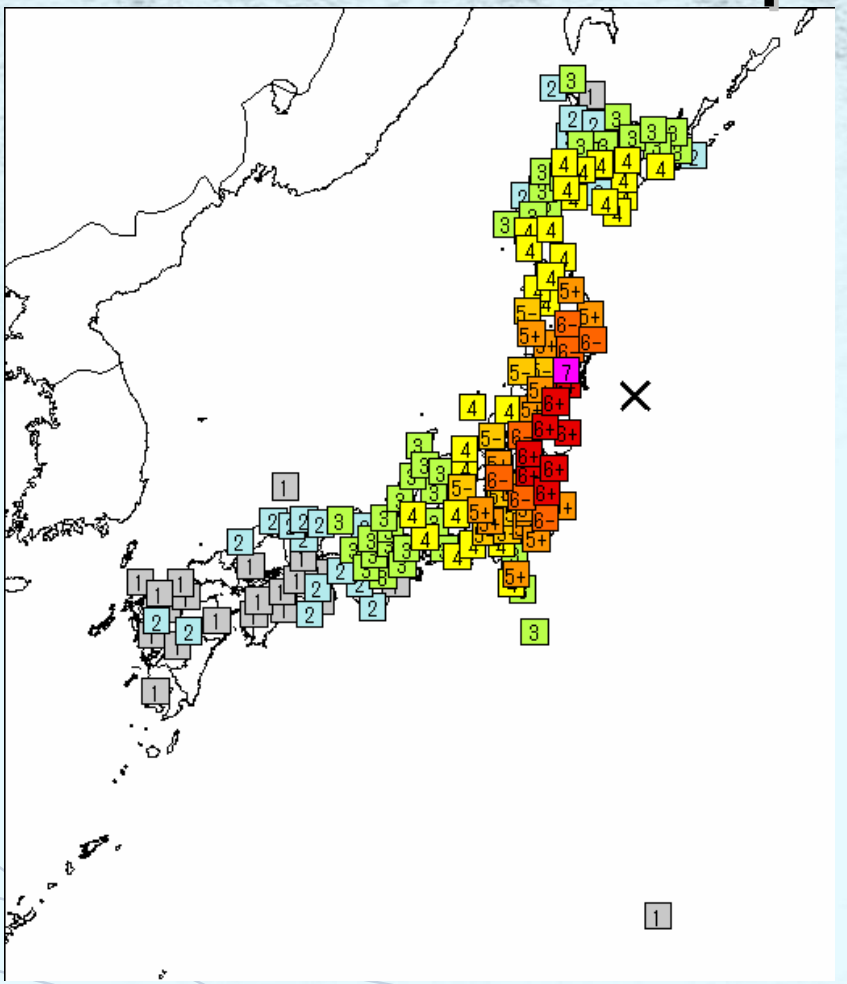
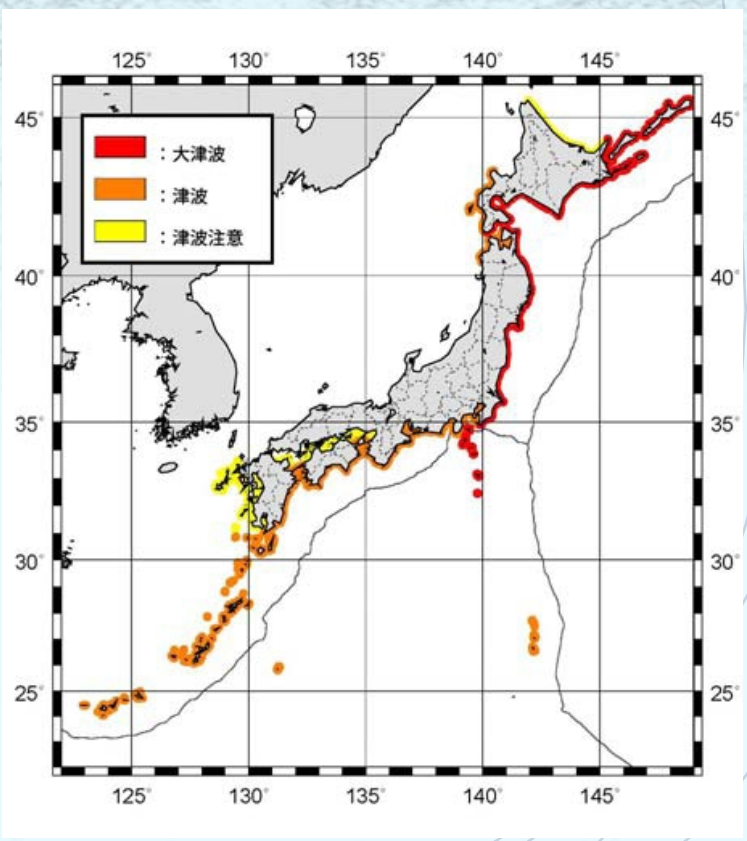
Information on Great East Japan Earthquake



Seismic Intensity



Tsunami

Damage on River Channel

Bridge

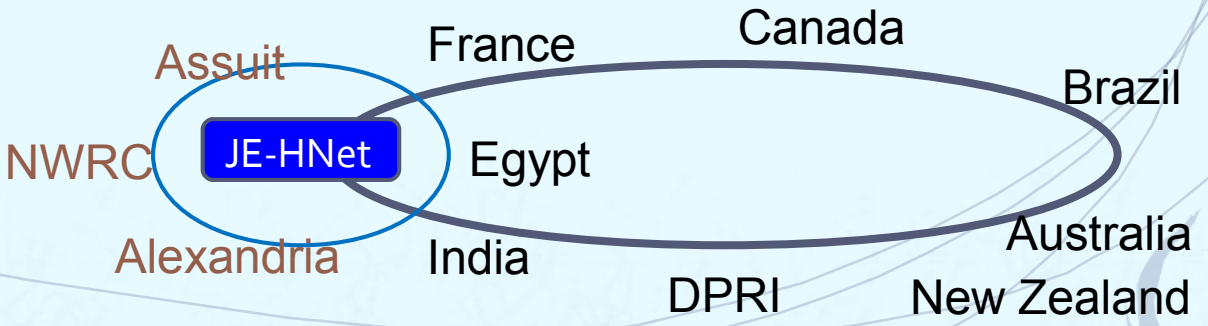
Dike break

Crack

Sinking

Countermeasures against Disasters

- Risk assessment
- Risk management for abnormal disasters
- Probabilistic prediction with evacuation system
- Interdisciplinary approaches among engineering, science and sociology
- Integrated revival plan under residents participation
- Necessity of global network such as JE-HydroNet



Hydrological Change in the Basin

In recent years…

Disappearance of permafrost layer

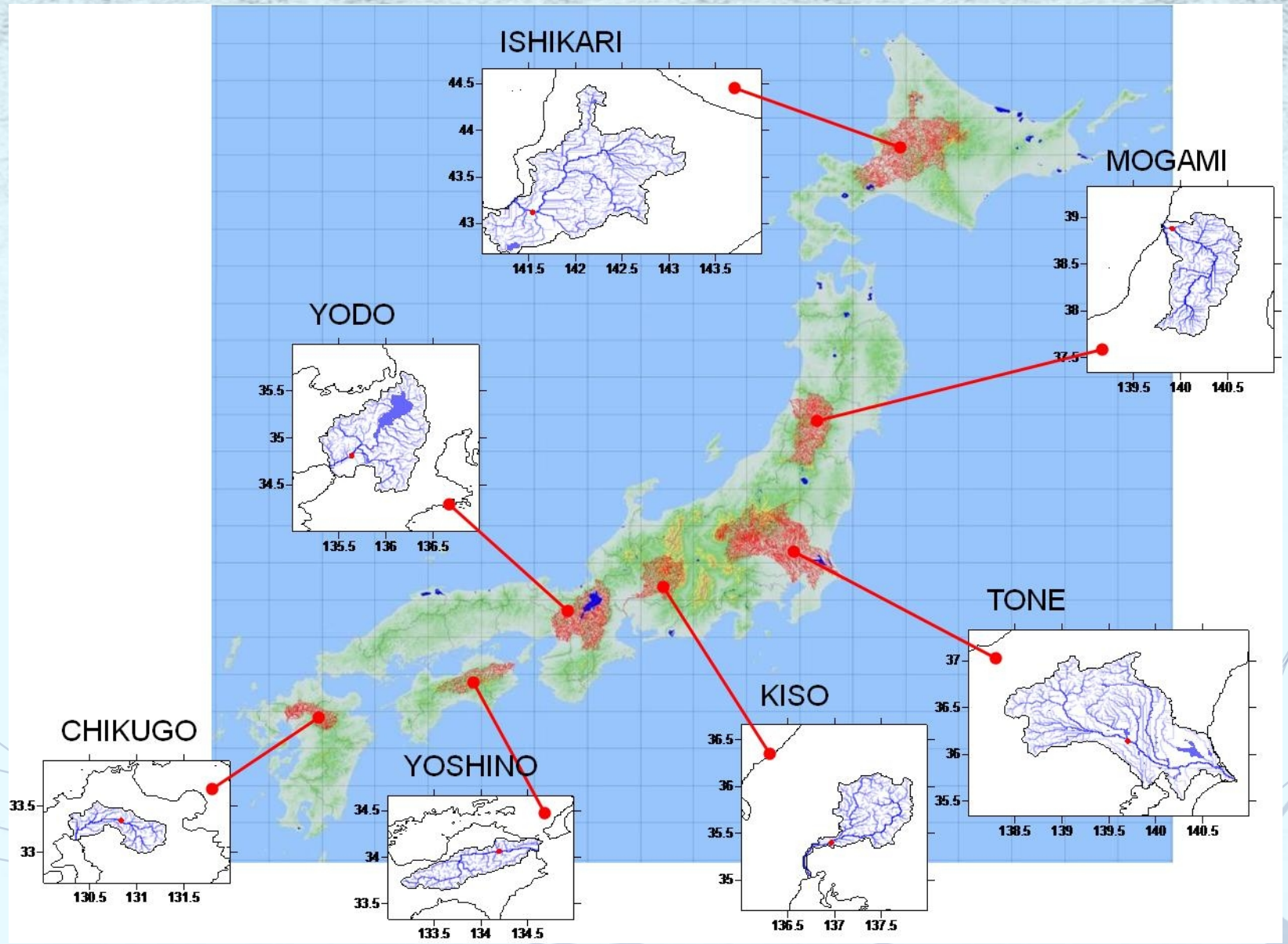
Glacial recessions

Ishikari River basin, Japan

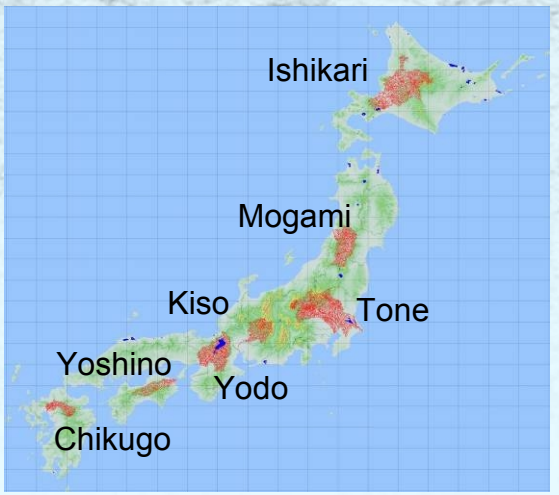
Mogami River basin, Japan

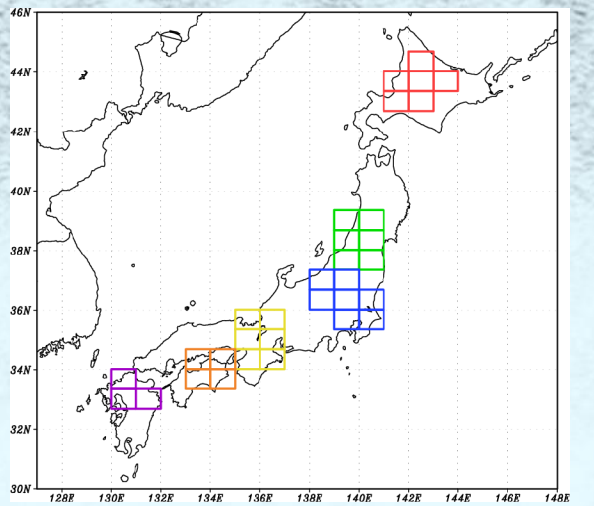
Change of seasonal snowfall and snowmelt in the northern part of Japan

Applied River Basins in Japan



Calculation Procedures



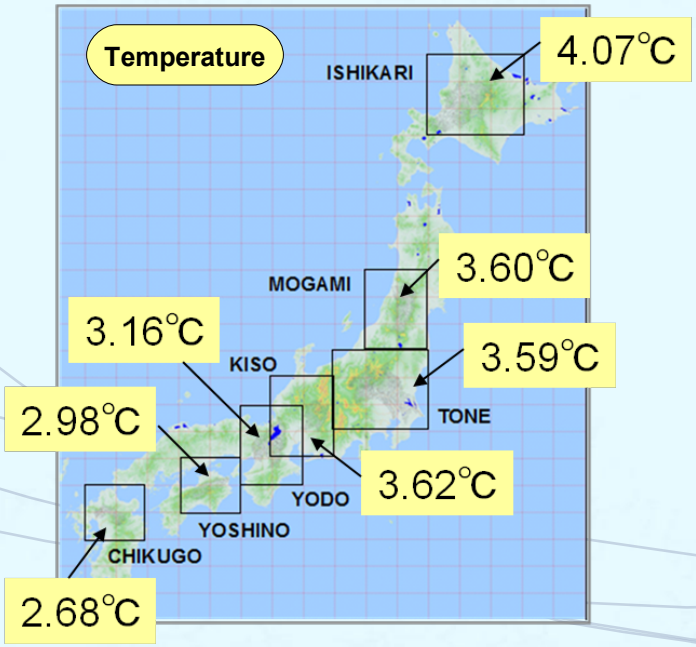


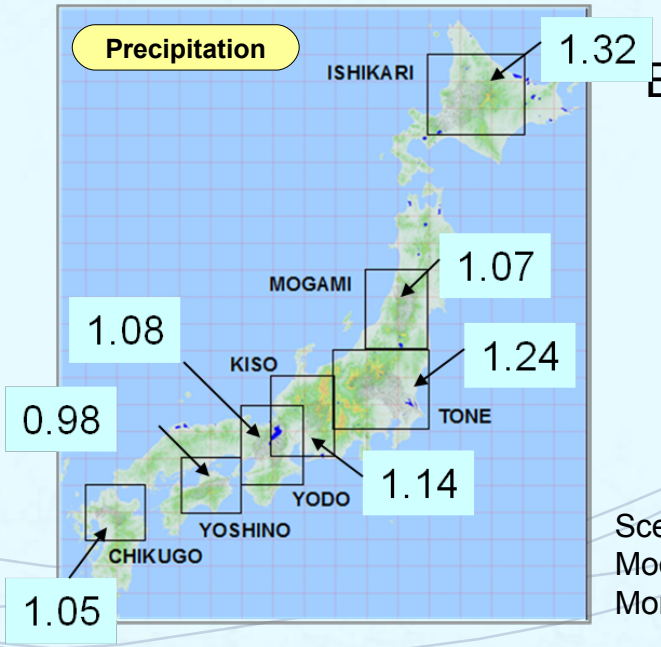
Applied meshes

Estimation of meteorological change

Evapotranspiration and snowmelt (SVAT)

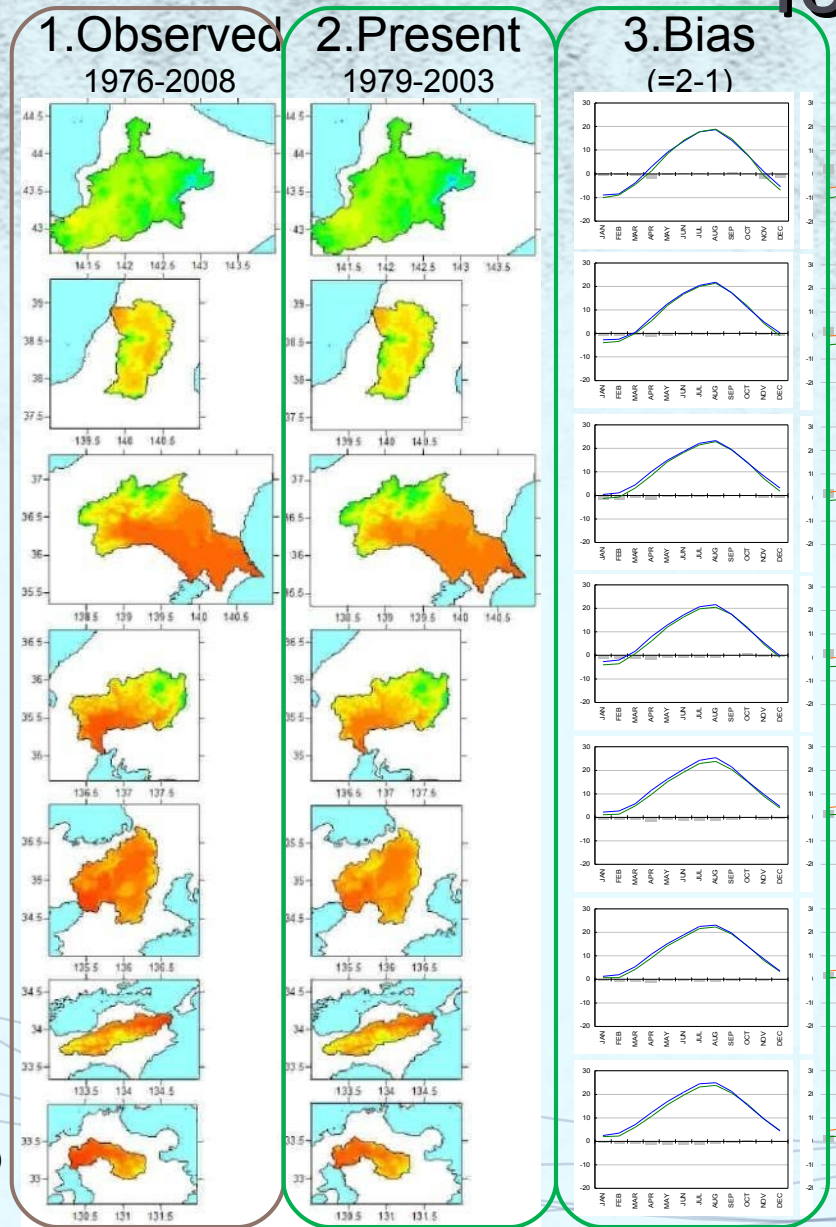
Runoff analysis (Hydro-BEAM)





Scenario : A1B
Model : AGCM3.1S
Month : JAN

Re-productivity with AGCM20 for Air Temperature



Observed

AGCM20 (Present)

High re-productivity in spatial and temporal distribution of air temperature

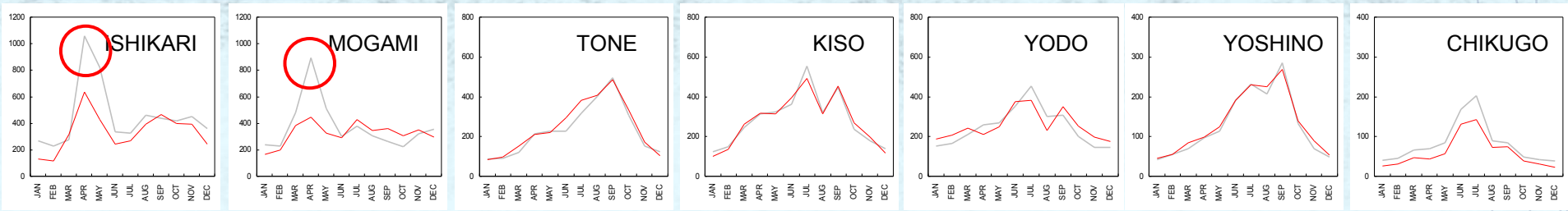
Re-productivity for Runoff Discharge

Monthly average river runoff (m^3/s)

Observed

Calculated (INPUT: Observed)

Model Performance



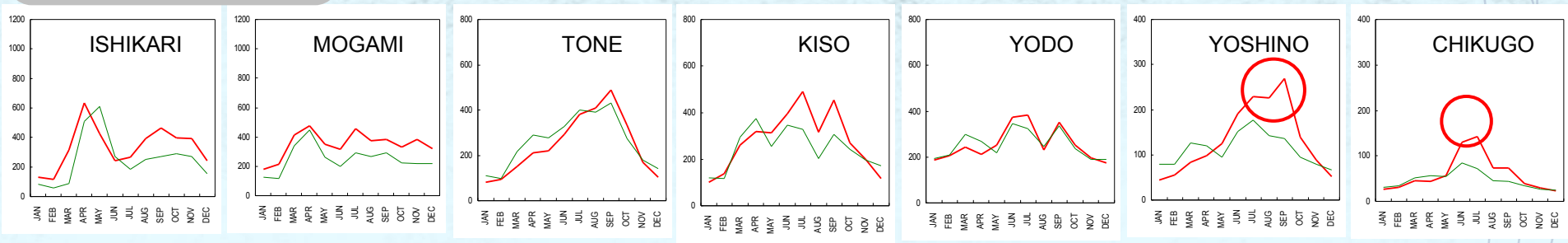
- Effective re-productivity with hydrological model
- Underestimation of river runoff in the northern region
- Regional difference on runoff discharge

Influence of Bias

Monthly average river runoff (m^3/s)

Calculated (INPUT: Observed)
Calculated (AGCM20-Present)

Bias



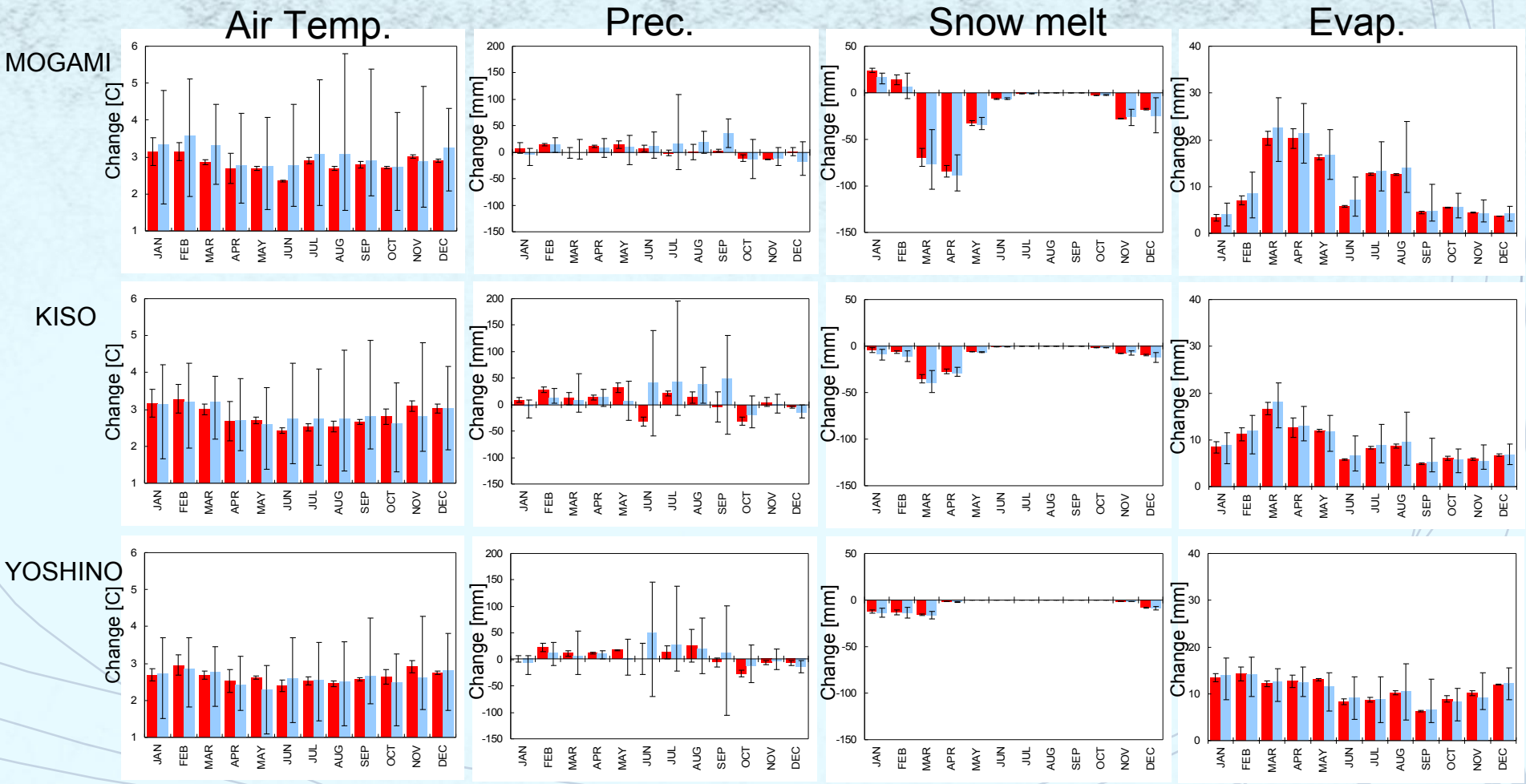
- Difference between red and green colored lines
- Bias correction of dynamic or statistic downscaling
- Improvement of GCM calculation

Hydrological Change with A1B Scenario

AGCM20 (MRI-AGCM3.1S/3.2S)

CMIP3-GCMs（8models）

※Error bars indicate the range between Max and Min.

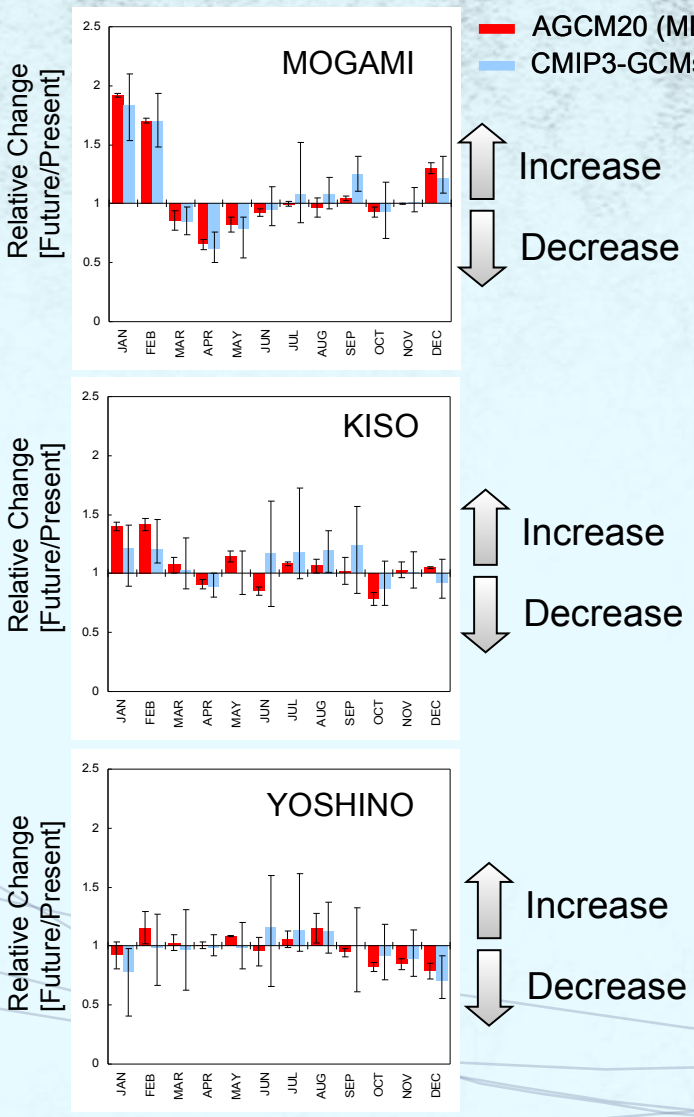


Impact of climate change in Northern Japan is larger than South-Western Japan.

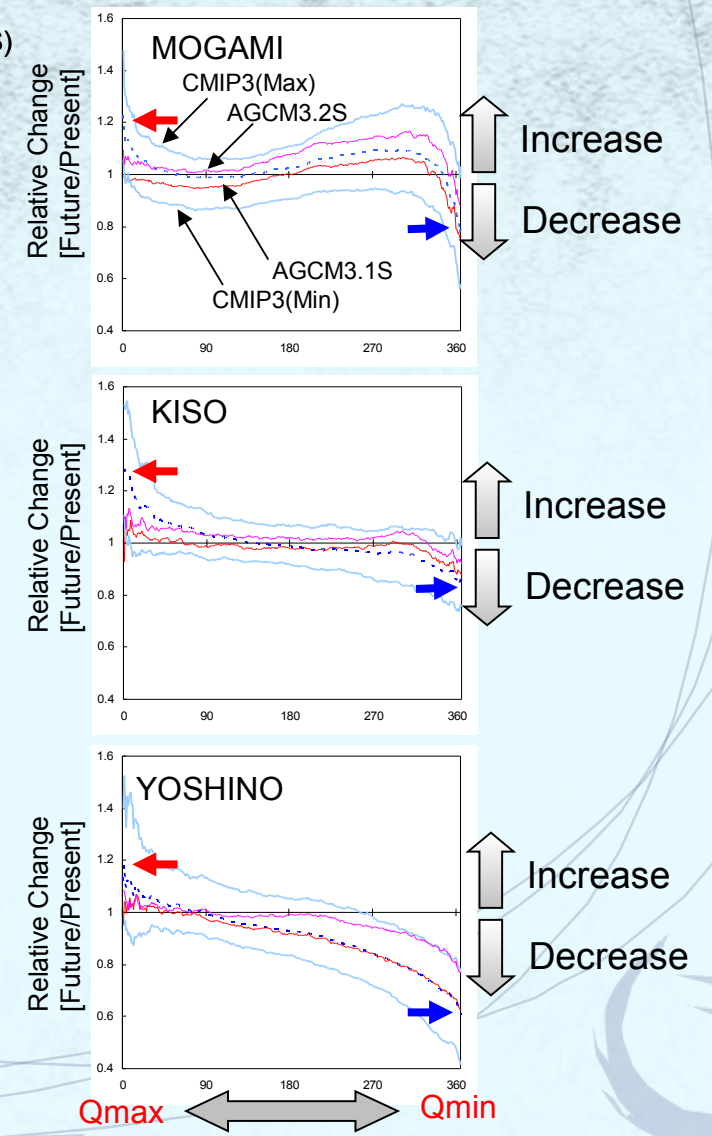
Ensemble average of CMIP3 models are well correspond with AGCM20.

River Runoff Change (A1B Scenario)

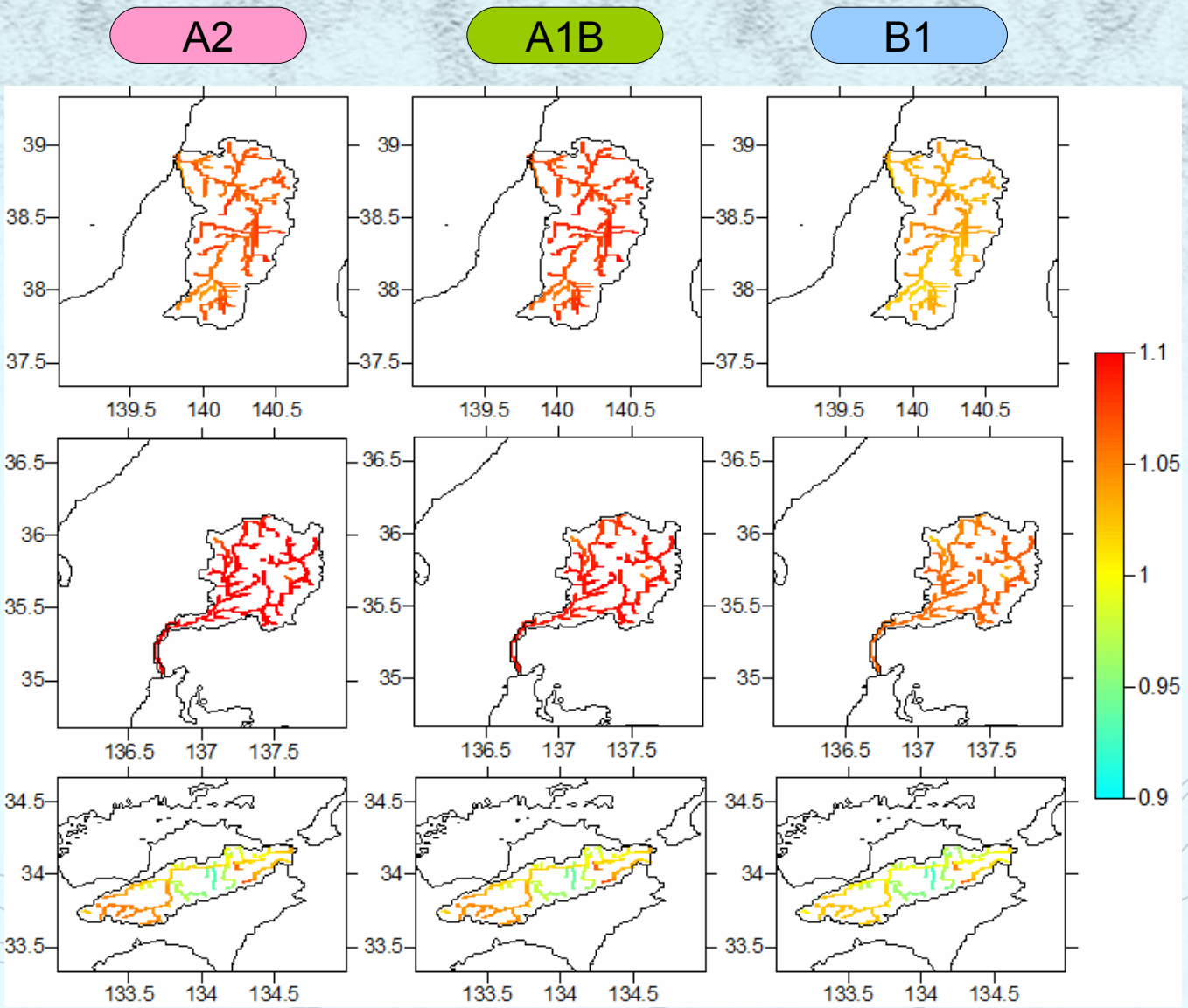
Monthly River discharge



Flow Duration Curve

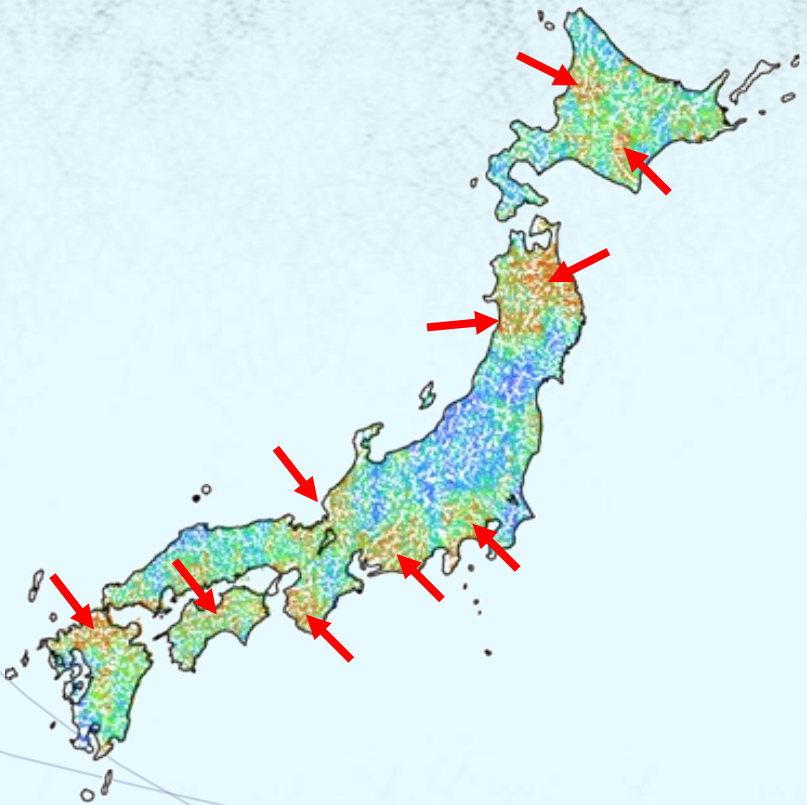


Difference among Scenarios

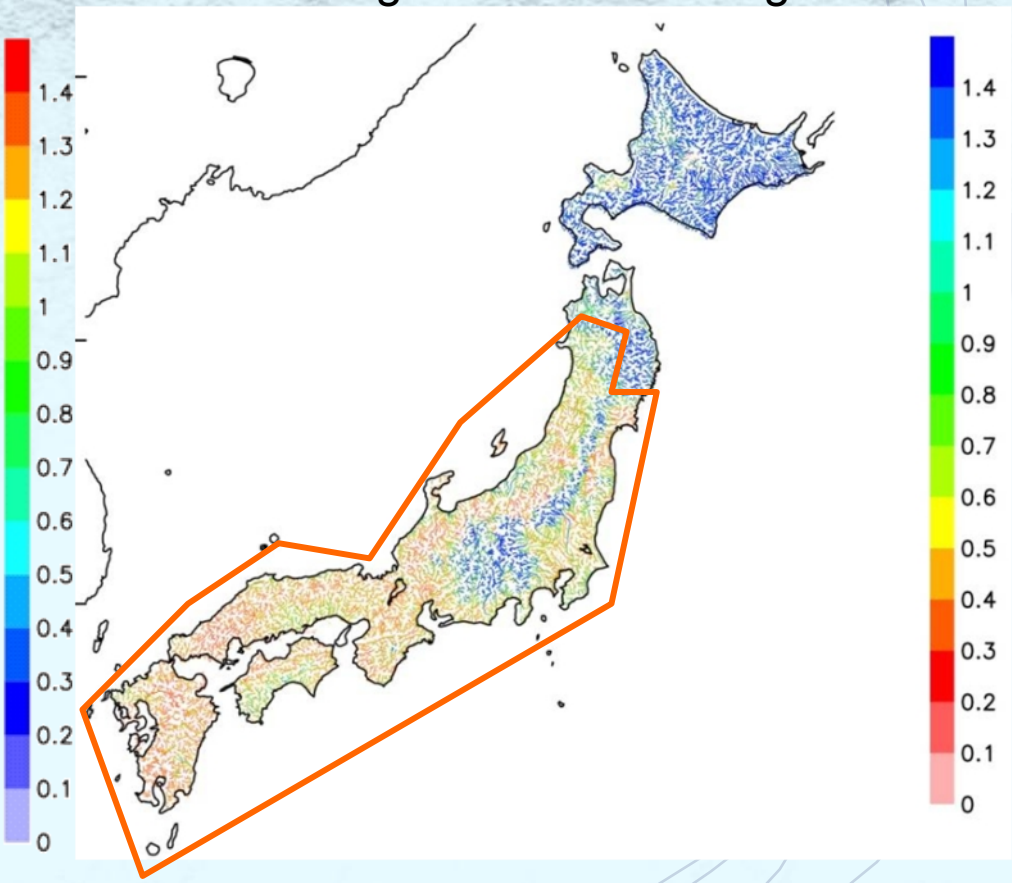


Change of River Runoff though AGCM20

Relative change of T=1/100 Flood



Relative change of T=1/10 Drought



Figures created by Prof. TACHIKAWA

The warm colored areas implies that more severe flood and drought will occur in many places in Japan.

Conclusions

- The super-high resolution AGCM20 can detect the regional impact of climate change in Japan.
- The regional impact assessment must be analyzed because Northern part of Japan will get larger damage than South-western part of Japan.
- More severe floods and droughts will happen in the most of river basins.
- Risk management with sociology is needed for abnormal events for the future uncertainty.
- Optimal plan with extreme probability events must be considered considering alarm and evacuation systems.