Third International workshop on downscaling (2011/10/12 V10)

date: From 17 to 19 October, 2011

place: Room #202, EPOCHAL Tsukuba, Japan

17. Okt					
	09:30		Director General of MRI	Opening Remarks	
	09:40		Dr. I. Takayabu	Objectives of this WS	
Session 2					
To develop a guideline on the role of DDS with respect to statsitical downscaling for application in impact studies					
Session chair : Dr. H. Kanamaru					
	10:00		Prof. Rasmus Benestad	Empirical-statistical downscaling: projections and uncertainties	S2-K1
	10:50		Prof. Jose Manuel Gutierrez	Reassessing statistical downscaling techniques for their robust application to GCM and RCM predictors under climate change conditions	S2-1
	11:20		Mr. Martin Olesen	Climate projections for Denmark based on ENSEMBLES - A demand for significant regional climate information	S2-3
	11:50		Break		
lunch					
	13:20		Dr. H. Kanamaru	Downscaling for climate impact assessment, characterization of vulnerability, and adaptation to climate change	S2-7
	13:50		Dr. Iseri	Bias correction of daily precipitation output from regional climate model using discrete wavelet transform	S2-6
	14:10		Prof. Eiichi Nakakita	(*)	
	14:40		Dr. Noriko Ishizaki	Probabilistic Regional Climate Analogue in the Warmer Japan	S2-5
	15:00		Dr. K. Takahashi	Application using climate analogue (*)	
	15:20		discussion		
	16:20		break		
Session 1					
To clarify the technical basis for DDS					
Session chair: Dr. K. Dairaku					
	16:20		Prof. M. Inatsu	Wintertime extratropical cyclone frequency around Japan	S1-6
	16:40		Dr. Burkhardt Rockel	Different nudging techniques in dynamical downscaling. Assessment of model system dependent retained and added value.	S1-1
	17:10		Dr. Ruth Cezero-Mota	The impacts of different land schemes and domains on the simulation of precipitation over Southern Africa	S1-2
	17:40		Dr. Jonathan Day	The impact of an ice free Arctic Ocean on the climate and surface mass balance of Svalbard	S1-4
	18:00		Reception		
	20:30				
18. Okt		EST(Summer)			
	09:00	20:00	Prof. Hans von Storch	Issues in dynamical downscaling: added value and spatial resolution	S1-K1
	09:50	20:50	Prof. Roger Pielke Sr.	by using SKYPE	
	10:30	21:30	Dr. K. Dairaku	Assessment of add-value of dynamical downscaling in Japan	S1-7
	11:00	22:00	discussion		
	12:00	23:00	break		
lunch					
	13:30		Prof. Kawagoe	Application of slope failure risk evaluation model due to GCM data outputs	S2-4
	14:00		Dr. Toshichika Iizumi	ELPIS-JP: A dataset of local-scale daily climate change senarios for Japan	S2-2

	14:20		Dr. Marcelino Q. Villafuerte II	Strengths and Limitations of Presently used Climate Downscaling in the Philippines	S1-5	
	14:40		Dr. Suzuki Parker Asuka	An assessment of uncertainties and limitations in simulating tropical cyclone climatology and future changes.	S1-3	
	15:00		Prof. H. Kusaka	Urban climate projection in summer in the 2070s by the WRF model with 3-km horizontal grid increment: Dynamical downscaling and impact assessment to heat stress	S1-8	
	15:20		break			
	15:20			poster session		
			Dr. Hoang Anh Nguyen-Thi	The contribution of tropical cyclone rainfall in Vietnam and its relation to ENSO	S2-P4	
			Dr. Iizuka	Assessment of possible biases in RCM simulations around Japan	S1-P1	
			Dr. Ryuhei Yoshida	Inter-model differences in the relationships between downward shortwave radiation and air temperature derived from dynamical and statistical downscaling models.	S2-P1	
			Dr. M. Nishimori	Comparison of the current climate reproductivities for statistical and dynamical downscaling methods: MMLR-SD and S-5-3 RCMs over Japan by using the same genaral circulation field.		
			Prof. H. Kusaka	Simple DDS scheme in S-8 projects (*)		
			Dr. J. Hirano	Flood risk analysis in the Tokyo metropolitan area for climate chgange adaptation (RECCA)	S2-P2	
			Dr. S. Yamaguchi	Investigation of combinig the regional climate model with the numerical snow cover model	S2-P3	
			Dr. N. Tsunematsu	Pre-experiments on regional climate change in the Tokyo metropolitan area	S1-P2	
			Dr. S. Adachi	Projection of Summer Climate on Tokyo Metropolitan Area using Pseudo Global Warming Method		
	16:20					
Session 3						
To propose a better design of multi-model experimants of DDS						
Session chair : ??						
Session organizer : Dr. Tomonori Sato						
Session organizer : Prof. Kei Yoshimura						
Session organizer : Dr. H. Shiogama						
	16:20		Prof. Jens H. Christensen	Keynote speech		
	17:10		Prof. R. Arritt	Lessons from multi-model dynamical downscaling projects		
	17:40		Prof. Kei Yoshimura	(*)		
	18:00		break			
19-Oct.						
	09:00		Dr. S. Kanada	Projections of future changes in precipitation and the vertical structure of the frontal zone during the Baiu season around Japan using a 5-km mesh regional climate model		
	09:20		Prof. Tomoniri Sato	Detection and evalutaion of uncertainty in regional climate simulation by sensitivity experiment	S3-1	
	09:40		Dr. Shiogama	Can detuning ensembles provide insights into the projection uncertainty and performance of RCM?	S3-2	
	10:00		discussion			
	10:20		break			
Wrapping-up						
	10:20			Wrapping-up the WS		
	11:00					

Abstracts of Third international workshop on down-scaling (2011/10/12 V10)

S1-K1

Issues in dynamical downscaling: added value and spatial resolution

Hans von Storch
Institute for Coastal Research, Helmholtz Zentrum Geesthacht, Germany

The key purpose of dynamical downscaling is to infer knowledge about smaller scale dynamics from information about larger scale dynamics and regional physiographic details (such as land-sea contrasts). While limited area models certainly generate more detail, the question is if this detail is mostly trivial (i.e., may be derived by considerably cheaper geostatistical methods) or adds nontrivial "correct" detail (e.g., polar lows or land-sea effects near coasts), and what the spatial resolution in describing smaller scale phenomena is.

The former issue has been addressed to some extent; with the result that nontrivial added value is clearly added in (re-analyses-driven) reconstructions, in particular when the driving large scale conditions are constrained. For scenarios, Big Brother experiments have shed some light on this question. The latter question, on the spatial resolution (which is not the same as the grid resolution), has hardly been addressed systematically; instead mostly hand-waving vague guesses have been made.

In the presentation, added value concerning dynamics phenomena, scales and local physiographic influences is reviewed. A strategy for examining the additional skill of a dynamical downscaling step in scenario post-processing is sketched. First ideas concerning the issue of determining the spatial resolution are discussed.

S1-1

Different nudging techniques in dynamical downscaling. Assessment of model system dependent retained and added value.

Burkhardt Rockel

Helmholtz-Zentrum Geesthacht, Germany

Castro et al. (2005) studied the retained and added value of the regional model RAMS for three different resolution by NCEP reanalysis data. In a follow up study Rockel et al. (2008) repeated their experiment with a different model system setup. They applied the climate version of the COSMO model (CCLM) on three different resolutions (100, 50, 25 km) and two different domain sizes (a small one covering approximately North-America, and a large one double in size). Boundary conditions were provided by ERA40 data. It turned out that the CCLM shows similar results as the RAMS for traditional nudging into the global model data (i.e. boundary conditions are given only in a sponge zone of the regional model). Applying an additional interior nudging lead to better retaining (i.e. representation) of the large-scale values. However, interior nudging suppresses the small-scale variability of the regional model, i.e. it reduces its added value. Although RAMS and CCLM gave similar results for the traditional boundary nudging, it turned out that the internal nudging technique "spectral nudging" as used in simulations with the CCLM has less influence on the smaller scales and thus gives a better added value then the "grid nudging" in the interior of the regional model as applied in the RAMS. Also the large-scale values are slightly better retained by "spectral nudging" then "grid nudging" over the whole model domain.

References:

Castro, C. L., S. Pielke, R. A., and G. Leoncini, 2005: Dynamical downscaling: Assessment of value retained and added using the Regional Atmospheric Modeling System (RAMS), J. Geophys. Res., 110, D05,108, doi:10.1029/2004JD004,721

Rockel, B., C. L. Castro, R. A. Pielke Sr., H. von Storch, G. Lencini, 2008: Dynamical Downscaling: Assessment of Model System Dependent Retained and Added Variability for two Different Regional Climate Models, J. Geophys. Res., 113, D21107, doi:10.1029/2007JD009461

S1-2

The impacts of different land schemes and domains on the simulation of precipitation over Southern Africa.

Ruth Cerezo-Mota[1], Dáithí Stone[1], Alice Favre[1], Richard Jones[2] and Bruce Hewitson[1]
[1] Climate System Analysis Group, University of Cape Town, South Africa
[2] Met Office, Exeter, UK

Within the framework of CORDEX-AFRICA several simulations were carry out. After a detailed analysis using the monthly precipitation produced by 11 regional climate models (RCMs) and the GPCC gridded observations it was concluded that most of the RCMs failed to capture in a realistic way the spatial extension of the winter precipitation over the Western Cape, South Africa.
From all the simulations available for this first stage of CORDEX-AFRICA we chose two to thoroughly analyse the reasons for which these RCMs tend to fail in capture the winter rainfall regime. Both simulations used the same RCM, HadRM3P, differing only in the land scheme, MOSES and MOSES2. MOSES2 includes a tiled representation of heterogeneous surface and more importantly it also includes a seasonal variation for deciduous trees. The impacts of these land schemes on the winter-rainfall regime are studied in this paper.
Two additional experiments with the same domain and both land schemes but using a sub-domain of CORDEX-AFRICA were done. The sub-domain covers just southern Africa. When comparing the outputs from the smaller domain against the full CORDEX-AFRICA domain, the winter-rainfall is more realistic when using the smaller domain. The reasons for this are explored in this work.

S1-3

Uncertainties in tropical cyclone climatology simulation in a regional climate model

Asuka Suzuki-Parker[1], Greg Holland[2], James Done[2], Cindy Bruyere[2], and Peter Webster[3]
[1] University of Tsukuba, Japan
[2] National Center for Atmospheric Research, United States
[3] Georgia Institute of Technology, United States

A number of studies used numerical simulations to examine potential future change in tropical cyclone (TC) activity due to greenhouse gas warming. There is an emerging consensus with

regard to projected change in future global mean TC activity among those studies. Most studies resulted in decrease in future global mean frequency, and increase in intensity. However, there is little agreement at regional-scale. Such disagreement may arise from many factors, and identification and quantification of uncertainty at regional-scale projection is a critical task at hand.

This study explores inherent uncertainties in simulating TC climatology with a regional climate model (RCM). Specifically, we will focus on TC tracking scheme tuning and how it affects tracking result, which is practically reported as "simulated" TC climatology by numerical models. Different research groups have adopted their own TC tracking scheme, usually without providing detailed explanations. The result shows that there is a remarkable sensitivity in the detected number of tracks by varying TC tracking scheme parameters. Therefore, caution is required when using TC tracking results as the simulated TC frequency. We will also present potential sources of uncertainty in TC frequency simulation that have not been given much attentions thus far, such as model boundary location, initial condition, and computer architecture.

S1-4

Dear Takayabu-san,

Here is an abstract. Here is a link to the discussion paper currently
under review for "The Cryosphere".

http://www.the-cryosphere-discuss.net/5/1887/2011/tcd-5-1887-2011.html

Best wishes

Jonny

The impact of an ice free Arctic Ocean on the climate and surface mass balance of Svalbard.

General circulation models predict a rapid decrease in Arctic sea ice
extent over the 21st century. The observed decline in summer sea ice extent since the 1970s is expected to continue until the Arctic Ocean is seasonally ice free, leading to a much perturbed Arctic climate with large
changes in surface energy flux. Svalbard, located on the present day
sea ice edge, contains many low lying ice caps and glaciers which are extremely sensitive to changes in climate. Ice core records indicate that the climate and surface mass balance (SMB) of Svalbard is sensitive

to changes in the position of the sea ice edge. Svalbard's ice caps
and glaciers are expected to make a significant contribution to sea level rise in the 21st Century. The total sea level rise if all the ice on Svalbard were to melt completely is 0.02m.

Svalbard is expected to experience dramatic increases in temperature
and precipitation in the 21st Century. The purpose of this study is to quantify these changes, their impact on Svalbard's SMB and to determine what proportion of the projected changes in precipitation and SMB are
a result of changes to the Arctic sea ice cover. To investigate this a
high resolution (25 km) regional climate model was forced with a repeating cycle of sea surface temperatures (SSTs) and sea ice conditions for the periods 1961–1990 and 2061–2090. By prescribing 20th Century SSTs and 21st Century sea ice for one simulation the role of sea ice forcing is investigated. Over 50% of the projected increase in winter precipitation over Svalbard under the A1B emissions scenario is due to an increase in lower atmosphere moisture content caused by reduced sea ice concentration. This increase in precipitation may act to moderate mass loss of Svalbard's
glaciers due to future Arctic warming.

Strengths and Limitations of Presently used Climate Downscaling in the Philippines

Marcelino Q. Villafuerte II[1,2], Thelma A. Cinco[1], Emma D. Ares[1], Rozalina de Guzman[1] and Flaviana D. Hilario[1]

ABSTRACT

Here, we present the current dynamical downscaling approach performed in the Philippines. A 20km and 25km resolution using two different Regional Climate Models (RCMs), Conformal Cubic Atmospheric Model (CCAM) and PRECIS, respectively, has been done. The performance of the RCMs in capturing the climate of the Philippines is tested using different statistical measures however, it is too early to decide which RCM performs well because of different boundary conditions used. Future projections for rainfall and temperature assuming two scenarios (A2 and A1B) have also been done. Agreement between the models were found for temperature; however, our confidence weakened when contrasting results for precipitation were obtained even assuming similar scenarios. On the other hand, results serve as a start and might be used to measure the uncertainty of future climate conditions in the Philippines. Disagreement of the results may be due to different boundary conditions used thus, it is recommended that future work might be able to use similar boundary conditions.

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S1-6

Wintertime Extratropical Cyclone Frequency around Japan.

Masaru Inatsu (Hokkaido University)

Data analysis and regional atmospheric model (RAM) experiments revealed key factors in the control of wintertime cyclone passage routes from Northeast Asia to the western North Pacific. The cyclone routes were independent of the global flow pattern in the interannual variability, while cyclone growth closely agreed with linear baroclinic theory. The RAM experiments with a different lateral boundary condition composed of a combination of monthly mean and transient components also showed that the upstream eddies are important for the track route, but the background states are not. Additionally, the RAM experiments showed that the mean flow controlled the growth rate of cyclones.

S1-7

Assessment of add-value of dynamical downscaling in Japan

Koji Dairaku[1], Roger A. Pielke Sr.[2], Satoshi Iizuka[1], Wataru Sasaki[3], Satoru Yamaghchi[1]

ABSTRACT

Climate change caused by human activities will continue for centuries. It will need at least several decades until mitigation will take effect. It is necessary to put adaptation together immediately. The impacts and potential applications of interest to the stakeholders are mostly at regional and local scales. Users of climate scenarios produced by global climate models with coarse grid-spacing have been dissatisfied with the inadequate mismatch of spatial scale. Downscaling technique is used to obtain the regional climate scenarios, especially in regions of complex topography, coastlines, and in regions with highly heterogeneous land surface covers where those results are highly sensitive to fine spatial scale climate processes. Dynamical and statistical downscaling techniques available for generating regional climate information have the respective strengths and weaknesses.

We quantified the confidence and uncertainties of Type II, Type □, and Type□ dynamical downscaling where the lateral and bottom boundary conditions were obtained from Japanese 25-year ReAnalysis (JRA-25), AGCM (AMIP run) and CGCM (CMIP run) respectively. We assessed the value (skill) added by the downscaling to a climate simulation in Japan. Based on the lesson learning from the multi-downscaling project in Japan (S5-3) and the Research Program on Climate Change Adaptation (RECCA), “added value” and "predictability" of

downscaling to provide scientific knowledge for sustainable development by adapting to climate change is discussed.

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1 National Research Institute for Earth Science and Disaster Prevention
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S1-8

Title: Urban climate projection in summer in the 2070s by the WRF model with 3-km horizontal grid increment: Dynamical downscaling and impact assessment to heat stress

Presenters: Hiroyuki Kusaka (Univ. of Tsukuba), Masayuki Hara (JAMSTEC), and Yuya Takane (Univ. of Tsukuba)

Abstract:

Urban climate projection in the 2070s is conducted using the WRF model with 3-km grid increment involving an urban canopy model (UCM) in this study. First, the accuracy of dynamical downscaling for present climate is evaluated. Secondly, dynamical downscaling for the future urban climate from the different three GCMs (MIROC, MRI, CSIRO) is performed, and, finally, simple impact assessments to heat stress are reported.

The observed spatial distribution of the surface air temperature in August is successfully reproduced in the WRF model. The biases at the three major metropolitan areas, Nerima (Tokyo), Nagoya, and Sakai (Osaka), are -0.3 ºC, -0.1 ºC, and -0.1 ºC, respectively. Diurnal variations of the temperatures at these urban stations are also very well reproduced.

The results of the urban climate projection from the three ensemble members show that the projected ensemble and monthly average August temperatures in the 2070s are higher than those in the record-breaking hot summer of 2010. The maximum temperatures are 32.9 ºC, 33.4

ºC, and 34.7 ºC in Tokyo, Nagoya, and Osaka, respectively, in the 2070s, while the temperature in the inland areas exceeds 35 ºC. The uncertainty due to GCM is about 1-2 ºC.

Simple impact assessments show that urban warming over the next 70 years will nearly always make sleeping very uncomfortable in the three major metropolises, similarly to the case of the recent abnormal hot summer of 2010. The Wet-Bulb Globe Temperature (WBGT) shows that people in metropolitan areas will be warned not to participate in strenuous exercise outdoor for 63% of the daytime hours in the 2070s, compared to 30% in the 2000s.

Additional experiments show that the urban heat island intensity (UHII) is comparable to urban warming associated with background global warming effect until the 2070s.

S1-P1

Assessment of possible biases in RCM simulations around Japan

Satoshi Iizuka and Koji Dairaku

The dynamical downscaling technique should retain the large-scale features of a global reanalysis data or global models and add information on smaller scales. However, it can be expected that an RCM exhibits certain level of internal variability due to nonlinearities in the model's physics and dynamics. Therefore, an assessment of the ability of RCMs would help to understand the uncertainties in the downscaled information on climate changes. Here, we assess ocean surface winds in regional climate models (RCMs) and evaluate the ability of RCMs to downscale the features of tropical cyclones (TCs). RCMs show a smaller bias in the mean ocean surface wind around Japan during summer when compared the reanalysis data that is used as boundary data because of the better representation of land/ocean contrast in RCMs. However, for extreme values of ocean surface winds, all RCMs show a large bias over the ocean south of Japan. The RCMs reasonably simulate the TC tracks for about 40 % of TCs, whereas these models fail to simulate realistic TC tracks for the remaining TCs. The TC track errors in the RCMs spread over a wide range with peaks ranging from 100 to 200 km. Although two RCMs underestimate the surface wind speed associated with TCs, one RCM simulates it reasonably. Therefore, it is suggested that the bias in the extreme values of ocean surface winds can be

caused not only by an insufficient representation of surface winds associated with a model TC but also by the model TC track errors.

We also assess the impact of horizontal resolution in sea surface temperature (SST) data on the winter time climate around Japan in RCMs. Generally, the high-resolution SST is warmer in the south of the Polar Front over the Japan Sea, the Kuroshio/Oyashio extension, and the coastal regions around Japan comparing with the low-resolution SST because the former resolves the small scale features in the SST related to ocean currents. In comparison, the magnitude of surface winds simulated with the high-resolution SST is weaker (stronger) on the (colder) warmer SST regions. The difference affects the convergence fields of surface winds, further causing the difference in precipitation. The results suggest that the use of SST derived from coarse global climate models for a dynamical downscale could lead to uncertainties in climate simulation of RCMs, in particularly in coastal areas located downwind of mean flow.

S1-P2

Pre-experiments on regional climate change in the Tokyo metropolitan area

Nobumitsu Tsunematsu [1] and Koji Dairaku [1]

[1] National Research Institute for Earth Science and Disaster Prevention, Tsukuba, Japan.

Future atmospheric warming may enhance the potential of heavy rainfall in the Tokyo metropolitan area, thereby increasing the risk of floods. As a part of REsearch Program on Climate Change Adaptation (RECCA) funded by Ministry of Education, Culture, Sports, Science and Technology, we started numerical model experiments for investigating the vulnerability and adaptation to climate change in water hazard assessments, using regional climate scenarios. In the research project of multi-model ensembles and down-scaling methods for assessment of climate change impact (S-5-3), future climate projections were simulated by regional climate models with the 20 km horizontal grid spacing. We utilize those as the regional climate scenarios.

The model experiments adopt dynamical downscaling techniques. The regional climate scenarios are downscaled into finer grids (less than 5 km horizontal resolutions) of Regional Atmospheric Modeling System modified by National Research Institute for Earth Science and Disaster Prevention (NIED-RAMS).

Prior to performing the dynamical downscaling experiments, the NIED-RAMS model

simulations are carried out by using the Japanese Re-Analysis (JRA) data and Japan Meteorological Agency Meso-Scale Model (MSM) outputs as the initial and boundary conditions. Results of the simulations are compared with long-term surface meteorological observations in order to show the model biases. Also, digitized land-use patterns in the metropolitan area in the past 120 years and natural land-cover data are used as inputs of the model experiments to evaluate impacts of land-cover changes on regional climate.

S2-K1

Empirical-statistical downscaling: projections and uncertainties.

R.E. Benestad, The Norwegian Meteorological Institute

Global climate models (GCMs) are designed to provide a rough description of large-scale climatic features, but not for accurate information on local scales. The local climate is nevertheless related to the large-scale situation, and is furthermore affected by local geographical conditions. The fact that the small scales are related to large scales makes downscaling possible, and traditionally both high-resolution limited-area regional climate models (RCMs) and empirical-statistical downscaling (ESD) have provided a means to infer local details. These two approaches are different in nature, with different strengths and weaknesses: whereas RCMs predict local details by explicitly solve equations describing known physics, ESD brings in information from past observations and may include unknown effects with signatures that are embedded in the empirical data. Hence the two approaches compliment each other and should as far as possible be combined. RCMs are computationally expensive but provide a complete picture of a virtual world that tends to bebased on a small selection of GCMs for limited time slices and for a limited region. ESD, on the other hand, can easily be applied to large ensembles of GCMs, long time series, long timeseries, and locations far apart, but may involve different statistical techniques that are tailored for different purposes. In fact, ESD can be used to predict both the shape of probability distributions as well as point-to-point variations in time series. Furthermore, ESD should be viewed as an advanced analysis that provides a range of diagnostics with information about data quality and model skill. Hence, ESD is well suited for describing uncertainties. Here, two different types of ESD analysis with high impacts relevance are presented, illustrating the utility of using different ESD approaches.

S2-1

Reassessing statistical downscaling techniques for their robust application to GCM and RCM predictors under climate change conditions

Dr. Jose Manuel Guiterrez

The performance of statistical downscaling methods is critically reassessed with respect to their robust applicability in climate change studies. For this purpose, we cross-validate the different techniques focusing on three different aspects: a) accuracy scores (correlation, RMSE, etc.), b) distributional similarity scores (KS statistic and PDF-score), and c) stationarity/robustness under climate change conditions. In the latter case we consider anomalous cold/warm periods of the observational record —which serve as surrogates of possible climate alterations-- and test the performance of the methods, as compared to random periods. It is found that a near-perfect association between observed and downscaled series (e.g. in terms of the Pearson Correlation) may hide important shortcomings in terms of robustness and distributional similarity. We found that this adverse effect can be alleviated including near-surface temperature (e.g. 2m temperature) information into the predictor field, instead of only relying on data of the free troposphere. Free tropospheric absolute humidity should not be used as predictor since it leads to non-robust results in any case. In order to determine whether or not near-surface temperature is a suitable predictor for climate change downscaling applications, we tested GCM outputs in control scenarios w.r.t. the reanalysis predictors used to train the statistical downscaling methods. Moreover, we analyze both the standard perfect prognosis approach (applied to GCM predictors and used in this field during the last two decades) and some recent MOS-like versions suitable to be applied to RCM data. Examples are provided using methods and data from the ENSEMBLES project.

References:

J.M. Gutiérrez et al. (2011) Reassessing statistical downscaling techniques for their robust application under climate change conditions. To be submitted (draft available).

S. Brands et al. (2011) Validation of the ENSEMBLES global climate models over southwestern Europe using probability density functions: A downscaling perspective. Climate Research. Vol. 48: 145–161, DOI: 10.3354/cr00995

Turco, M. et al. (2011) Testing MOS Precipitation Downscaling for ENSEMBLES Regional Climate Models over Spain. Journal of Geophysical Research, Vol. 116, D18109, doi:10.1029/2011JD016166.

ELPIS-JP: A Dataset of Local-scale Daily Climate Change Scenarios for Japan

Toshichika Iizumi [1, *], Mikhail A. Semenov [2], Motoki Nishimori [1], Yasushi Ishigooka [1], and Tsuneo Kuwagata [1]

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Abstract

We developed a dataset of local-scale daily climate change scenarios for Japan (called ELPIS-JP) using the stochastic weather generators (WGs), the LARS-WG and in part WXGEN. The ELPIS-JP dataset is based on the observed (or estimated) daily weather data for seven climatic variables (daily mean, maximum, and minimum temperatures, precipitation, solar radiation, relative humidity, and wind speed) at 938 sites in Japan and climate projections from the multi-model ensemble of global climate models used in the Coupled Model Intercomparison Project (CMIP3) and multi-model ensemble of regional climate models form the Japanese downscaling project (called S-5-3). The capability of the WGs to reproduce the statistical features of the observed data for the period 1981-2000 is assessed using several statistical tests and qunatile-quantile plots. Overall performance of the WGs was good. The ELPIS-JP dataset consists of two types of daily data: (1) the transient scenarios throughout the 21st century using projections from ten CMIP3 GCMs under three emission scenarios (A1B, A2, and B1); and (2) the time-slice scenarios for the period 2081-2100 using projections from three S-5-3 RCMs. The ELPIS-JP dataset is designed for use in conjunction with process-based impact models (e.g., crop models) for assessment, not only the impacts of mean climate change, but also the impacts of changes in climate variability, wet/dry spells, and extreme events, as well as the uncertainty of future impacts associated with climate models and emission scenarios. The ELPIS-JP offers an excellent platform for probabilistic assessment of climate change impacts and potential adaptation at a local scale in Japan.

S2-3

Climate Projections For Denmark Based on ENSEMBLES
-A Demand for Significant Regional Climate Information

The ENSEMBLES project consisted of 15 regional climate models and 5 global climate models. The RCMs covering Europe were run at 25km spatial resolution with boundary conditions from 5 different global climate models for the A1B scenario.

The present challenge is to make use of the huge amount of harmonized climate data in the ENSEMBLES database for specific adaptation and mitigation purposes in Denmark. How will the public, the society and the business world be affected by the climate change. Politicians demand for valid climate projections for e.g. sea level rice and extreme precipitation events and scientists demand for significant climate projections for improving the impact models and obtain knowledge for better adaptation strategies. Statistical analysis, weighting and compilation of the outcome of RCM's are carried out to provide significant and useful climate information, upon which the adaptation can be build.

The fields of interest are temperature and precipitation in Denmark (Northern Europe) for the scenarios A1B, A2, B2 and EU2C. To obtain projections for all scenarios the results from A1B are simply scaled to the remaining scenarios of interest. All projections are calculated for the short and long term time scale corresponding to 2021-2050 and 2071-2100 respectively. Here I show an attempt towards making the ENSEMBLES based information useful for the end users by first showing the resulting climate change information for Denmark and then pointing towards how this is communicated with the end-users.

Martin Olesen
Danish Climate Centre
Danish Meteoroligical Institute

S2-4

Application of slope failure risk evaluation model due to GCM data outputs

Faculty of symbiotic systems science, Fukushima University Seiki KAWAGOE

Japan is a country with a very steep relief and weak geologic condition. The Japanese people have suffered numerous slope failure disasters since ancient times. Heavy rainfall as a result of climate change could loosen soils making slope failures more common and worsen in future. The objective of this study is to develop a risk evaluation model which incorporates the General Circulation Model (GCM) and digital geographical information concerning particularly on the slope failure hazards due to high intensity rainfall in future. Risk map with the probability due

to the effects of the heavy rainfall will be developed for the whole Japan. Risk evaluation models based on the geographical and geological features are common in the previous studies. Quantitative risk index is a better tool for counter measures planning than the qualitative risk index that shows the range of risk varies from high to low risk area. The quantitative risk index is compiled based on the safety factors with stability analysis or the probability analysis that gives a quantitative value for better understanding the potential risk.

As characteristic of the slope failure risk evaluation model, it is able to apply some rainfall conditions. The slope failure risk model uses digital geographic data such as hydraulic properties, geographical features, geological features, and historical slope failure results. To obtain hydraulic properties are calculate to infiltration analysis. The hydraulic gradient was used as the hydraulic property. The hydraulic gradient was derived from the phreatic line obtained by unsaturated infiltration analysis using the Richards equation. Rainfall conditions are important factor to obtain hydraulic gradient because it indicates to discuss climate change risk potential. This model will be able to estimate slope hazard risk in future to using GCM date outputs. In this study, it discusses slope hazard risk change in some rain conditions to GCM dynamical downscaling.

S2-5

Probabilistic Regional Climate Analogue in the Warmer Japan

Noriko N. Ishizaki, Hideo Shiogama, Kiyoshi Takahashi, Seita Emori, Koji Dairaku, Hiroyuki Kusaka, Toshiyuki Nakaegawa, and Izuru Takayabu

Abstract:

Regional climate projection in association with the global warming is of great importance for the mitigation and adaptation strategy, while it is subject to various uncertainties. This study newly developed a method to consider every conceivable uncertainty in climate analogue with a probabilistic way using pattern-scaling method and bootstrap resampling. The RCM uncertainty in climate analogue excesses comparable level to those due to different global mean temperature change between emission scenarios and GCMs. Comparison of the projection between the probabilistic and deterministic views demonstrates a benefit of this method to apply the impact studies.

S2-6

Bias correction of daily precipitation output from regional climate model using discrete wavelet transform

Yoshihiko Iseri and Shinjiro Kanae

Abstract:

When regional climate impact assessment is performed, outputs from regional climate model are widely used to meet the spatial and temporal resolutions which are necessary for regional assessment. For hydrological impact studies, daily precipitation output is important as fundamental forcing for hydrological model. However, it has been pointed out biases in precipitation output are strong. Thus, the removal of biases in precipitation output from climate model is important for hydrological impact assessment. Although many studies have suggested statistical methods to correct biases of basic statistics such as mean or standard deviations, those methods do not originally aim to correct the biases in temporal variations of climate model outputs. However, the temporal variation of precipitation time series is very important in most of hydrological impact assessment. Because, for instance, the duration of low precipitation is trigger of drought and duration length of heavy precipitation is associated with occurrence of flood disasters.

This study suggests method to correct biases in temporal variations using time frequency analysis method, which is discrete wavelet transform. Performance of the proposed method is compared to conventional bias correction methods in order to clarify the characteristics of the proposed method. The comparisons would provide some information on which bias correction method should be selected under the situation model output user is involved. The comparison indicated the strength of relatively longer term temporal variation, which is at least up to almost 1 month, are corrected by the proposed method, although the proposed method seemed to have low performance in correcting median or mean of model output. However, by combining conventional daily scaling type bias correction method with the proposed method, it seemed not only long term temporal variations but also median and standard deviations can be corrected. The capability to correct temporal variation biases in climate model output would be particularly useful when one conduct the assessment which needs accuracy for long term temporal variations.

S2-7

Downscaling for climate impact assessment, characterization of vulnerability, and adaptation to climate change

KANAMARU Hideki, Food and Agriculture Organization of the United Nations (FAO)

Regional climate models and statistical models used for climate downscaling are now much more than a research tool for climate scientists as downscaled climate data are increasingly used

for climate change impact studies and adaptation planning. Providers of climate downscaled products need to realize that their job does not end when they publish the data. Their responsibility goes a long way – informing impact modelers and guiding adaptation practitioners. Adapting to climate variability and climate change in a robust way is the goal, and downscaling climate or assessing impacts are only intermediate steps on way to the goal. Climatologists should communicate well assumptions and uncertainties inherent in downscaled products. Otherwise end-users might misuse the data and "maladapt" practices. In fact there are cases where downscaling is not necessary for devising adaptation actions. It may be high time for impact modelers and climatologists to work together to devise a methodology for climate change impact assessments from scratch.

Vulnerability is a larger concept in which sensitivity to impacts and adaptive capacity are also considered. In the end climate change may only be one of the many threats to social and environmental resources. A concept of a new study on characterization of vulnerability under a changing climate in the context of food security will be presented to illustrate the issue. The project AMICAF (Analysis and Mapping of Impacts of Climate change for Adaptation and Food security) uses FAO's new impact assessment toolbox MOSAICC (MOdelliing System for Agricultural Impacts of Climate Change), one component of which is statistical downscaling models.

S2-P1

Inter-model differences in the relationships between
downward shortwave radiation and air temperature derived
from dynamical and statistical downscaling models

Ryuhei Yoshida (NIAES)

This study evaluated the downward shortwave radiation (S_d) and monthly mean daily mean, maximum, and minimum surface air temperatures (T_m, T_x, and T_n) derived from the present-day climate downscaling experiments of the S-5-3 multi-model ensemble for Japan. The inter-model differences in the relationship between the downward shortwave radiation bias and the temperature variable biases are also highlighted. Four dynamical models (NHRCM; Operational nonhydrostatic mesoscale model developed by the Japan Meteorological Agency with the Meteorological Research Institute, NRAMS; Regional Atmospheric Modeling System (RAMS) modified by the National Research Institute for Earth Science and Disaster Prevention, TRAMS; RAMS modified by the Terrestrial Environment Research Center, University of Tsukuba, and TWRF; Weather Research and Forecasting (WRF) model set up by the Center for

Computational Sciences, University of Tsukuba) and one statistical model (CDFDM: Cumulative Distribution Function based downscaing method) are employed in the intercomparison. All models except for CDFDM remarkably overestimated the downward shortwave radiation throughout the year. Although biased downward shortwave radiation is expected to lead to a biased temperature, all models except for NRAMS accurately simulated the mean seasonal change of the temperature variables. This inconsistency is attributed to the large inter-model differences in the relationship between the S_d bias and each of the temperature variable biases. These results suggest that an evaluation of such inter-climatic-variable relationships would be valuable for a better understanding of the source of climate downscaling uncertainty.

S2-P2

Flood risk analysis in the Tokyo metropolitan area for climate change adaptation.

Junpei Hirano, Koji Dairaku

Flood is one of the most significant natural hazards in Japan. In particular, the Tokyo metropolitan area is highly vulnerable to flood, because densely populated area is located along mouth of major rivers. The Tokyo metropolitan area has been affected by several large flood disasters. We aim to evaluate potential flood risk in Tokyo Metropolitan area by considering effect of historical land use change, land cover change, socio-economic change, and climatic change. For this purpose, it is necessary to build up a consistent flood database system, which contains long-term consistent flood data for the past. Ministry of land, infrastructure, transport and tourism in Japan published “Statistics of flood”, which contains data for flood causes, number of damaged houses, area of wetted surface, and total amount of damage for each flood at small municipal level. Based on these flood data documented in “Statistics of flood”, we construct a flood database system for Tokyo metropolitan area for the period from 1961 to 2008 by using ArcGIS software. In this database, each flood record is linked to municipal polygons. By using this flood database, we can refer to a specific flood record for each year at small municipal level. We can also calculate total amount of damage for each flood cause such as interior water inundation, over flow, levee crevasse. First, we analyze long-term variations of flood risk in Tokyo metropolitan area based on this flood database. Then, we aim to evaluate influence of socio-economic and climatic change on flood risk variations by comparing flood variations in the past with rainfall data and socio-economic indicators. Finally, we construct a flood risk curve representing exceedance probability for total damage of flood by using past

flood data. Based on the flood risk curve, we discuss potential vulnerability to flooding and risk of economic losses in Tokyo metropolitan area for climate change adaptation.

S2-P3

Investigation of combining the Regional Climate Model with the numerical snow cover model

Satoru Yamaghchi[1], Hiroki Motoyoshi[1], and Koji Dairaku[1]

ABSTRACT

Regional climate models (RCMs) provide information on snow depth and snow-water equivalent. However, snow processes (physics and dynamics of snow) implemented in the current RCMs vary considerably. In fact, snow parameterizations in some RCMs can be very coarse. For example, density and/or thermal property (conductivity or diffusivity) are sometimes set to a constant value at all points and through seasons. On the other hand, for prediction of snow disasters, it is necessary to simulate variations of detailed snow properties. Snow cover model (SCM) can estimate snow profile (e.g., snow type, snow temperature and density, water content, thermal conductivity) by using the meteorological data (e.g., air temperature and humidity, surface pressure, wind, downward short- and longwave radiation) and National Research Institute for Earth Science and Disaster prevention (NIED) has introduced and improved the snow cover model for snow disaster forecasting.

In this study, we carried out the simulations to combine a RCM (RAMS) with a SCM (SNOWPACK) (R-S simulation) and compared the R-S simulation results with simulation results of the land surface model in the RAMS. Based on these comparison results, we discuss

problems and improvement methods to connect the RCM with the SCM to understand the change of characteristics of snow disasters near the future based on global warming scenarios

1 National Research Institute for Earth Science and Disaster Prevention

S2-P4

The contribution of tropical cyclone rainfall in Vietnam and its relation to ENSO

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Abstract:

Tropical cyclone (TC) activity is one of the most dangerous disasters to regularly affect many countries. Vietnam is located in the typhoon center of the South China Sea, and on average, it is hit by 4-6 typhoons per year. This study understands the distribution of rainfall associated with TCs and clarifies that in El Nino and La Nina years for the coastal region in Vietnam using the TCs best track data of JTWC Advisories and daily rainfall data from 15 weather stations in the period 1961-2008 observed by the Vietnamese National Hydro-Meteorological Service. Results show that the coastal 14^{o}N-17^{o}N region is most frequently affected by TC on average. For monthly distribution, TC rain ratio varies from 0% to 25% with maximum value occurring in September in 16^{o}N-17^{o}N region. During El Nino years, TC frequency and TC rain ratio in 12^{o}N-19^{o}N region increase in September. During La Nina years, TC frequency and TC rain ratio increase in October-November in all regions.

S3-1

Detection and evaluation of uncertainty in regional climate simulation by sensitivity experiment

Tomonori Sato and Shinji Matsumura (Hokkaido University)

Abstract

In this study, we will discuss several types of uncertainty appeared in regional climate modeling. In order to obtain more reliable (or accurate) regional simulation, there are several possible causes of uncertainty due to model physics which we have to pay attention. What makes difficult to detect and evaluate these uncertainties for improving the regional model is the fact that the responsible natural processes are strongly regional dependent. In this talk, we would like to propose the necessity of sensitivity experiment for each natural process in order to determine the magnitude of uncertainties caused by regional-dependent natural processes, introducing some examples for North Japan with preliminary result from dynamical downscaling experiment.

S3-2

Can detuning ensembles provide insights into the projection uncertainty and performance of RCM?

Hideo Shiogama
National Institute for Environmental Studies, Tsukuba, Japan

There are three main sources of uncertainty in climate projections based on GCM. The first is due to the natural variability. The second is the emission scenario uncertainty. Uncertainty of model is the third source. The model uncertainty can be further divided to two parts. Different physical parameterization schemes and resolutions cause the “structure uncertainty”. The “physics parameter uncertainty” is another substantial model uncertainty. Present climate biases and future climate changes in a single GCM may be sensitive to changes in parameter values (or on/off of logical switches) in the model physical schemes. Recently researchers in the GCM community are actively investigating physics parameter uncertainties of climate responses to external forcing. These investigators performed several Perturbed Physics Ensembles or Physics Parameter Ensembles (PPEs) in which they swept uncertain parameters within a single GCM. These ensembles can be considered as detuning ensembles.

When modeling experts develop GCM or RCM, they do not only improve model structure (schemes, resolutions, nesting, etc), but also tune the parameters. When we compare the future

projections from multi well-tuned GCMs or RCMs with an identical boundary, are differences in projections caused by different model structure or different tuning? Although model performance metrics are getting more attention, do models with good metrics have better schemes or better tuning? I want to introduce how the detuning ensembles provide insights into these problems in GCMs. I am happy if my talk brings up a topic for discussion about further progress of RCM experiments.

*** END ***