Sesión Especial

Modelación climática regional y CORDEX

Organizadores:
Ruth Cerezo-Mota
Ramón Fuentes-Franco

SE02-1

CORDEX STATUS AND PROGRESS: AN OVERVIEW

Nikulin Grigory
Rossby Centre, Swedish Meteorological and Hydrological Institute, SMHI
grigory.nikulin@smhi.se

Coordinated Regional climate Downscaling Experiment (CORDEX) sponsored by the World Climate Research Programme (WCRP) aims to coordinate international efforts in both empirical-statistical and dynamical regional climate downscaling. Downscaling activities within the CORDEX framework have been significantly growing worldwide since establishing CORDEX in 2009 and nowadays CORDEX provides downscaled regional climate information for climate change research, impact assessments and adaptation planning. One of the CORDEX tasks is to make downscaled regional climate information easy accessible for end-user communities at regional and local levels. In 2013 the first CORDEX simulations were made openly available on the Earth System grid Federation (ESGF) - an up-to-date federative scientific infrastructure for distributing climate data and since then the number of CORDEX simulations and users have been consistently increasing. A detail overview on the CORDEX activities is provided describing what has been done, what is ongoing and what will be next steps in CORDEX.

SE02-2

MEETING CLIMATE INFORMATION NEEDS OF DECISION MAKERS: NEED FOR AMERICAS' ALLIANCE

Asrar Ghassem R. y Leung Ruby
Pacific Northwest National Laboratory
ghassem.asrar@pnnl.gov

The need for science-based climate information at the regional and national level to enable analyses of impacts, vulnerabilities and risks of climate variability and change for adaptation and mitigation choices is well documented both in the scientific literature and a wide range of policy fora. Major efforts are under way to meet this rapidly emerging need in different regions of the world because the manifestation of climate variability and change in different sectors (e.g. agriculture and food, health, water resources, energy and economy, etc.) will differ regionally thus requiring greater regional/national focus. Significant progress has been made on observations, models, understanding and assessment of climate/Earth system climate variability and change at global scale during the past three decades; however, our progress on understanding the regional aspects has been limited. A combination of the need for science-based information and limitations associated with our current ability to meet this need motivated international frameworks and national initiatives such as the Coordinated Regional Downscaling Experiment (CORDEX), North American Regional Climate Project (NARCAP), etc. These efforts are making great strides to advance the science of regional climate and meet the demand for science-based climate information by decision makers. We believe the American countries can join forces together to make greater progress on the exciting challenges and opportunities ahead. We present a few examples of scientific challenges, especially those associated with water and energy cycle that are key to meeting the urgent need for knowledge about regional climate and availability and distribution of fresh water resources that can benefit from such partnership for greater progress in this region.

SE02-3

A DISCUSSION OF CURRENT CORDEX ACTIVITIES AND PERSPECTIVES FOR THE NEXT PHASE

Giorgi Filippo
Abdus Salam International Centre for Theoretical Physics, Trieste, Italy
giorgi@ictp.it

The COordinated Regional Downscaling EXperiment (CORDEX) was designed with the purpose of assessing and improving regional downscaling techniques (RCDs) (i.e. regional climate models, RCMs, and statistical downscaling, SD) in order to produce a new generation of RCD-based 21st century regional climate projections for use in Vulnerability, Impact and Adaptation (VIA) studies. The CORDEX Phase I framework (Giorgi et al. 2009) envisioned large domains covering all land areas of the globe at a horizontal resolution of ~50 km, an intermediate resolution aimed at maximizing involvement in the program. A number of groups worlwide have completed large sets of RCM simulations over different domains, and the analysis of these experiments is providing important information RCMs and on the value of this multi-model based information for the assessment of the uncertainties characterizing regional projections. In particular, the regional model RegCM4 (Giorgi et al. 2012) of the Abdus Salam International Centre for Theoretical Physics (ICTP) was used to produce a set of 34 projections over 5 CORDEX domains (Mediterranean, Africa, South Asia, Central America and South America) using driving fields from three global climate models (GCMs) and two greenhouse gas concentration scenarios, RCP4.5 and RCP8.5. This effort, named the CORDEX RegCM4 hyper-Matrix (CREMA) experiment was the result of a collaboration across the ICTP, CICESE (Mexico), IIT (India), U. Sao Paolo (Brasil) and Eotvos U. (Hungary). The first part of this paper will provide a summary of the key issues emerging from the first CORDEX results, using illustrative examples drawn from the CREMA and other regional efforts. Among these issues, focus will be given on the added value provided by the use of RCMs. In addition, relevant examples from the Central America CREMA simulations will be provided. Based on the lessons learned from the Phase I activities, the RCD community is now discussing the design of the second phase of the CORDEX project, and the second part of the paper will describe the main elements of this discussion in order to elicit comments and contributions to this debate. References Giorgi F, Jones C, Asrar GR (2009) Addressing climate information needs at the regional level: The CORDEX framework. WMO Bulletin 58:175-183. Giorgi F, et al. (2012) RegCM4: Model description and preliminary tests over multiple CORDEX domains. Climate Research 52:7-29.

SE02-4

MULTI-MODEL EXPERIMENTS FOR REGIONAL CLIMATE STUDIES

Arritt Raymond
Iowa State Univeristy
rwarritt@bruce.agron.iastate.edu

The period since the mid-1990s has seen a growth in collaborative experiments that apply multiple regional climate models to studies of climate in various regions. These experiments have considered a range of topics including process studies, seasonal forecasting, and projections of regional climate change. Recent examples of collaborative regional climate modeling experiments include the Ensemble-Based Predictions of Climate Changes and their Impacts (ENSEMBLES) project, the North American Regional Climate Change Assessment Program (NARCCAP), and the ongoing Coordinated Regional Downscaling Experiment (CORDEX). This presentation gives an overview of coordinated regional climate experiments with a focus on those that include domains within the Americas. Both the advantages and challenges of conducting such experiments are discussed. Strategies for effective design of multi-model experiments are explored, in particular for experiments that use multiple global models to provide initial and boundary conditions for multiple regional models. The presentation also considers the scientific and logistical challenges of organizing and analyzing the large amount of data produced by these experiments.

SE02-5

PROJECTING FUTURE CHANGES IN EXTREME WEATHER DURING THE NORTH AMERICAN MONSOON IN THE SOUTHWEST WITH HIGH RESOLUTION, CONVECTIVE-PERMITTING REGIONAL ATMOSPHERIC MODELING

Castro Christopher, Chang Hsin-I, Luong Thang, Lahmers Timothy y Carrillo Carlos
University of Arizona
castro@atmo.arizona.edu

The North American monsoon (NAM) is the principal driver of severe weather in the Southwest U.S. With sufficient atmospheric instability and moisture, monsoon convection over the high terrain initiates in the early afternoon and later may organize into mesoscale convective systems (MCSs). Most monsoon-related severe weather occurs in association with this organized convection, including microbursts, dust storms, flash flooding and lightning. Our objective is to project how monsoon severe weather is changing due to anthropogenic global warming. We first consider a dynamically downscaled reanalysis (35 km grid spacing), generated with the Weather Research and Forecasting (WRF) model during the period 1948-2010. Individual severe weather events, identified by favorable thermodynamic conditions of instability and precipitable water, are then simulated for short-term, numerical weather prediction-type simulations of 24h at a convective-permitting scale (2 km grid spacing). Changes in the character of severe weather events within this period likely reflect long-term climate change driven by anthropogenic forcing. Next, we apply the identical model simulation and analysis procedures to several dynamically downscaled CMIP3 and CMIP5 models for the period 1950-2100, to assess how monsoon severe weather may change in the future and if these changes correspond with what is already occurring per the downscaled renalaysis and available observational data. The CMIP5 models we are downscaling (HadGEM and MPI-ECHAM6) will be included as part of North American CORDEX. The regional model experimental design for severe weather event projection reasonably accounts for the known operational forecast prerequisites for severe monsoon weather. The convective-permitting simulations show that monsoon convection appears to be reasonably well captured with the use of the dynamically downscaled reanalysis, in comparison to Stage IV precipitation data. The regional model tends to initiate convection too early, though correctly simulates the diurnal maximum in convection in the afternoon and subsequent westward propagation of thunderstorms. Projected changes in extreme event precipitation will be described in relation to the long-term changes in thermodynamic and dynamic forcing mechanisms for severe weather. Results from this project will be used for climate change impacts assessment for U.S. military installations in the region.

SE02-6

CORDEX - NORTH AMERICA: WET/DRY YEARS OF THE NORTH AMERICAN MONSOON CORE REGION

Cerezo-Mota Ruth[1], Cavazos Tereza[2], Torres-Alavez Abraham[2], Arritt Raymond[3], Nikulin Grigory[4], Moufouma-Ofram William[5], Sieck Kevin[6] y Salinas Prieto José Antonio[7]
[1]*UNAM*
[2]*CICESE*
[3]*Iowa State University*
[4]*SMHI*
[5]*Met Office*
[6]*Max Plank*
[7]*IMTA*
ruth.cerezomota@gmail.com

Within CORDEX framework, in this work we analysed four different model's output from the CORDEX-North America over the North American Monsoon (NAM) core region. Model precipitation was compared against several observational gridded datasets at different time scales. From this analysis it was found that all four models capture well the annual cycle, however models have some problems to reproduce the interannual variability of the monsoon. To further investigate this, two extreme summer seasons were chosen: one wet (1990) and one dry (2005). It was found that during the wet year the land-sea thermal contrast (LSTC) was stronger, there was a larger number of hurricane near the Gulf of California, the warm pool was more extended, and the ICTZ was located northerly and all these processes contribute to a wetter NAM season. Whereas during the dry year (2005) the LSCT was weaker, with a later onset and a shorter rainy season, probably due to a previous very wet winter.

SE02-7

INTER-ANNUAL VARIABILITY OF PRECIPITATION OVER SOUTHERN MEXICO AND CENTRAL AMERICA AND ITS RELATIONSHIP TO SEA SURFACE TEMPERATURE FROM A SET OF FUTURE PROJECTIONS FROM REGCM4 CORDEX SIMULATIONS

Fuentes Franco Ramón[1], Giorgi Filippo[2], Coppola Erika[2], Pavia Edgar[3], Diro Gulilat Tefera[4] y Graef Federico[3]
[1]*The Abdus Salam International Centre for Theoretical Physics, ICTP*
[2]*ICTP*
[3]*CICESE*
[4]*UQAM*
rfuentes@ictp.it

The precipitation variability over the SMECAM region and its dependence on the gradient between Atlantic and Pacific sea surface temperature (SST) anomalies are verified by comparing how two GCM and four RegCM4 simulations reproduce SST anomaly patterns during wettest and driest years against those seen in observational datasets. RegCM4 does a comparably better job than the driving GCMs. This strong relationship between precipitation and SST anomalies does not appear to change substantially under future climate conditions. For the rainy season, June to September, we find a future change in inter-annual variability of precipitation towards a much greater occurrence of very dry seasons over the SMECAM region, with this change being more pronounced in the regional than in the global model projections. A greater warming of the Tropical Northeastern Pacific (TNP) compared to the Tropical North Atlantic (TNA), which causes stronger wind fluxes from the TNA to the TNP through the Caribbean Low Level Jet, is identified as the main process responsible for these drier conditions.

SE02-8

ANÁLISIS DE LA VARIABILIDAD ESPACIO-TEMPORAL DE LA SEQUÍA METEOROLÓGICA EN MÉXICO PARA UNA SIMULACIÓN DE 34 AÑOS (1979-2012) CON EL MODELO REGCM4

Méndez-Pérez Juan Matías[1], Méndez-Turrubiates Raúl Fernando[1], Cruz-Pastrana Daniela Alejandra[2], Cerezo-Mota Ruth[2], Luna-Niño Rosa Beatriz[1] y Ramírez López Ana Karen[1]
[1]*Universidad Veracruzana, UV*
[2]*UNAM*
jumendez@uv.mx

En este trabajo se discute la capacidad del modelo de clima regional RegCM4 para simular la variabilidad espacio-temporal de la sequía meteorológica en México y regiones adyacentes, con una resolución horizontal de 50 km. La simulación del modelo es forzada con el reanálisis de ERA-Interim, cubriendo el periodo de 1979 a 2012. Se realiza una comparación entre la precipitación mensual simulada y la observada (CRU TS3.2.1 y estaciones climatológicas). La sequía meteorológica está basada en el cálculo del Índice de Precipitación Estandarizada (SPI por sus siglas en inglés) para 3, 6, y 12 meses. Finalmente, se muestran y discuten las características (severidad, duración y distribución espacial) de la sequía observada y simulada.

SE02-9

FLOOD RISK ASSESSMENT IN JAMAICA: CASE STUDIES ON COMBINED TERRESTRIAL AND COASTAL FLOOD RISK DRIVEN BY PROJECTIONS OF FUTURE CLIMATE USING THE PRECIS REGIONAL CLIMATE MODEL

Mandal Arpita[1], Wilson Matthew[2] y Taylor Michael[3]
[1]*University of the West Indies, Mona Campus, UWI MONA*
[2]*Department of Geography, University of the West Indies, St. Augustine, Trinidad & Tobago*
[3]*Climate Studies Group, Department of Physics, University of the West Indies, Mona, Jamaica*
mandalarpitaster@gmail.com

By virtue of its location in the Atlantic hurricane belt, Jamaica is exposed to both terrestrial and coastal flooding from extreme rainfall events and storm surges. The island has experienced severe flooding events, the frequency of which has increased in the last decade concurrent with an increase in the frequency of hurricanes and tropical storms resulting in damage of over US $1.27 Bn (Planning Institute of Jamaica, 2011). Flooding in Jamaica ranges from riverine as in the Yallahs river watershed in Eastern Jamaica to a combination of coastal and terrestrial in the low-lying areas of Negril in west Jamaica. Terrestrial flood models for Yallahs watershed exist but they date back to 1984 and are not two dimensional flood models. For Negril, however, inland flooding has not been studied previously and no flood risk map exists for the South Negril-Orange river watershed. In addition. This project considers the effects of extreme rainfall on the two topographically distinct yet vulnerable watersheds of Jamaica showing distinct spatial variability in the rainfall patterns. The present research created flood models for the lower Orange and Negril River and the Yallahs river using the HEC-HMS hydrological and the LISFLOOD-FP hydraulic models. Intensity-Duration-Frequency (IDF) for the present day were calculated from measured rainfall data and used to drive the HEC-HMS model of catchment hydrology to produce streamflow levels for a range of exceedance probabilities from the upper sections of the catchments. Calculated streamflows were then used to drive the 2D hydraulic model code, LISFLOOD-FP, capable of flood wave routing and the calculation of overland flow and able to incorporate downstream boundary water-level effects. Storm surges for past events were incorporated in the model through tidal measurements. In this way, the relative importance of storm-surge vs. rainfall in causing flood inundation risk was assessed and mapped. The model was also used to run simulations for tropical storm Gustav which had caused widespread flooding island-wide. IDF curves were then perturbed for future climate using the PRECIS regional climate model with projections of future climate generated using multiple realizations from the PRECIS model for the 2099's forced with two Global Climate Models (HadCM and ECHAM) at its lateral boundaries and run under two different Special Report on Emissions Scenarios (SRES scenarios). For both the watersheds, the rainfall intensities for the different probabilities of exceedances increased under the B2 scenario for both time periods (2040-2070 and 2070-2099). However, the A2 scenario showed a decline in the long term (2070-2099) projections as compared to the mid-term. These future IDF's were then used to drive the HEC-HMS model to generate future streamflows which were then used in the LISFLOOD-FP model, together with projections of future sea-level, enabling the prediction of future flood hazard maps incorporating both terrestrial and coastal flooding.

SE02-10

ANÁLISIS DE 15 MODELOS DE CIRCULACIÓN GENERAL (CMIP3) PARA LA CLIMATOLOGÍA Y TENDENCIAS DE TEMPERATURA Y PRECIPITACIÓN EN MÉXICO

Montero Martínez Martín José[1] y Martínez Jiménez Jessica[2]
[1]*Instituto Mexicano de Tecnología del Agua, IMTA*
[2]*CICESE*
martin_montero@tlaloc.imta.mx

La variabilidad climática se ha convertido en uno de los temas más importantes dentro de las ciencias ambientales, ya que actualmente el clima ha presentado variaciones considerables, debido principalmente a modificaciones causadas por el hombre, las cuales alteran el ciclo hidrológico mundial y la circulación atmosférica y oceánica. Lo anterior trae como consecuencia la afectación de variables meteorológicas como la temperatura y precipitación, es por esto la importancia de estudiar las simulaciones de los Modelos de Circulación General (MCGs), con la finalidad de encontrar los MCGs que mejor representen la climatología y la tendencia de dichas variables para la República Mexicana. En el presente estudio se analizó la climatología y la tendencia para la precipitación y la temperatura en 9 zonas de la República Mexicana para el periodo 1961-1990. Para el análisis se hizo uso de 15 MCGs que participaron en el pasado 4to. Reporte de Evaluación del Panel Intergubernamental de Cambio Climático (IPCC) y de la base de datos observados Climatic Research Unit (CRU). De las simulaciones hechas por los MCG se comparó con la base de datos CRU a través de un estudio estadístico en el que se obtuvo la correlación y error cuadrático medio. De dicha simulación se observó que los MCG simularon adecuadamente los patrones de la precipitación y temperatura en el norte del país asociado con el monson y, en el centro y sureste con la sequía intraestival.

SE02-11

EVALUACIÓN DEL DESEMPEÑO DE MODELOS ATMOSFÉRICOS GLOBALES PARA MÉXICO EN 6 VARIABLES ATMOSFÉRICAS

Salinas Prieto José Antonio, Colorado Gabriela, Maya Magaña María Eugenia y González Robles Maura
Instituto Mexicano de Tecnología del Agua, IMTA
jsalinas@tlaloc.imta.mx

Se realizó un estudio para calcular el desempeño de 16 modelos de circulación general del experimento CMIP5 (Proyecto de Inter-comparación de Modelos Acoplados, fase 5, por sus siglas en inglés.) tanto para períodos históricos como a futuro: aplicando los forzantes radiativos de los escenarios RCP2.6, RCP4.5 y RCP8.0 de dos periodos del siglo XXI: de 2015 a 2039 y de 2075 a 2099. El desempeño se evaluó utilizando las observaciones de la base de datos de datos NARR (North American Regional Reanalysis), con resolución de 0.3°. Las variables analizadas son: precipitación, temperatura, humedad relativa, específica, presión a nivel del mar y viento (tanto zonal como meridional) que ofrezcan información para emprender acciones de adaptación al clima actual y a su posible cambio en 5 regiones mexicanas. Mediante el método de ensamble ponderado llamado REA (Reliability Ensemble Averaging), de los 16 modelos, se estimó el grado de fiabilidad de cada uno de los modelos utilizados. Se destacan los siguientes resultados: 1. En la comparación tanto de los modelos globales como de su ensamble (REA) contra los datos del NARR se observan que no es posible estimar un modelo único como el de mejor desempeño, ya que éste no es homogéneo, es decir, el mismo modelo no estima adecuadamente todas las variables. 2. La incertidumbre se incrementa para el escenario RCP8.5 3. Respecto al futuro lejano (2075-2099) se estiman proyecciones de cambio en eventos extremos (P95) en México: En precipitación desde -1mm hasta 2.5mm. En temperatura máxima desde 2.5°C hasta 8.5°C En temperatura mínima desde 3.0°C hasta 6.0°C Para entender las principales causas de los errores de los modelos, es necesario aplicar regionalizaciones dinámicas y analizar los efectos locales como: la influencia de la abrupta orografía mexicana en la dinámica atmosférica, la ubicación e intensidad de la precipitación asociada a la zona de convergencia intertropical, la intensidad y ubicación de la corriente del pacífico de niveles altos y su relación energética con los frentes fríos, la intensidad y variabilidad estacional de la corriente en chorro de niveles bajos del Caribe y su intercambio energético con las ondas del este, la reproducción adecuada del inicio e intensidad de la precipitación asociada al Monzón de Norteamérica y su relación con la dinámica local como los sistemas convectivos de mesoescala y la orografía

SE02-12

PRONÓSTICO DE LLUVIA POR ENSAMBLE PONDERADO CON EL MODELO WRF PARA LA REPÚBLICA MEXICANA

Mendoza Uribe Indalecio[1] y Rosario de la Cruz José Guadalupe[2]
[1]*Instituto Mexicano de Tecnología del Agua, IMTA*
[2]*CTI Automation S.A. de C.V.*
indalecio_mendoza@tlaloc.imta.mx

El modelo de investigación y previsión del tiempo WRF (por sus siglas en inglés, Weather Research Forecast) es un sistema de predicción numérica de mesoescala sumamente flexible. Se ha convertido en una de las herramientas más utilizadas para las predicciones meteorológicas, aunque también se puede utilizar para otro tipo de estudios como son la calidad del aire, modelación climática regional y previsión meteorológica a corto plazo. Existen diferentes líneas de trabajo sobre la calibración, validación y mejora del desempeño del modelo para la República Mexicana. Entre dichos trabajos se encuentran la asimilación de datos, corrección estadística y modelación por ensambles. Para esta última, a partir del año 2008, en el Instituto Mexicano de Tecnología del Agua, se empezó a correr el modelo WRF en modo ensamble lineal con seis miembros, asignando el mismo peso a cada miembro del ensamble, utilizando como variación entre cada miembro del ensamble la parametrización del esquema de nube cúmulus: Kain-Fritsch, Betts-Miller-Janic, Grell-Devenyi, Grell 3D, Arakawa y Old Kain-Fritsch. A diferencia de otras variables meteorológicas, como es el caso de la temperatura, la lluvia es la variable más difícil de pronosticar. A pesar que el pronóstico por ensamble ha demostrado mejoras en el pronóstico de lluvia a nivel nacional, aun presenta un sesgo con respecto a los registros diarios de precipitación cuando se realiza el pronóstico regional. Este trabajo presenta la mejora en el pronóstico de lluvia acumulada en 24 horas obtenida con el modelo WRF con seis diferentes parametrizaciones de nubes cumulus, dando mayor peso a los miembros del ensamble que tienen un elevado coeficiente de correlación de pearson y un menor error cuadrático medio de las corridas históricas con respecto a los registros diarios de precipitación de la red de estaciones climatológicas del Servicio Meteorológico Nacional. Las corridas del modelo WRF se realizaron tomando como condiciones iniciales y de frontera las salidas del modelo GFS (por sus siglas en inglés, Global Forecast System) a medio grado de resolución. La resolución espacial es de 30 km con escritura de resultados cada tres horas. Se considera la lluvia acumulada entre las 12Z del día de inicialización del modelo y las 12Z del día siguiente.

SE02-13 CARTEL

ANÁLISIS DE LA VARIABILIDAD CLIMÁTICA INTERANUAL DE LA REGIÓN CENTRO-NORTE DE MÉXICO USANDO DATOS COMPUESTOS DE NARR-CLICOM

Pineda-Martinez Luis F y Ríos Sánchez Diana Citlalli
Universidad Autónoma de Zacatecas, UAZ
lpineda@uaz.edu.mx

En este trabajo presentamos lo resultados de un análisis de la variabilidad climática de la región Centro-Norte de México. Aunque existen varias bases de datos climáticos para México, en la mayoría de ellas no se cuenta con un conjunto de datos históricos suficientes para la investigación del clima a nivel regional ya que también se caracterizan por una extrema desigualdad en la cobertura espacial y temporal. Debido a las limitaciones presentes en las bases de datos climáticos en México para el análisis del clima, el objetivo de este trabajo fue realizar un ensamble de datos de precipitación, temperatura máxima y mínima observados (CLICOM) y de reanálisis (NARR) a una malla regular en un periodo de 1985 a 2010. Los resultados muestran que NARR tiene una alta correlación con datos observados de precipitación y en menor proporción con los datos de temperatura. Al final se logró generar mallas de datos compuestos que representan una gran ventaja de distribución espacial y sin huecos en las series de tiempo.

SE02-14 CARTEL

ANÁLISIS PRELIMINAR DE LA INCERTIDUMBRE EN MODELOS REGIONALES DE PRECIPITACIÓN EN SUDAMÉRICA.

Castillo Pérez Nadia Itzel[1] y Solman SIlvina A.[2]
[1]*Centro de Investigaciones del Mar y la Atmósfera, CIMA*
[2]*CIMA*
ncastillo@cima.fcen.uba.ar

La Incertidumbre en las simulaciones climáticas se debe a diferentes fuentes: la variabilidad interna de los modelos climáticos, las imperfecciones en los modelos climáticos y la incertidumbre en los escenarios futuros de emisión. Este trabajo presenta un avance preliminar sobre el estudio de la incertidumbre en modelos regionales sobre Sudamérica. A partir de un conjunto de simulaciones del clima presente (1961-1990) para Sudamérica realizadas con Modelos Climáticos Regionales (MCR) anidadas en Modelos Climáticos Globales (MCG), se estudió la capacidad de los MCR en la representación de la precipitación del clima presente: condiciones medias y variabilidad en diferentes escalas temporales (interanual, intraestacional, sinóptica y eventos extremos). Para la comparación de la simulaciones en el periodo presente se utilizaron diferentes bases de datos :CPC-UNI, Erainterim y WFDEI.

SE02-15 CARTEL

REGIONAL CLIMATE AND STREAMFLOW PROJECTIONS IN NORTH AMERICA UNDER IPCC CMIP5 SCENARIOS

Chang Hsin-I, Castro Christopher, Troch Peter y Mukherjee Rajarshi
University of Arizona
hchang@atmo.arizona.edu

The Colorado River system is the predominant water supply for the Southwest U.S. and is already fully allocated, making the region's environmental and economic health particularly sensitive to annual and multi-year streamflow variability. Observed streamflow declines in the Colorado basin in recent years are likely due to the synergistic combination of anthropogenic global warming and natural climate variability, which are creating a overall warmer and more extreme climate. Recent climate change studies for the Southwest U.S. region project a dire future, with chronic drought, and substantially reduced Colorado River flows. Multi-scale downscaling modeling experiments are designed using recent IPCC AR5 global climate model projections, which incorporate regional climate and hydrologic modeling components. The Weather Research and Forecasting model (WRF) has been selected as the main regional modeling tool; the Variable Infiltration Capacity (VIC) model will be used to generate streamflow projections for the basin. The WRF domain is set up to follow the CORDEX-North America guidelines with 25 km grid spacing, and the VIC model is individually calibrated for upper and lower Colorado basins. The multi-scale climate and hydrology study aims to characterize how the combination of climate change and natural climate variability is changing cool and warm season precipitation and streamflow. Further, to preserve the downscaled RCM sensitivity and maintain a reasonable climatology based on the observed record, a new bias correction technique is applied to the RCM data before forcing the hydrologic model. Of specific interest is how major droughts associated with La Nina-like conditions may worsen in the future, as these are the times with the Colorado River system is most critically stressed and would define the "worst case" scenario for water resource planning.

SE02-16 CARTEL

RELACIÓN ENTRE EL JET DEL CARIBE ESTIVAL Y LA DIFERENCIA DE TEMPERATURA SUPERFICIAL DEL MAR ENTRE LOS OCÉANOS PACÍFICO ORIENTAL Y ATLÁNTICO OCCIDENTAL DURANTE EL SIGLO XXI

Pavia Edgar[1], Fuentes Franco Ramón[2], Graef Federico[3] y Villanueva Ismael[3]
[1]*Centro de Investigación Científica y de Educación Superior de Ensenada, CICESE*
[2]*ICTP*
[3]*CICESE*
epavia@cicese.mx

Proyecciones realizadas con un modelo climático regional (RegCM4) sugieren un reforzamiento del Jet del Caribe (JC) estival como respuesta al aumento de la diferencia de temperatura superficial del mar entre los océanos Pacífico oriental y Atlántico occidental (?T) hacia fines del Siglo XXI. Este reforzamiento, a su vez, provocaría durante los veranos una disminución significativa de la precipitación pluvial sobre el Sur de México y Centroamérica (SMCA) al transportar humedad hacia el Pacifico lejos del continente. Como este dramático escenario es una señal robusta en varios trabajos previos, su estudio merece especial atención. En este trabajo proponemos un mecanismo para simular la posible evolución de la relación entre el JC y la ?T durante los Siglos XXI y XXII. El mecanismo consiste en un par de ecuaciones acopladas para una componente del viento zonal (U) y una componente de ?T (U* y ?T*) que al imponerles condiciones inicial y final provistas por el modelo RegCM4 encontramos que U* y ?T* tienen soluciones periódicas u oscilatorias. Como U=U*+U0 y ?T = ?T* + ?T0 esto significa que U y ?T tienen una predisposición a volver a su estado original provista por U* y ?T*. El resto de la física del problema está contenida en U0 y ?T0.

SE02-17 CARTEL

THE ONSET AND CESSATION OF THE CARIBBEAN EARLY RAINFALL SEASON: DIAGNOSING AND PREDICTING THE CARIBBEAN RAIN-BELT.

Allen Theodore
The University of Miami, RSMAS
tallen@rsmas.miami.edu

The annual rainfall cycle for the Caribbean basin reveals a distinct bimodal pattern with peaks during the late spring and late summer months. A relative minimum during the mid-summer, known as the mid-summer drought (MSD) separates the early rainfall season (ERS) from the late rainfall season. Accumulated rainfall totals during the ERS appear as a quasi-stationary rain-belt stretching across the Caribbean from the southwest to the northeast. We place late spring rains in the Caribbean in context of other subtropical convergence zones in order to address the onset and cessation of the ERS while also offering an explanation of a Caribbean rain-belt pattern. Upper tropospheric westerlies, mid-tropospheric positive temperature advection, and moist low level poleward flow are the three primary ingredients that conspire to produce the first peak of the annual bimodal rain signal and the related Caribbean early season rain-belt. The MSD ensues as the primary ingredients weaken across the Caribbean and enhanced rainfall shifts north along the North Atlantic Convergence Zone (NACZ). Seasonal rainfall totals from the ERS through the MSD periods reveal a continuous rain-belt that extends from the Caribbean to the NACZ termed the Caribbean Atlantic Rain-belt (CAR-belt). The Car-belt is present in the long term mean, but has signs of interannual variability. We build a linear inverse model based on the diagnostic ingredients of the Caribbean rain-belt to predict outgoing long-wave radiation anomalies associated with the early rainfall season. Prediction skill score is assessed from error squared variance and correlation on lead times up to three weeks.

SE02-18 CARTEL

PROYECCIONES DE CAMBIO CLIMÁTICO PARA EL ALTIPLANO SUDAMERICANO HACIENDO USO DEL MODELO REGIONAL RCA4(EC-EARTH)

Barreto Schuler Christian
Servicio Nacional de Meteorología e Hidrología del Perú, SENAMHI
christian.b.sch@gmail.com

La región del altiplano podría ser fuertemente afectada por el cambio climático futuro. Los posibles cambios en los patrones de precipitación y temperatura inciden principalmente en las actividades del sector agropecuario, hidroeléctrico, etc. Teniendo en cuenta la importancia del cambio climático sobre esta región de Sudamérica, este trabajo tiene como principal objetivo la evaluación de sus posibles cambios en la precipitación y las temperaturas máximas y mínimas. En la evaluación del cambio climático para el Altiplano Sudamericano se estudiaron las proyecciones para el futuro cercano (2035), medio (2060) y lejano (2085), realizadas por el modelo regional RCA4. Para ello, inicialmente se validó el clima presente (1971-2000) del modelo regional, para lo cual se utilizaron datos del CRU, empleando algunos estadísticos como correlación, BIAS, RMSE, etc. Los resultados de la validación mostraron que el modelo regional posee un buen desempeño en la simulación del ciclo anual de la precipitación, sobrestimando la media mensual (aprox. 1.5mm/dia) en los periodos de primavera y verano austral. Sin embargo, estacionalmente se encontró una muy baja correlación temporal con lo observado. En las temperaturas máximas y mínimas, el modelo regional también logra simular el ciclo anual y estacionalidad. Sin embargo, ambas variables son subestimadas con BIAS de media mensual de 7ºC y 2.5ºC, respectivamente. Estacionalmente, el modelo regional posee menor variabilidad (con excepción del periodo de invierno) y bajas correlaciones con respecto a lo observado. Para las proyecciones a futuro se analizaron los escenarios rcp8.5 y rcp4.5, siendo el primero la ruta con mayores concentraciones de CO2 para fines del 2100. Es así que, en los periodos futuros bajo ambos escenarios de estudio; la precipitación proyectada por el modelo RCA4 muestra leves incrementos (descensos) en los periodos verano y primavera (otoño e invierno). Por otro lado, las temperaturas proyectadas simulan fuertes incrementos durante todo el ciclo anual, aumentando hasta en 2ºC para mediados de siglo XXI. En general, los cambios encontrados fueron de mayor intensidad para fines de siglo y bajo el escenario rcp8.5.

SE02-19 CARTEL

CLIMATE CHANGE IMPACT ON PRECIPITATION FOR THE AMAZON AND LA PLATA BASINS

Llopa Marta, Coppola Erika, Giorgi Filippo, da Rocha Rosmeri y Cuadra Santiago
International Centre for Theoretical Physics, ICTP
mllopart@ictp.it

We analyze the local and remote impacts of climate change on the hydroclimate of the Amazon and La Plata basins of South America (SA) in an ensemble of four 21st century projections (1970–2100, RCP8.5 scenario) with the regional climate model RegCM4 driven by the HadGEM, GFDL and MPI global climate models (GCMs) over the SA CORDEX domain. Two RegCM4 configurations are used, one employing the CLM land surface and the Emanuel convective schemes, and one using the BATS land surface and Grell (over land) convection schemes. First, we find considerable sensitivity of the precipitation change signal to both the driving GCM and the RegCM4 physics schemes (with the latter even greater than the first), highlighting the pronounced uncertainty of regional projections over the region. However, some improvements in the simulation of the annual cycle of precipitation over the Amazon and La Plata basins is found when using RegCM4, and some consistent change signals across the experiments are found. One is a tendency towards an extension of the dry season over central SA deriving from a late onset and an early retreat of the SA monsoon. The second is a dipolar response consisting of reduced precipitation over the broad Amazon and Central Brazil region and increased precipitation over the La Plata basin and central Argentina. An analysis of the relative influence on the change signal of local soil-moisture feedbacks and remote effects of Sea Surface Temperature (SST) over the Niño 3.4 region indicates that the former is prevalent over the Amazon basin while the latter dominates over the La Plata Basin. Also, the soil moisture feedback has a larger role in RegCM4 than in the GCMs.