CORDEX Activities in Mexico, Central America and the Caribbean

Tereza Cavazos
Department of Physical Oceanography, CICESE
Ensenada, Baja California, Mexico

7th RegCM Workshop
12-23 May 2014, ICTP, Trieste, Italy

CORDEX Original Domains

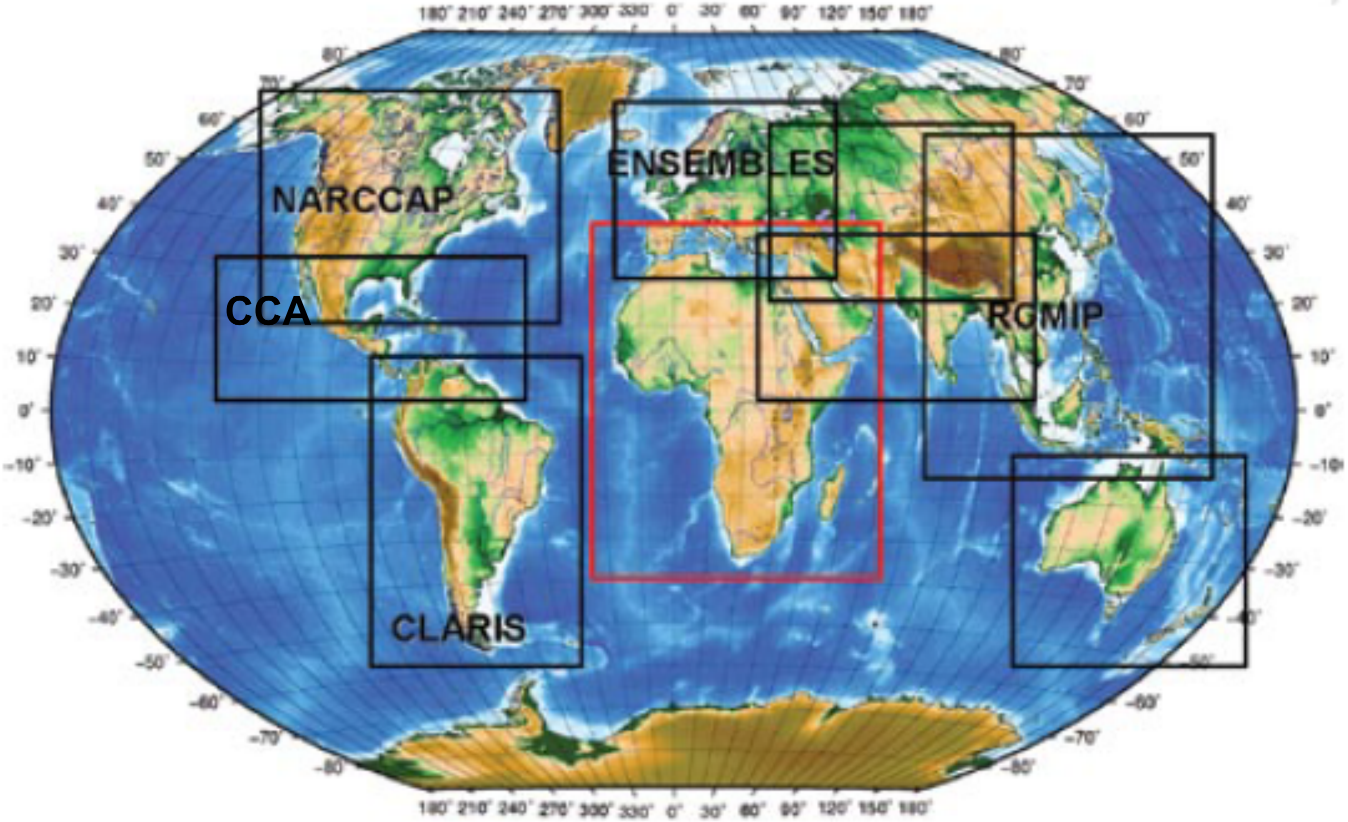


Figure 3— Regional domains planned for the CORDEX experiments (some still under discussion); also indicated are existing projects that make use of the corresponding domain.

Giorgi et al. 2009, *WMO Bulletin* 58 (3) - July 2009 | **175**

CORDEX CCA and CCA2 Domains
ICTP and Sweden groups

Diro et al. 2012; Fuentes-Franco et al. 2014; Nikulin

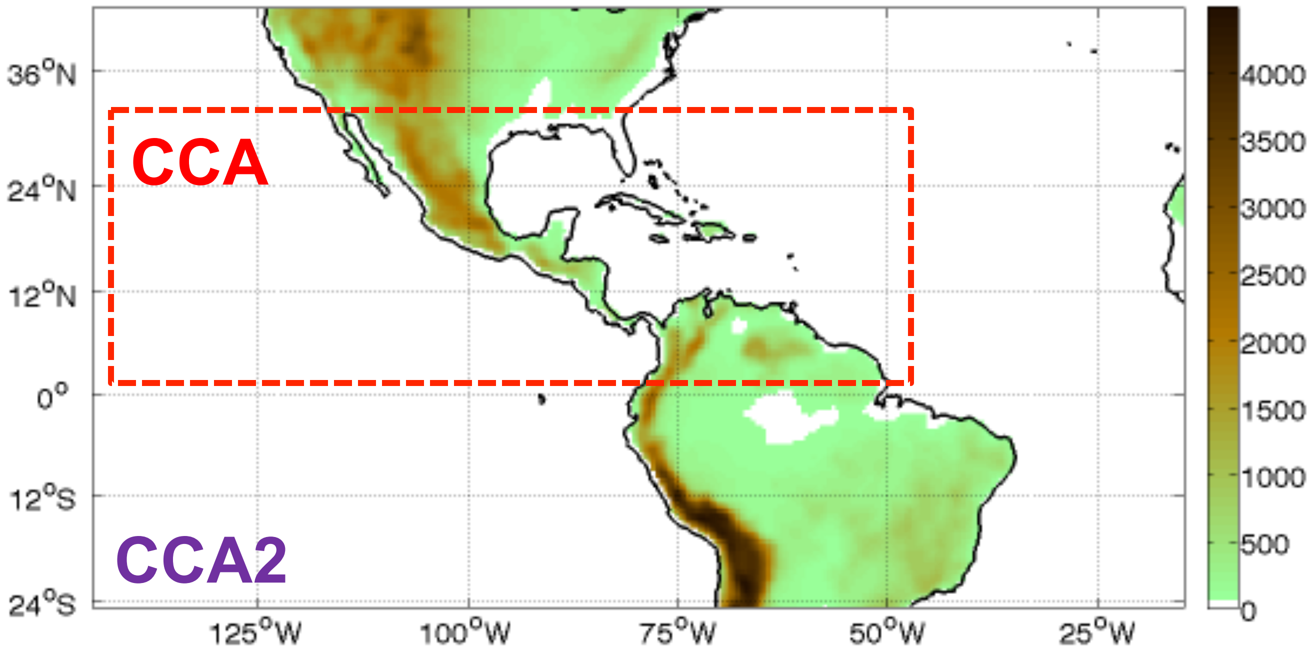
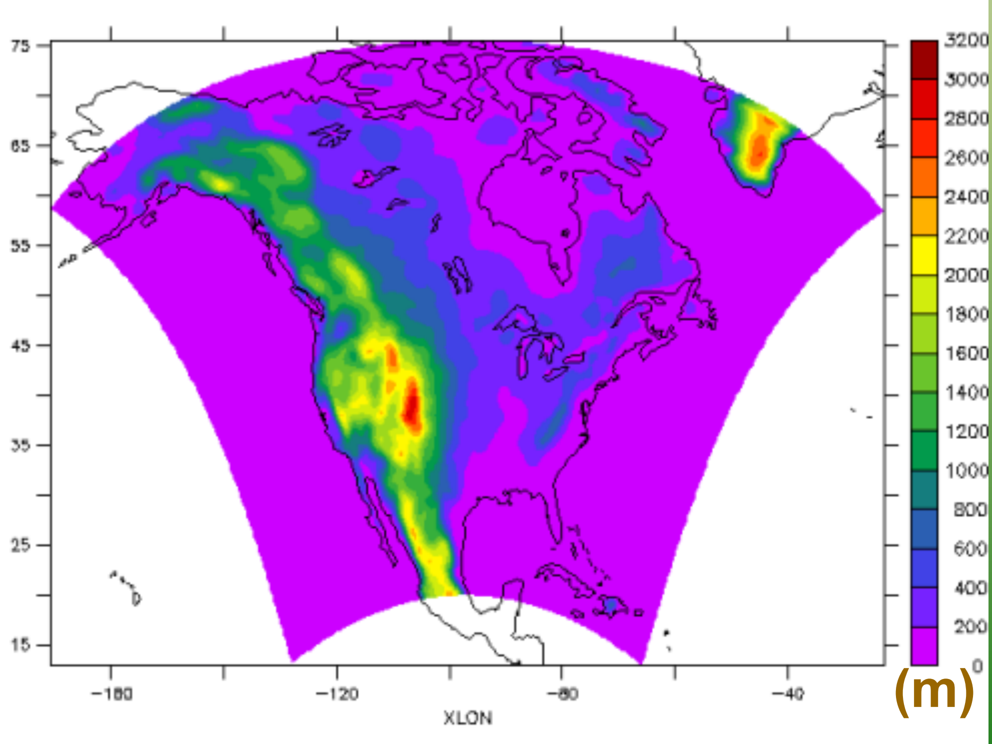


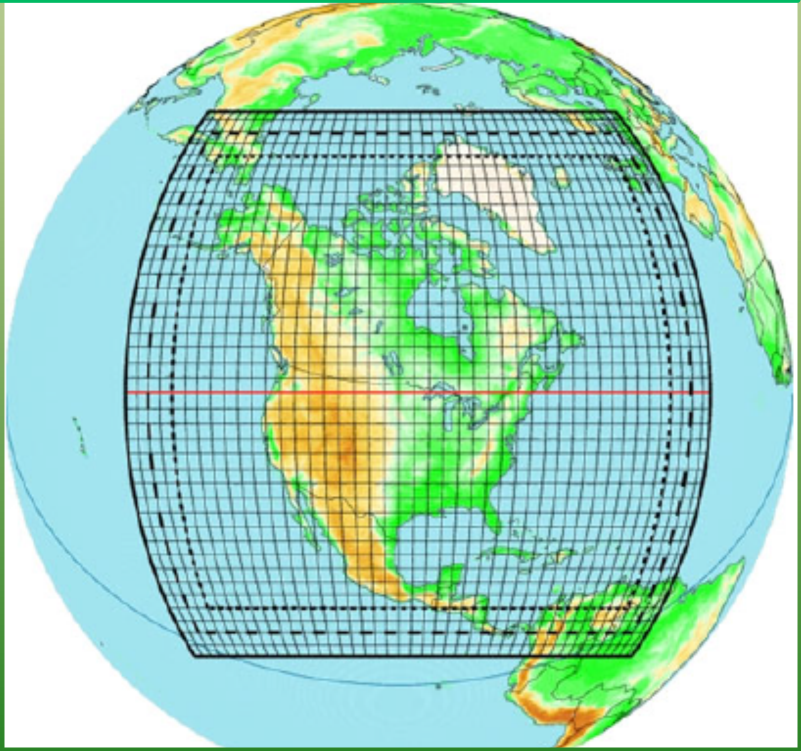
Figure 1. Topography of the Central America CORDEX domain. Colorbar units: meters.

NARCCAP Region

- US groups (Iowa: Gutowski and Arritt; Berkeley: Wehner; NCAR: Bukovsky et al.)
- Sweden group (G. Nikulin)
- Mexico group (Cerezo-Mota, Cavazos, et al.)
- Canadian-Swiss group (Martynov et al., Separovie et al.)
- UNAMex - U of AZ (Benjamin Martinez and Chris Castro)



http://www.narccap.ucar.edu/



Canadian/Swiss group

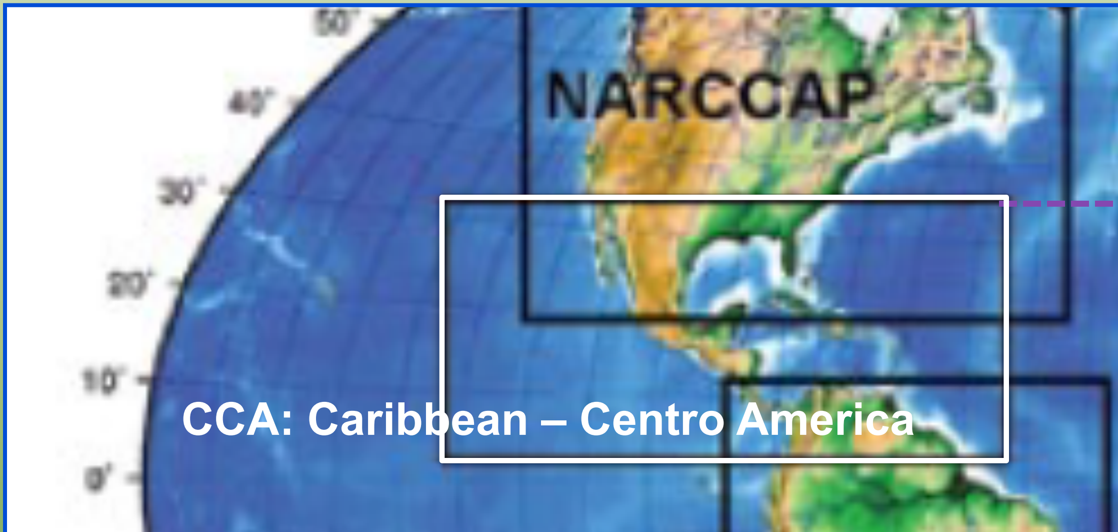
Other Modeling Groups

- **Germany group** (Hamburg and MPI, Jacobs et al.) – Validations in all CORDEX regions using REMO
- **U of Arizona and UNAM-Mex** – dynamical downscaling (WRF; REMO coupled to oceanic MPI at 100, 50, 25 and 17 km) for a region larger than NARCCAP. Interested in doing CORDEX (Chris Castro and B. Martinez)
- **U of Costa Rica** – interested in going to the RegCM workshop in Nov, but not working in CORDEX now (Jorge Amador and Eric)
- **Caribbean Islands** – Cuba and other Islands doing regional modeling

CORDEX CCA2 and NARCCAP Process Studies and Validations

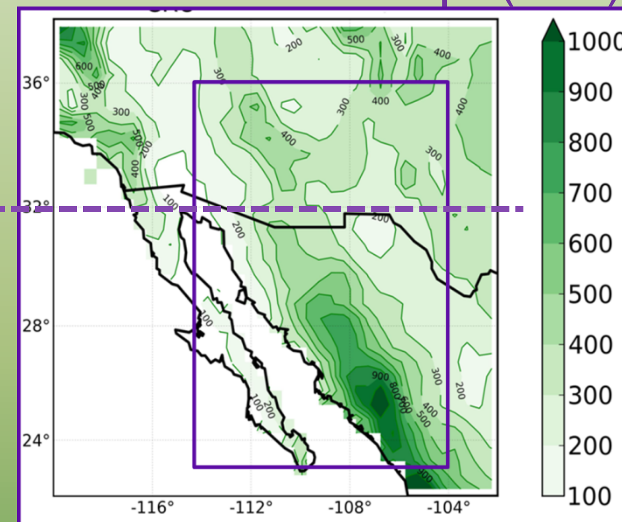
- **NARCCAP: NA monsoon, GPLLJ, SST biases**
  - CRCM5: Martynov et al. 2013; Separovie etal. 2013
- **NARCCAP: Extreme events and NA monsoon**
  - Ensemble of several RCMs: Wehner 2013
  - Several RCMs: Cerezo-Mota, Cavazos, Arritt, et al.
- **CCA2: Diurnal cycle and convection**
  - RegCM4: Diro et al. 2012
- **CCA2: CLLJ, MSD, warm pools, sensitivity to SSTs and land-surface schemes**
  - RegCM4: Diro et al. 2012; Fuentes-Franco et al. 2014
- **CCA2: Tropical cyclones, extreme events**
  - RegCM4: Fuentes-Franco et al. 2014; Diro et al. 2014
- Precipitation (regional validations – all groups)
- CMIP5 studies and regional validations

Original CORDEX Domains: NARCCAP and CCA



Giorgi et al. 2009, *WMO Bulletin* 58 (3) - July 2009 | 175

Monsoon Precip (mm)



CCA NBdy = 32 N

NARCCAP SBdy = 18 N

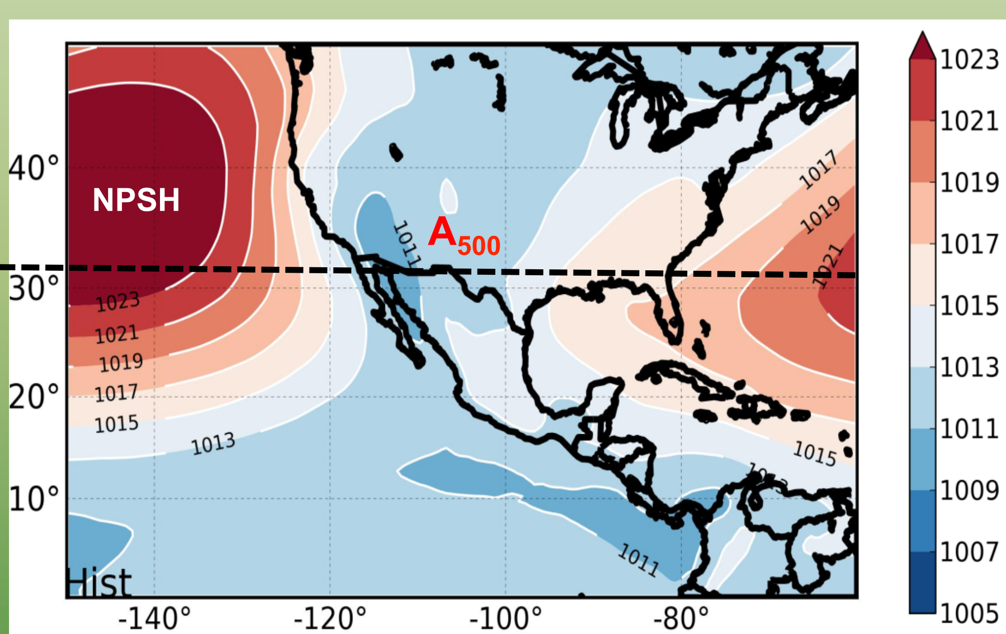
Mean Summer (JJA) SLP (mb) based on 6 CMIP5 GCMs (1979-2004)

(HadGem2-ES, MPI, MRI, CSIRO, CNRM, Can)

CCA2 N Bdy

CCA N Bdy

NARCCAP S Bdy

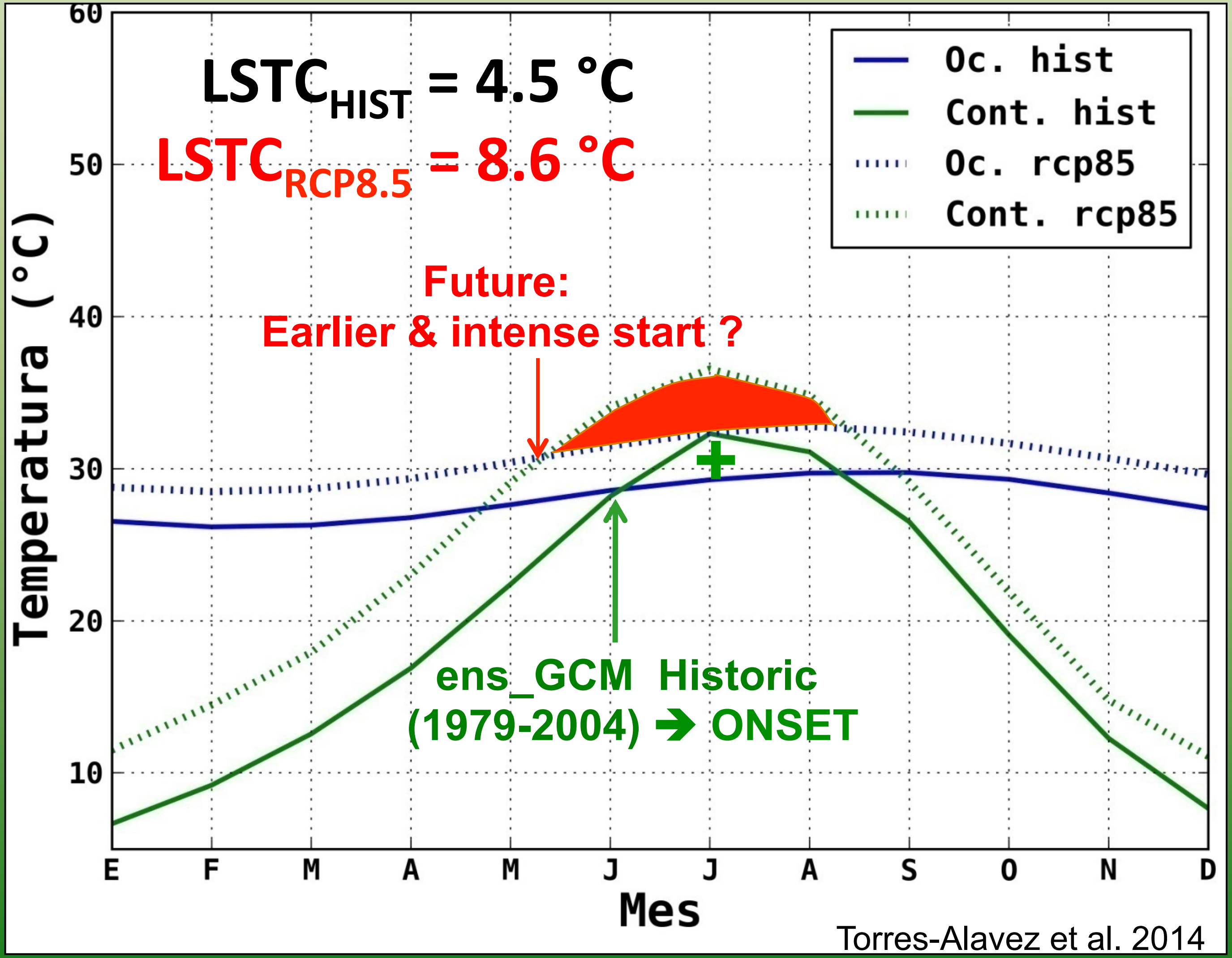


- Monsoon low
- Mid-tropos A
- NASH
    - warm pool,
    - CLLJ
- NPSH
- Land-sea thermal contrast (LSTC)
- ITCZ

LSTC (Desert-EPAC) modulates the onset of the monsoon

Torres-Alavez et al. 2014, J. Climate

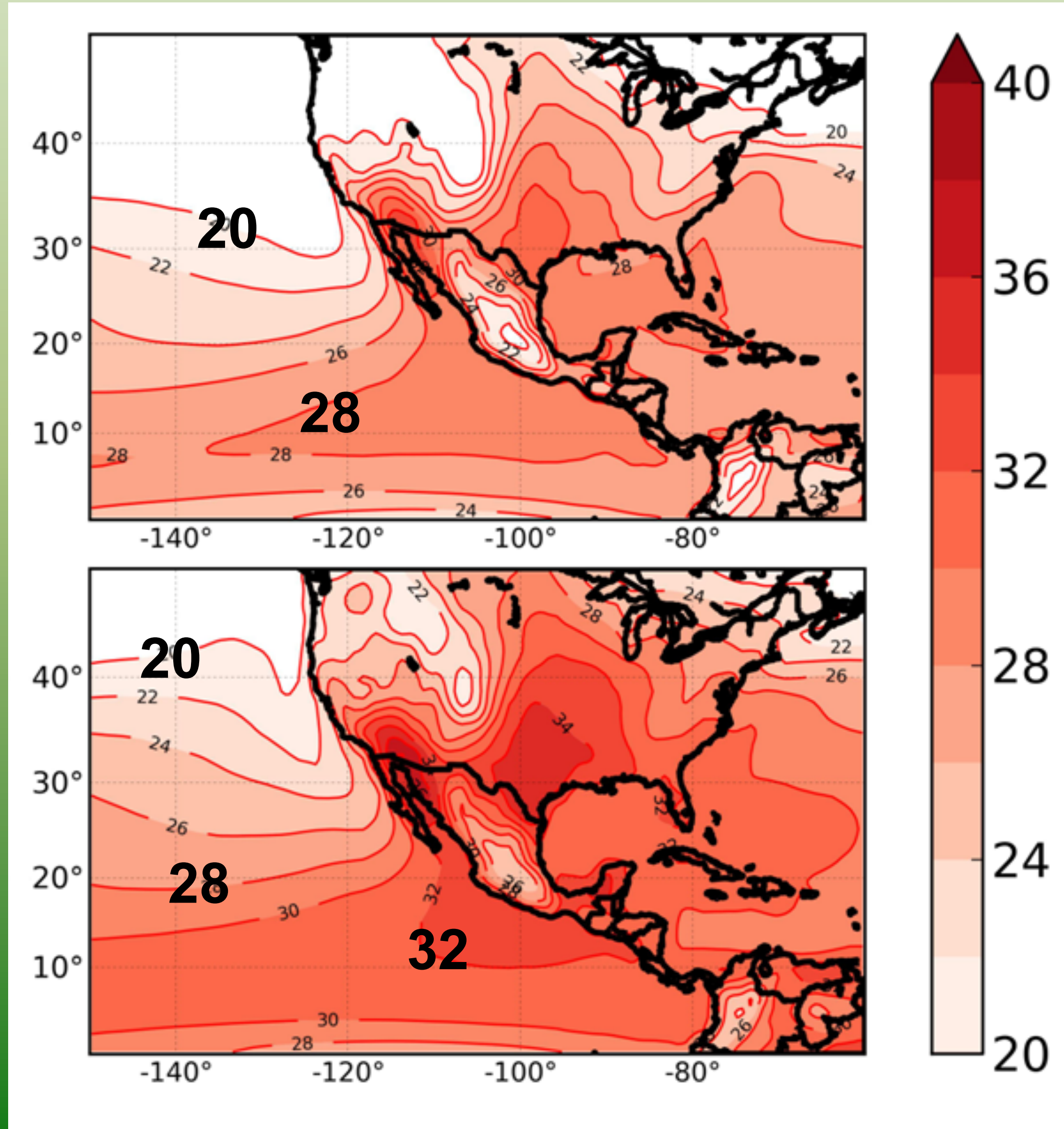
Change in the land-sea thermal contrast (2075-2099 and 1979-2004)



6 CMIP5 GCMs: Summer (JJA) Tskin (°C)
Historic (1979-2005) and RCP8.5 scenario (2075-2099)

Historic:
1979-2004
LSTC = 4.5°C

RCP8.5:
2075-2099
LSTC = 8.6°C



6 GCCMs

- Land-sea midTropospheric thermal contrast: decrease (JJ)
- Increase MidTr Stability (Torres-Alavez et al. 2014)
- Less NAM Prec

RegCM4

- Thermal gradients (Diro et al. 2013; Fuentes-Franco et al. 2014)

Vol. 58: 221–234, 2014
doi: 10.3354/cr01192

CLIMATE RESEARCH
Clim Res

Published January 7

Eastern Tropical Pacific hurricane variability and landfalls on Mexican coasts

Julio N. Martinez-Sanchez, Tereza Cavazos*

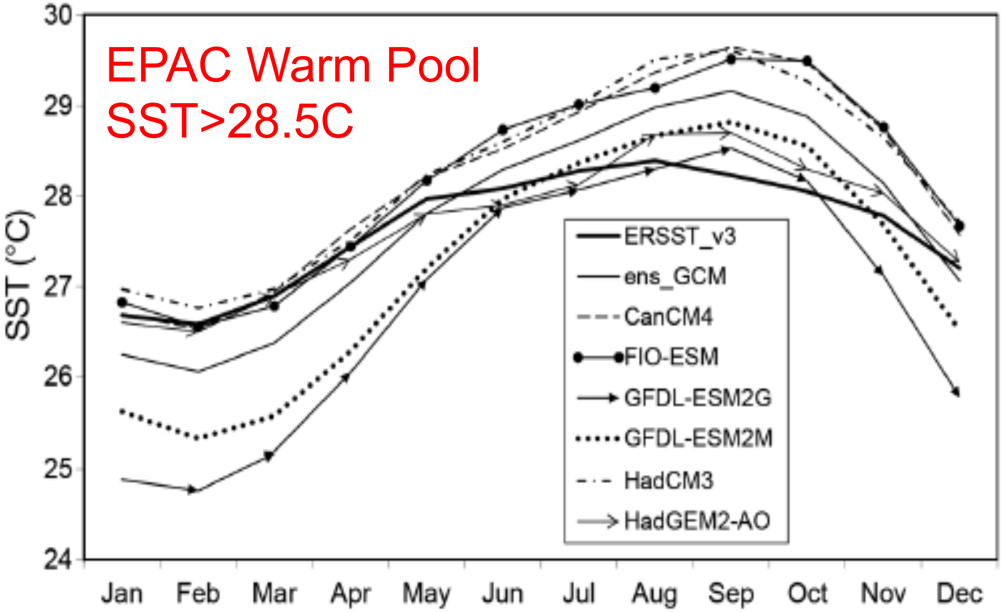


Fig. 8. Mean annual cycle of sea surface temperature (SST) averaged over the main development region of the Eastern Tropical Pacific during 1961–2000 for the observed NOAA Extended Reconstructed SST v3b (ERSST_v3) and the historical simulations of 6 general circulation models (GCMs; see Table 1) and their mean ensemble (ens_GCM)

Size of EPAC and NATL Warm Pools

Table 7. Same as Table 6, but for the average size ($\times 10^6$ km^2) of the Western Hemisphere Warm Pool in the Eastern Tropical Pacific (EPAC) and North Atlantic (NATL) basins according to observed NOAA Extended Reconstructed SST v3b (ERSST_v3) and the mean ensemble (ens_GCM) of the 6 general circulation models (GCMs) in Table 1 for the historical period 1961–2000. SST: sea surface temperature

SST	EPAC	NATL	Total
ERSST_v3	2.1	4.2	6.3
ens_GCM	3.4	2	5.4

1970-2010

Event	EPAC	NATL	Total
La Niña	1.4	6.3	7.7
Neutral	1.8	5.4	7.2
El Niño	2.4	4.6	7.0
Average	1.9	5.4	7.3

Warm EPAC and Cool NATL: Kozar & Mizra 2013; Fuentes-Franco et al. 2014

Fuentes et al. 2014, Clim Dyn, submitted

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.

MSD region ➔ drier

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 CMIP5 GCMs and RegCM4 CORDEX simulations

Ramón Fuentes-Franco[1,2]

Erika Coppola[2]

Filippo Giorgi[2]

Edgar G. Pavia[1]

Gulilat Tefera Diro[3]

Federico Graef[1]

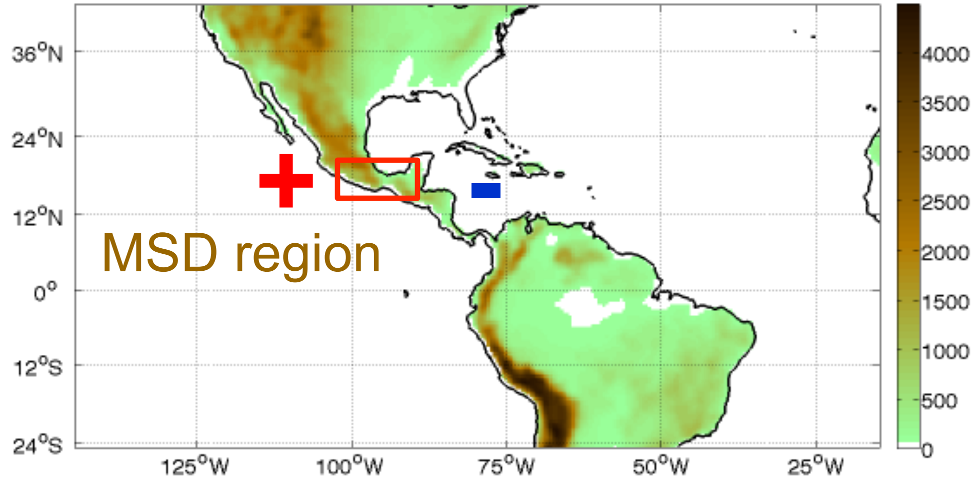


Figure 1. Topography of the Central America CORDEX domain. Colorbar units: meters.

Clim Dyn (2014) 42:629–647
DOI 10.1007/s00382-013-1686-z

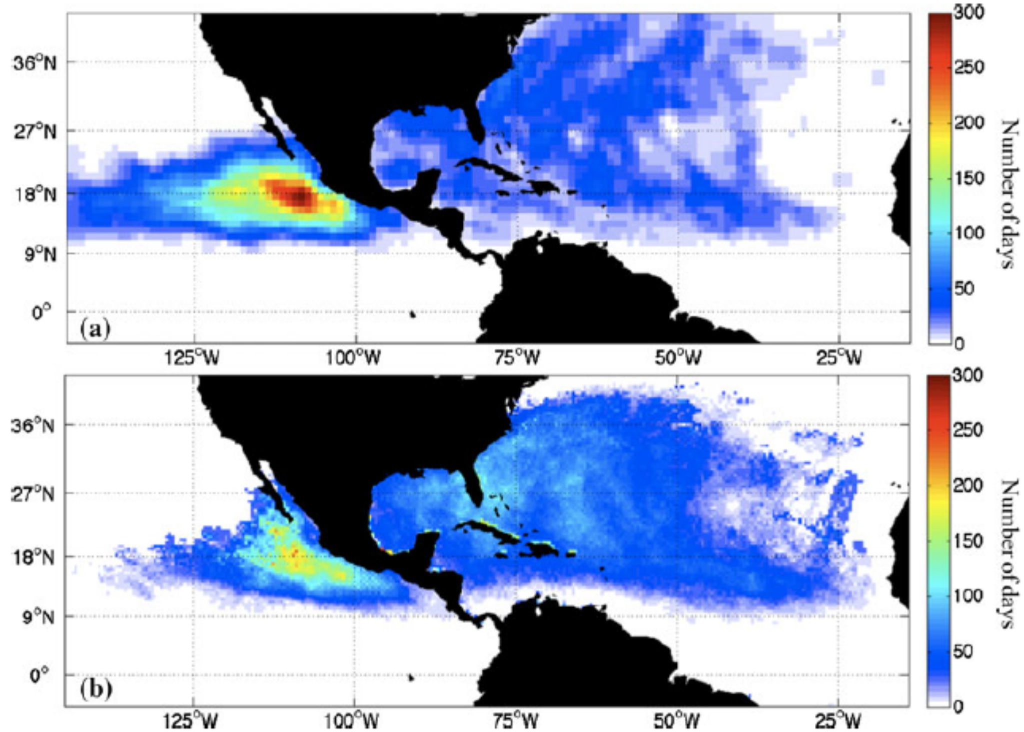
Assessment of RegCM4 simulated inter-annual variability and daily-scale statistics of temperature and precipitation over Mexico

Ramón Fuentes-Franco · Erika Coppola · Filippo Giorgi · Federico Graef · Edgar G. Pavia

Fig. 16 Number of tropical cyclone days (NCD) for the 1982–2008 period. **a** Observed from HURDAT and **b** from RegCM4 simulation

HURDAT: NCDays

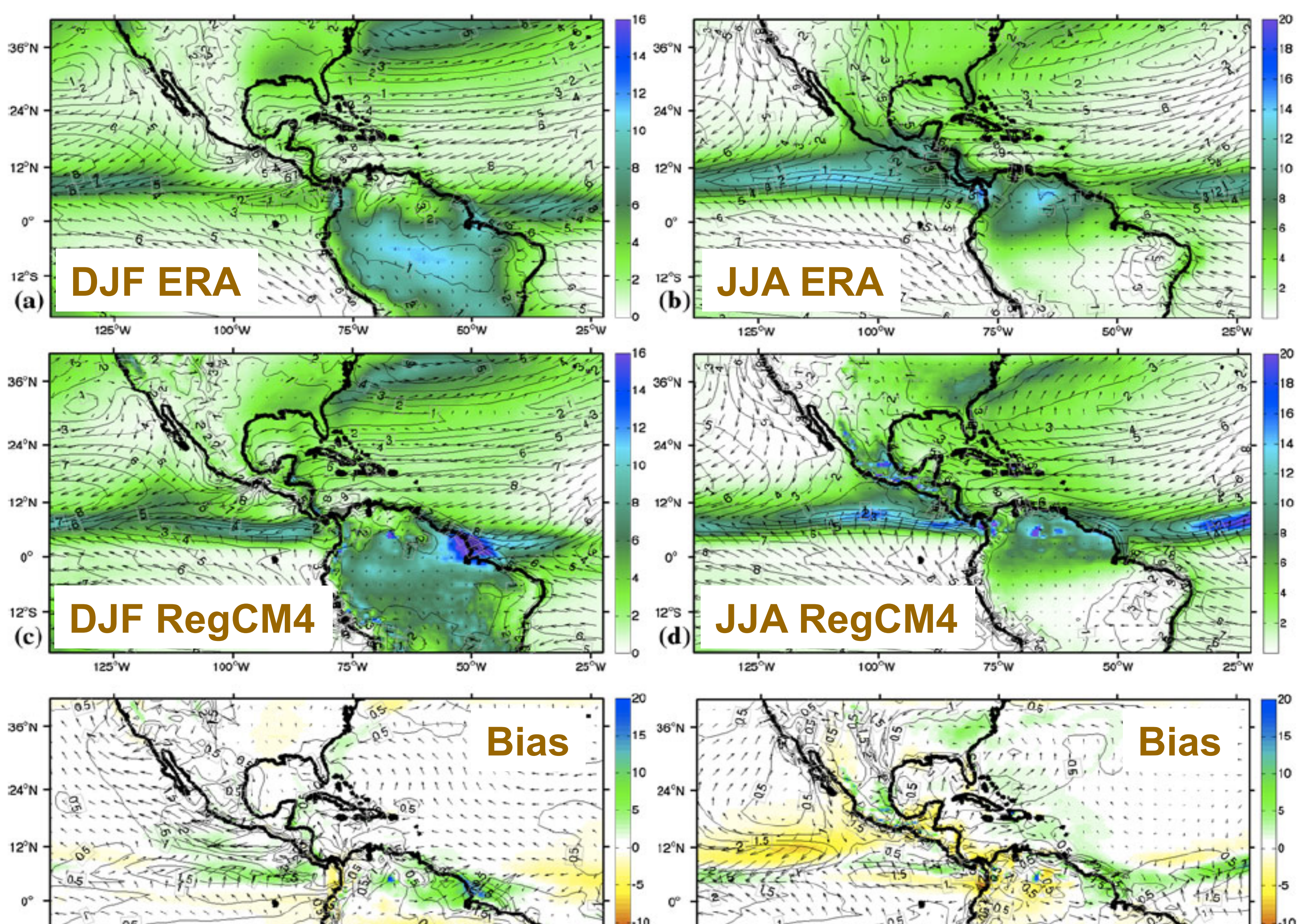
RegCM4 forced by HadGEM2-ES



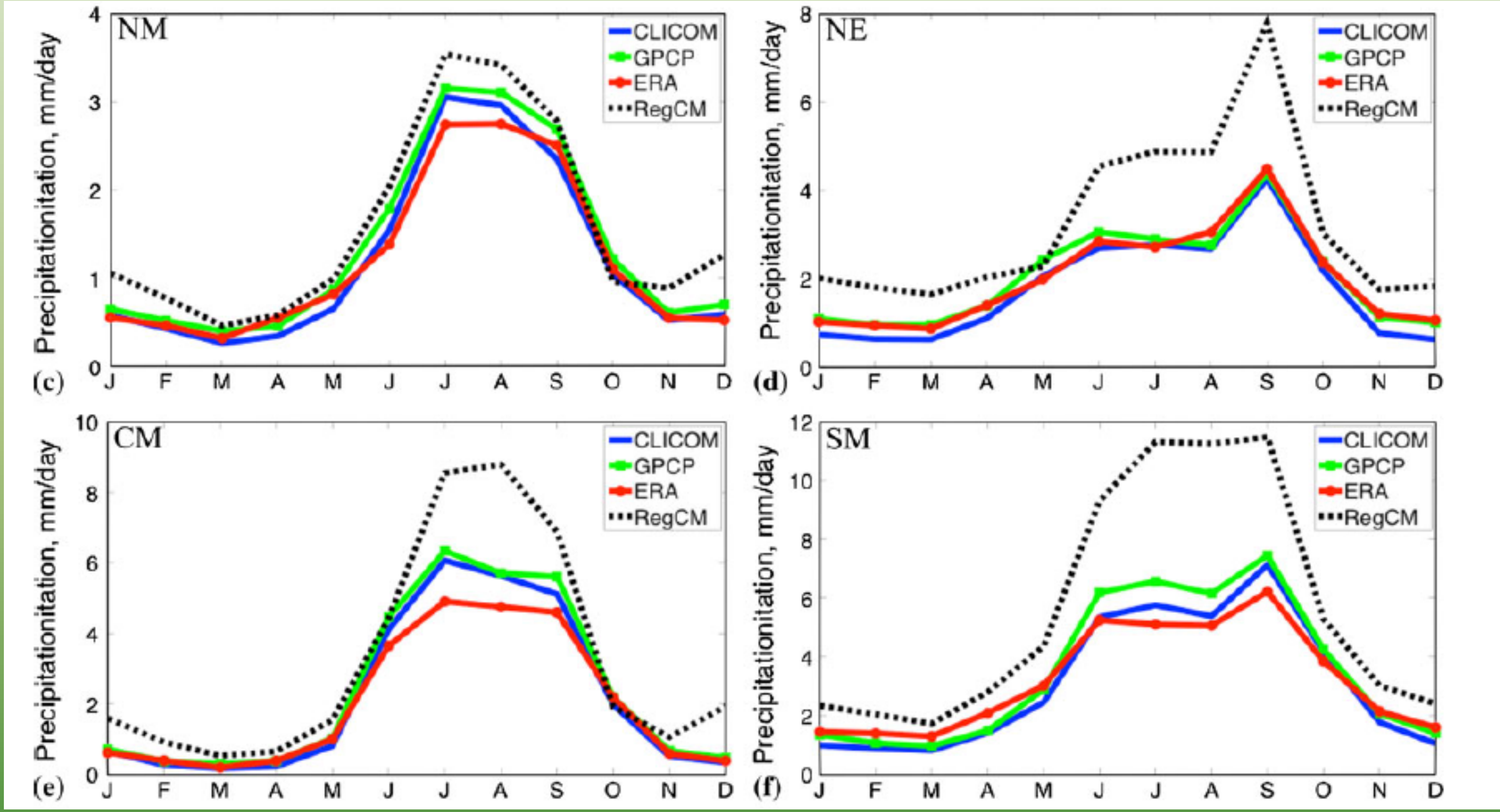
GPCP precip (mm/d) and U925 winds (m/s)

Assessment of RegCM4

Fuentes-Franco et al. 2014, Clim. Dyn



Fuentes-Franco et al. 2014
RegCM4 forced by HadGEM2-ES



Winter wet biases are common to CMIP3, CMIP5, RCMs (Consistent with Bukovsky et al. 2013; Geil et al. 2013; Jiang et al. 2012; Torres-Alavez et al. 2014), **but not the summer wet biases**

Fuentes-Franco et al. 2014
P95 precipitation
(RegCM4 ➔ BATS)

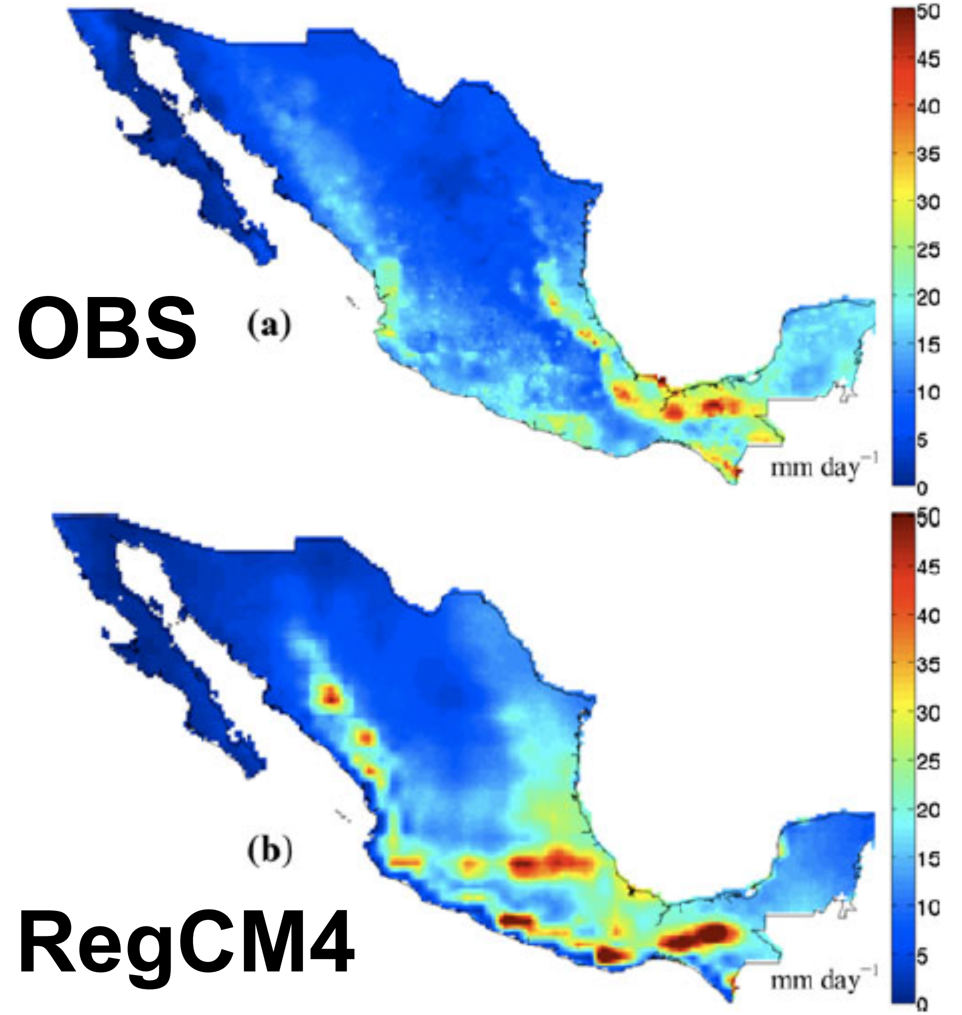


Fig. 13 **a** Observed 1982–2008 average of annual P95 and **b** the corresponding RegCM4 simulation

Vol. 52: 31–48, 2012
doi: 10.3354/cr01049

CLIMATE RESEARCH
Clim Res

Published March 22

Contribution to CR Special 29 'The regional climate model RegCM4'

OPEN ACCESS

Sensitivity of seasonal climate and diurnal precipitation over Central America to land and sea surface schemes in RegCM4

G. T. Diro[1,*], S. A. Rauscher[2], F. Giorgi[1], A. M. Tompkins[1]

Obs JJAS Precip (mm/d)

Mixed Convective Parameter.: Emanuel over oceans, Grell over land

BATS Scheme

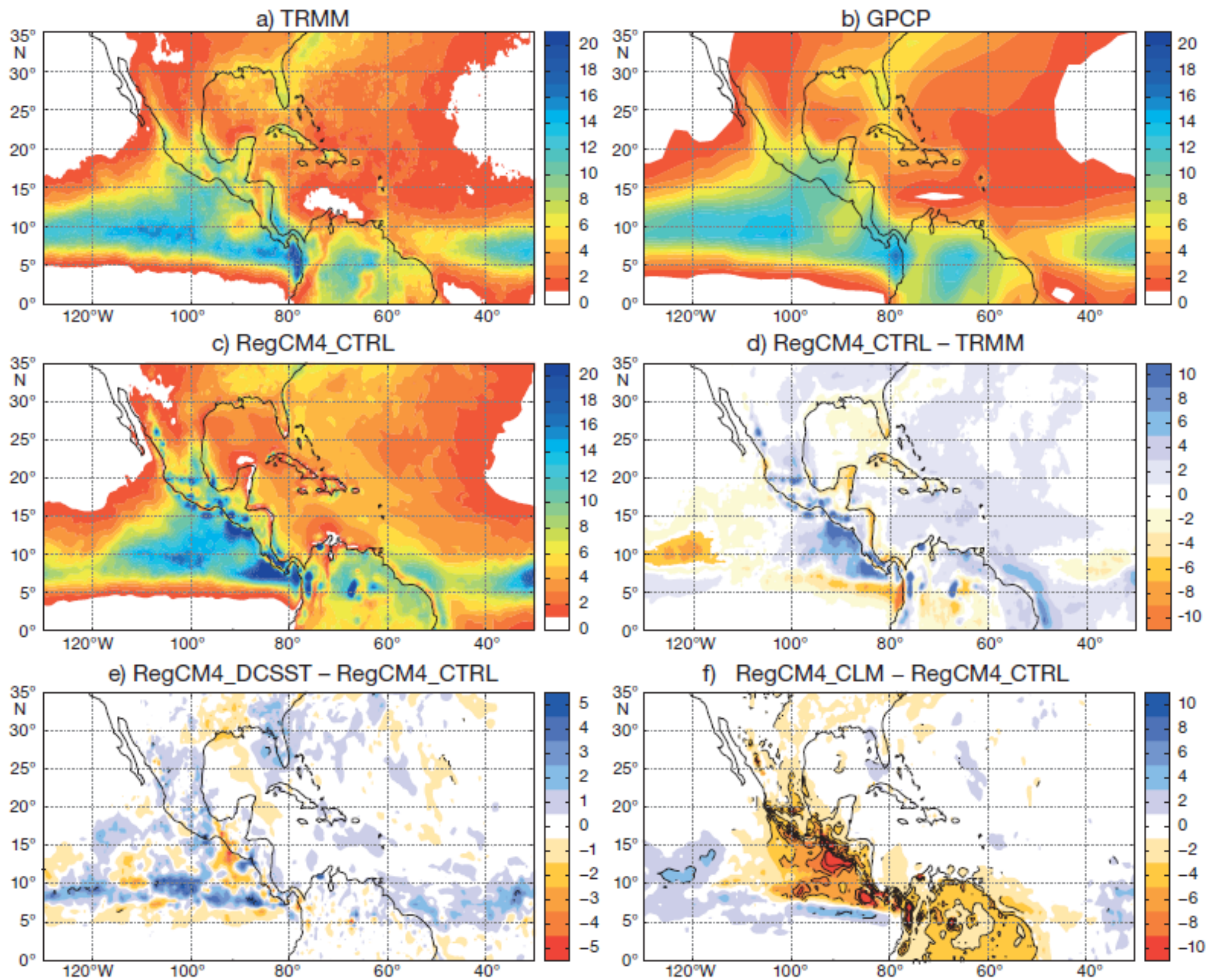
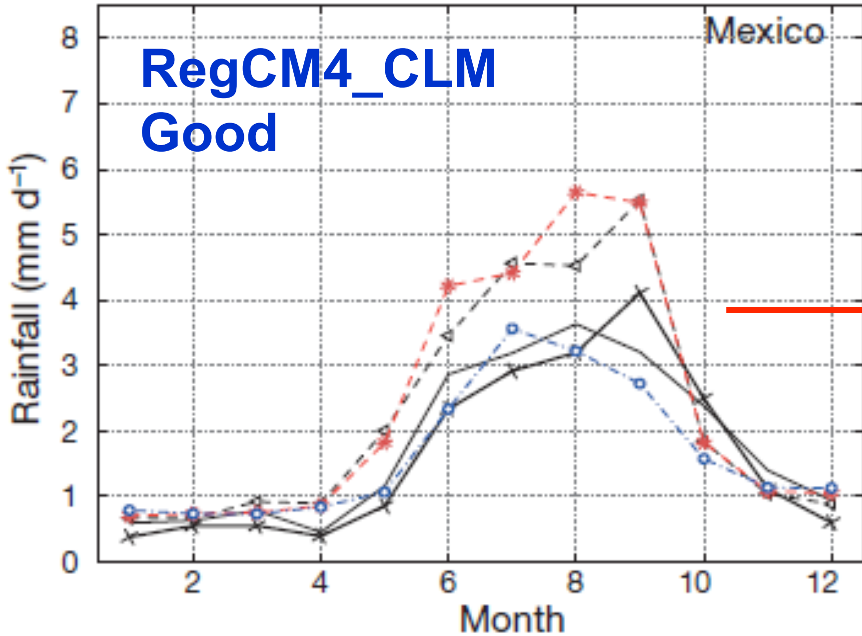
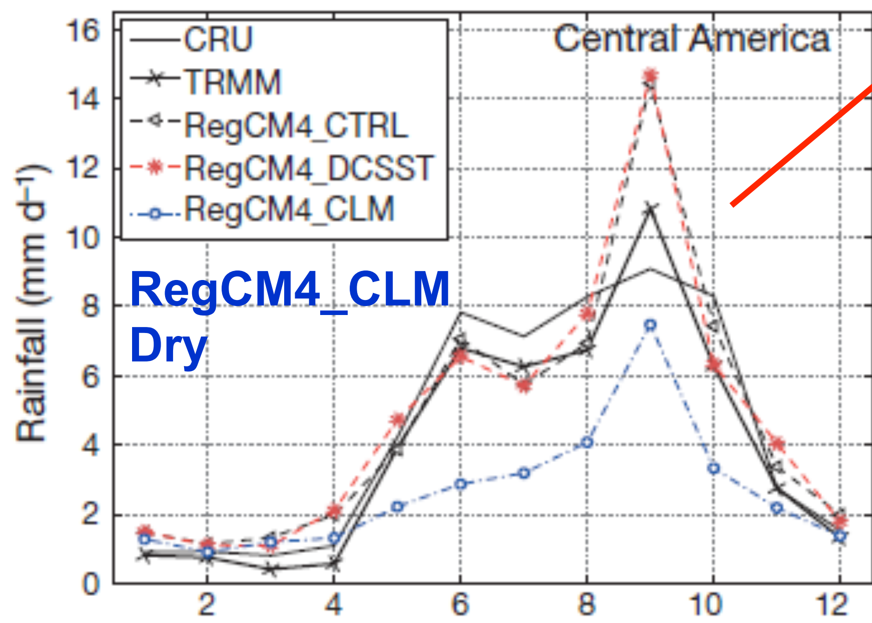


Fig. 2. JJAS mean precipitation (mm d^{-1}) for: (a) TRMM, (b) GPCP, (c) RegCM4_CTRL; and precipitation difference for (d) RegCM4_CTRL minus TRMM; (e) RegCM4_DCSST minus RegCM4_CTRL; and (f) RegCM4_CLM minus RegCM4_CTRL.

DCSST: Diurnal Cycle SST Scheme

CLM 3.5: Comm Land Model





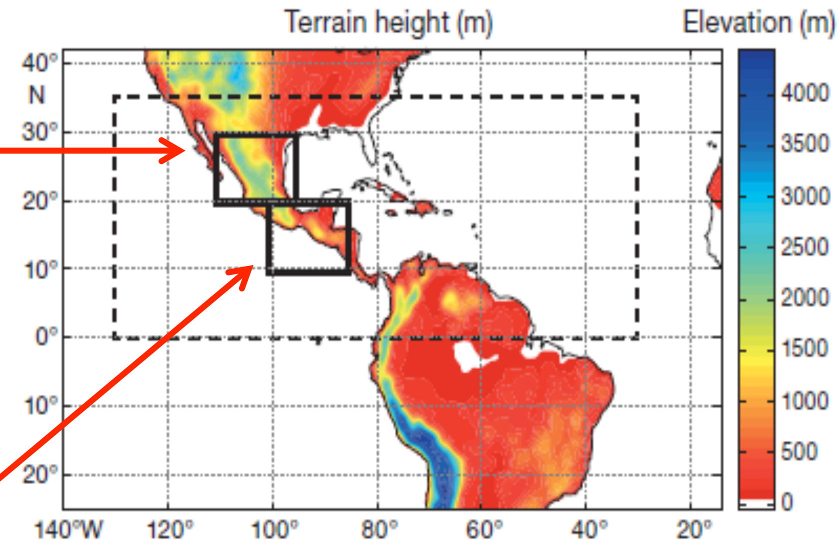


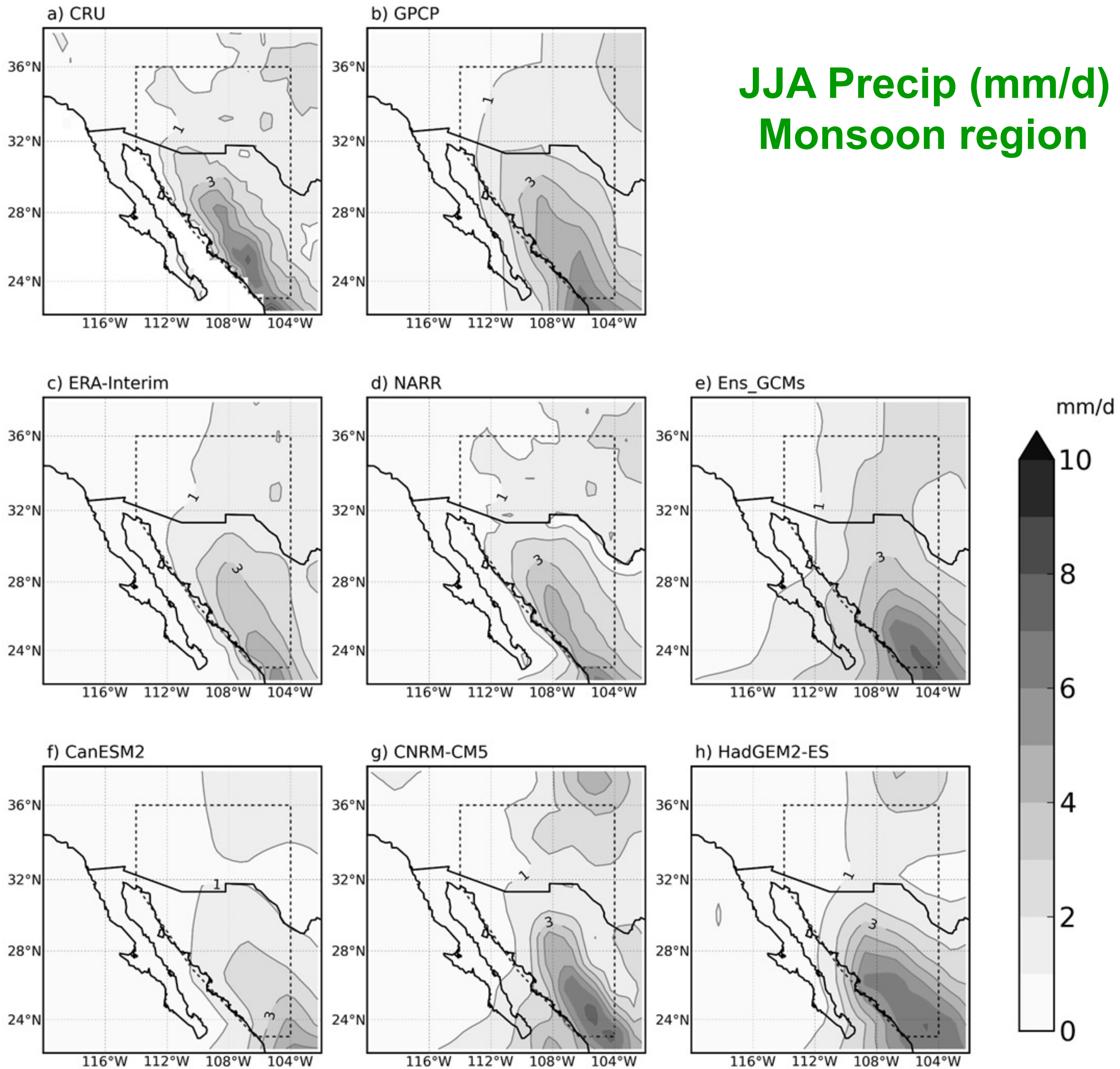
Fig. 1. Model domain and topography of the study region (dashed box). Solid boxes: subregions for which the annual cycle is analyzed — upper: Mexico; lower: Central America

Diro et al. 2012

CORDEX CCA2
RegCM4 forced by ERA

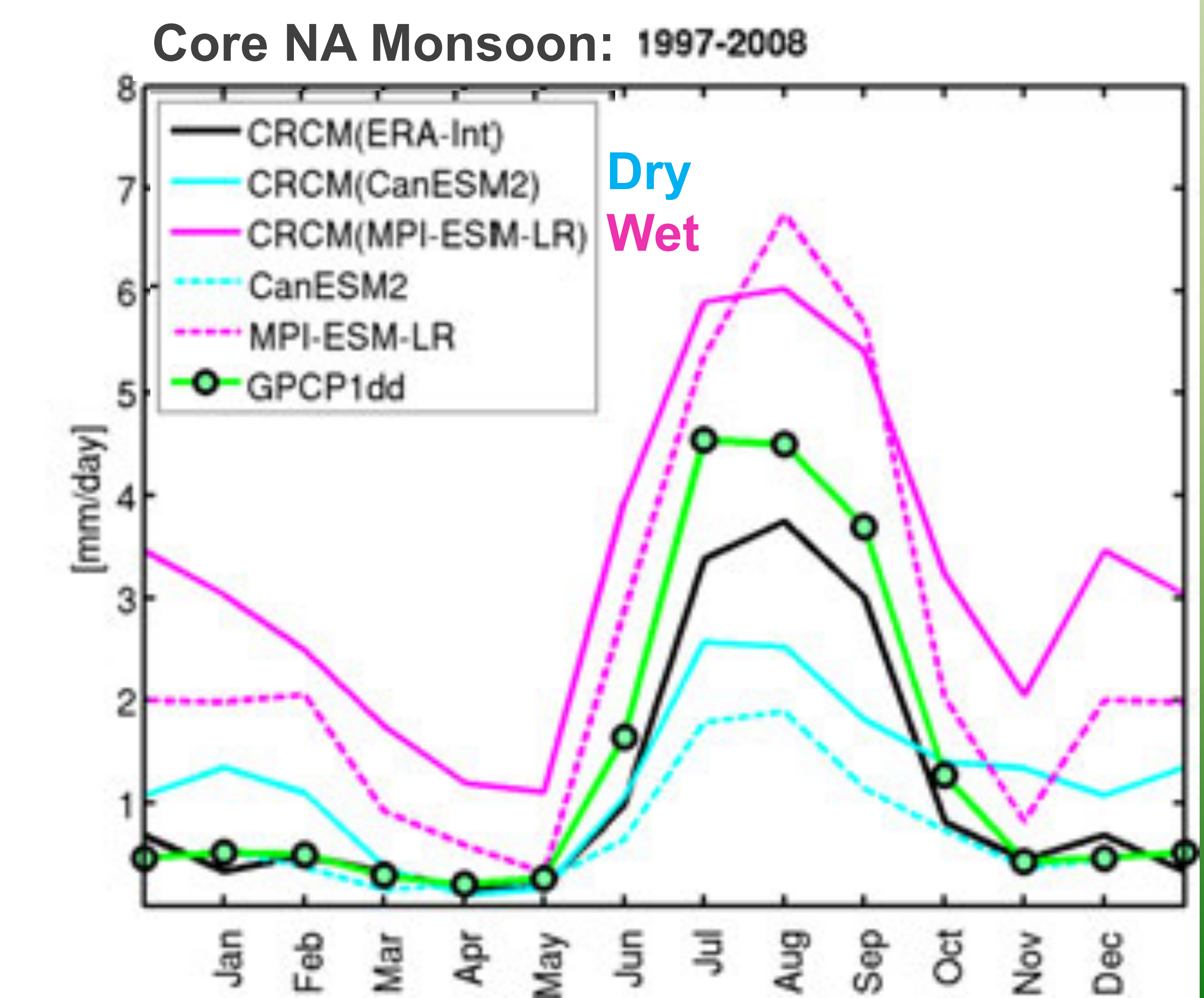
ERA is dry in the NAMonsoon

JJA Precip (mm/d)
Monsoon region

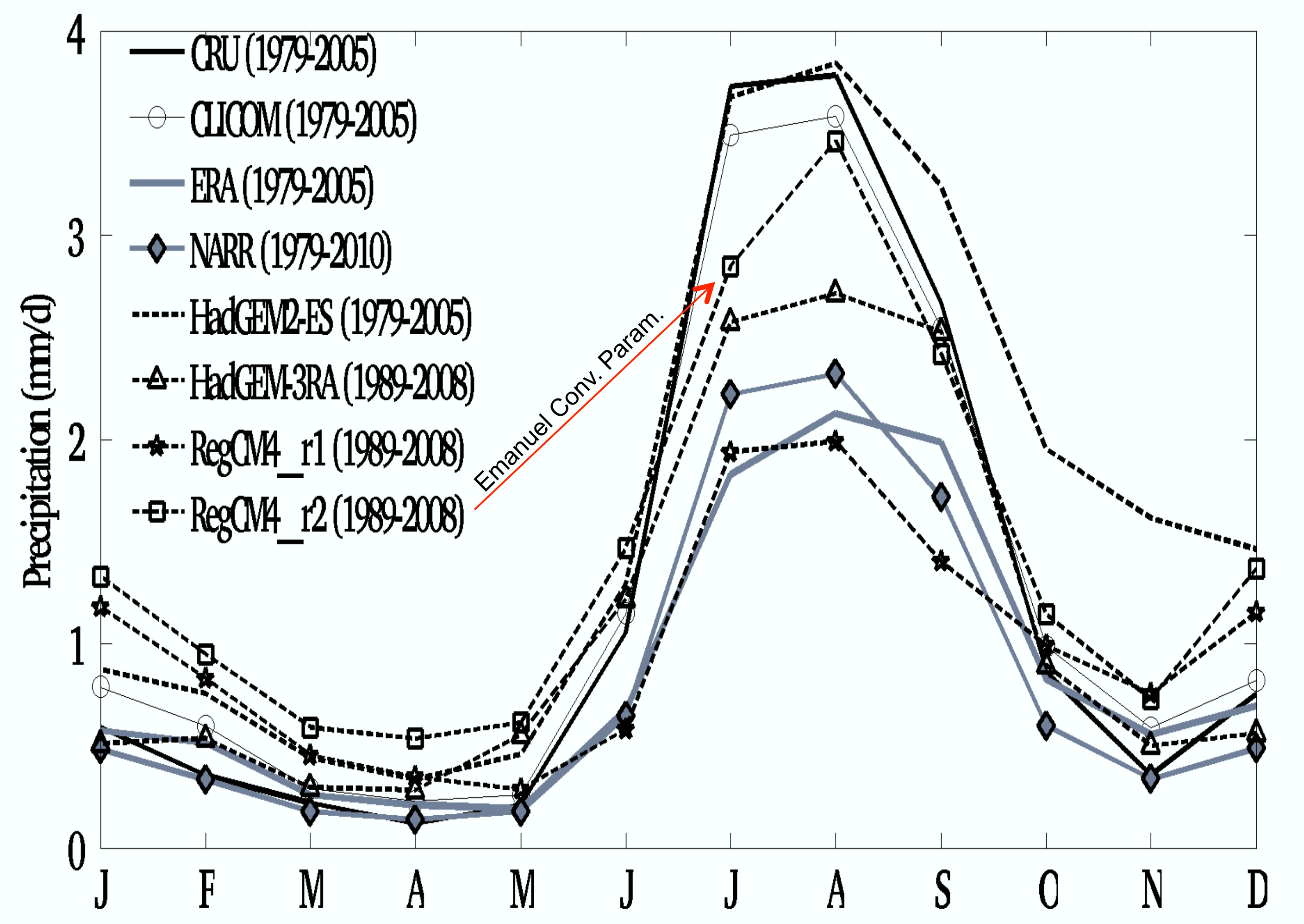


Torres-Alavez et al. 2014

CRCM-Can and CRCM-MPI ➔ RCMs improve simulation compared to parent GCMs, but RCMs reflect parent GCMs (Separovie et al. 2012)

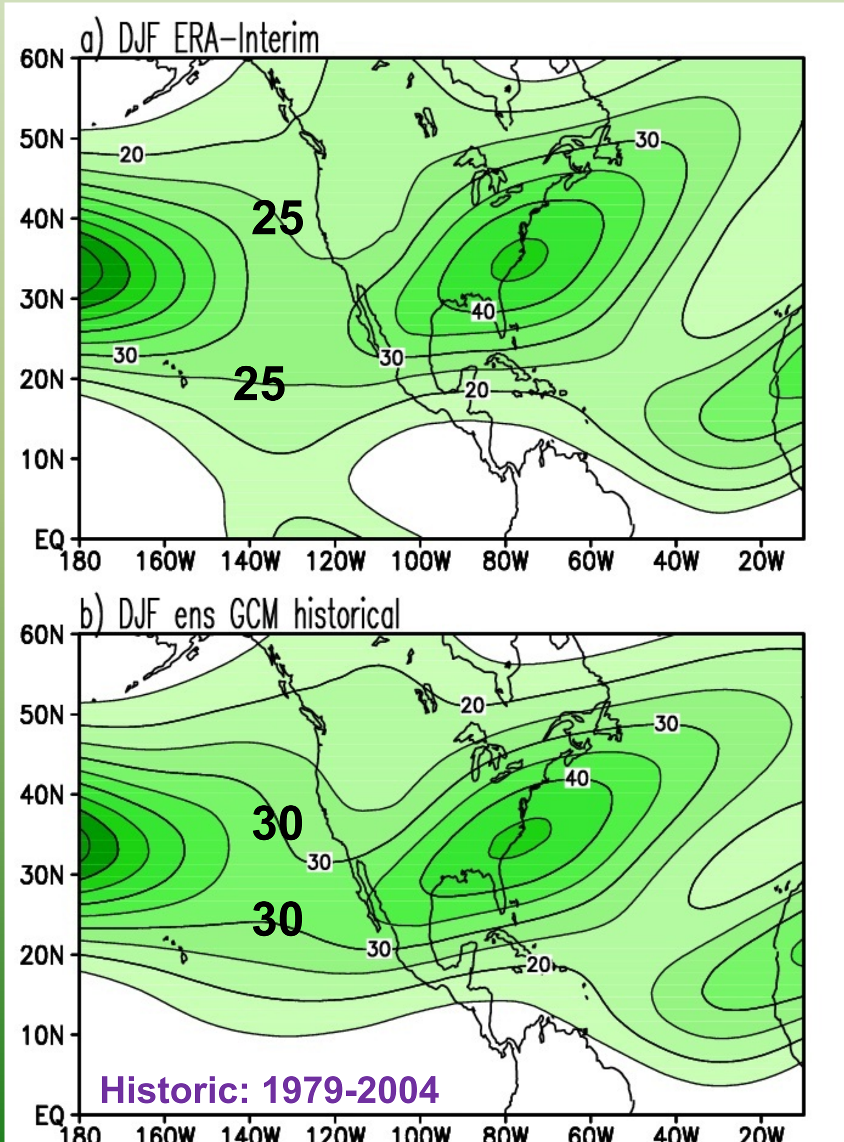


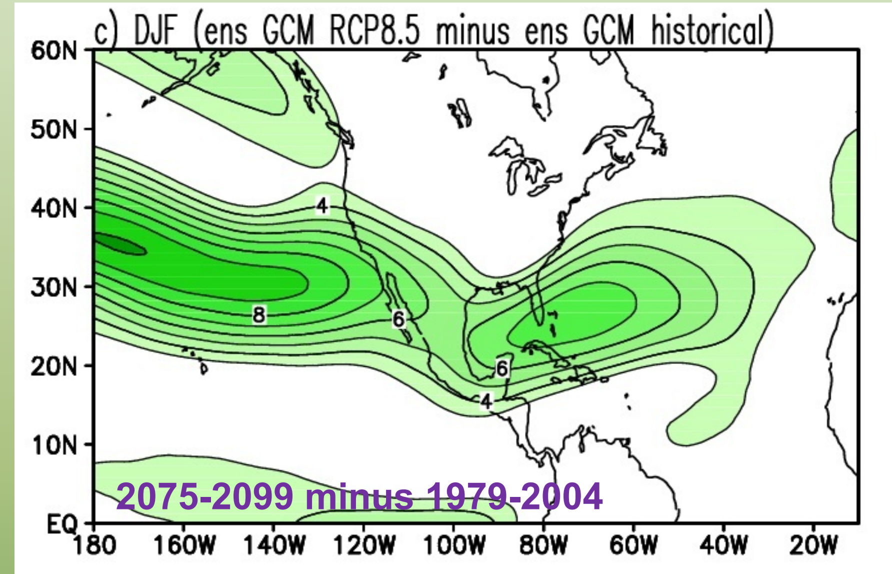
Annual cycle of precipitation (mm/d) in NA monsoon: NARCCAP
2 Obs, ERA, NARR, HadGEM-ES2, 2 RCMs



Cavazos, Torres-Alavez, Arritt, Cerezo-Mota, de Grau

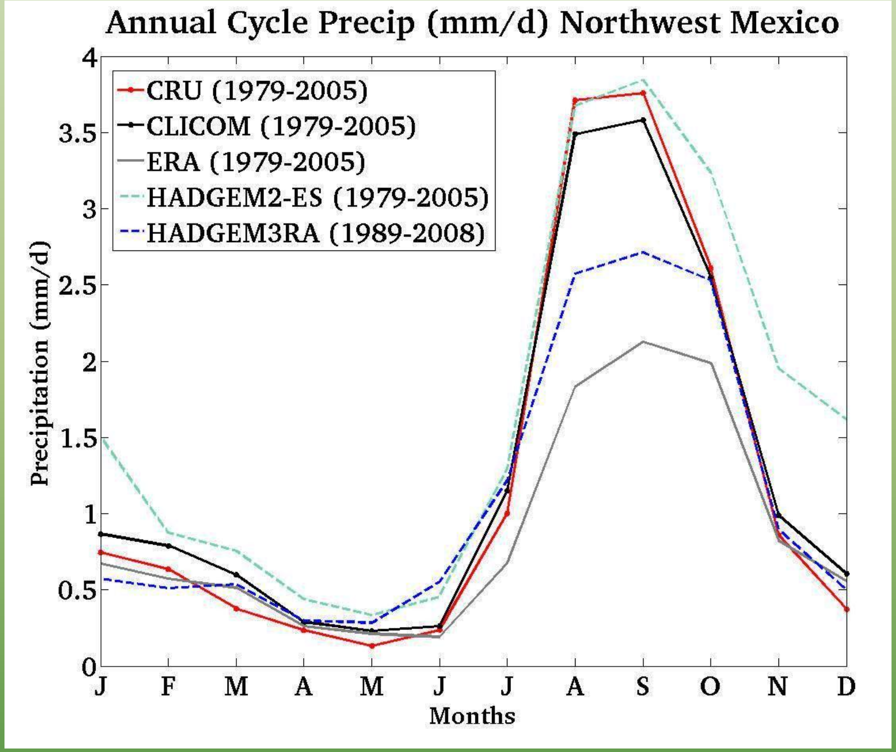
6 CMIP5 GCMs: Winter (DJF) Z200 hPa zonal wind Historic and future mean change (RCP8.5 scenario)

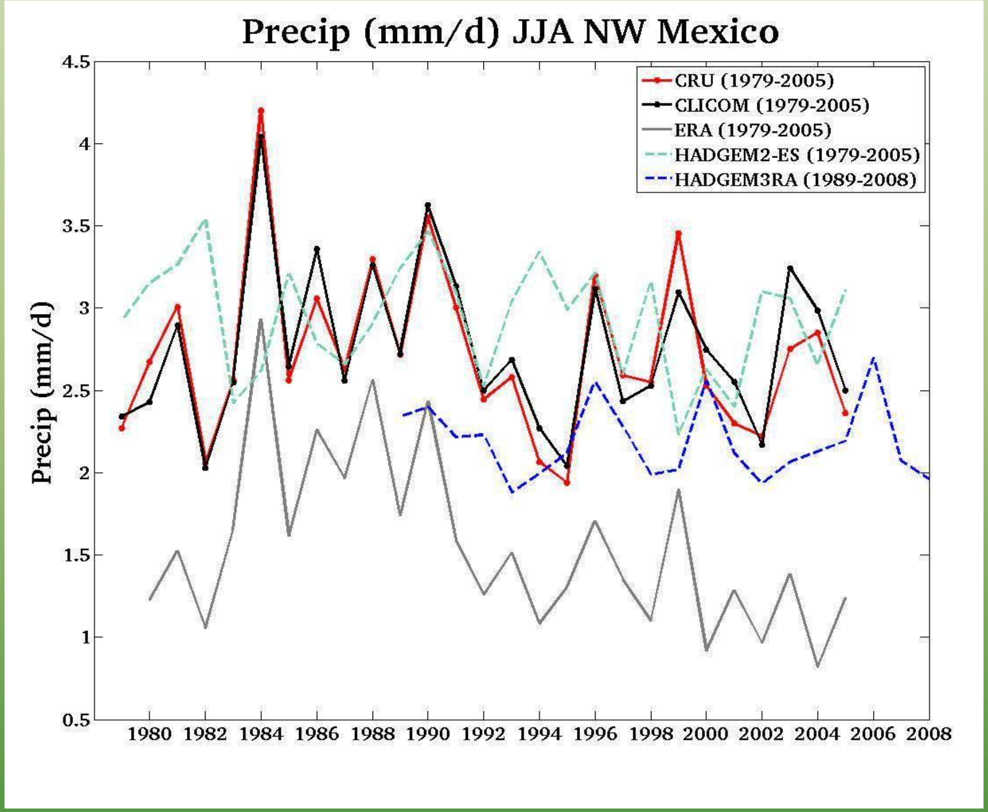




Torres-Alavez et al. 2014, J. Climate

Mean seasonal observed precipitation (mm)
North American Monsoon Region

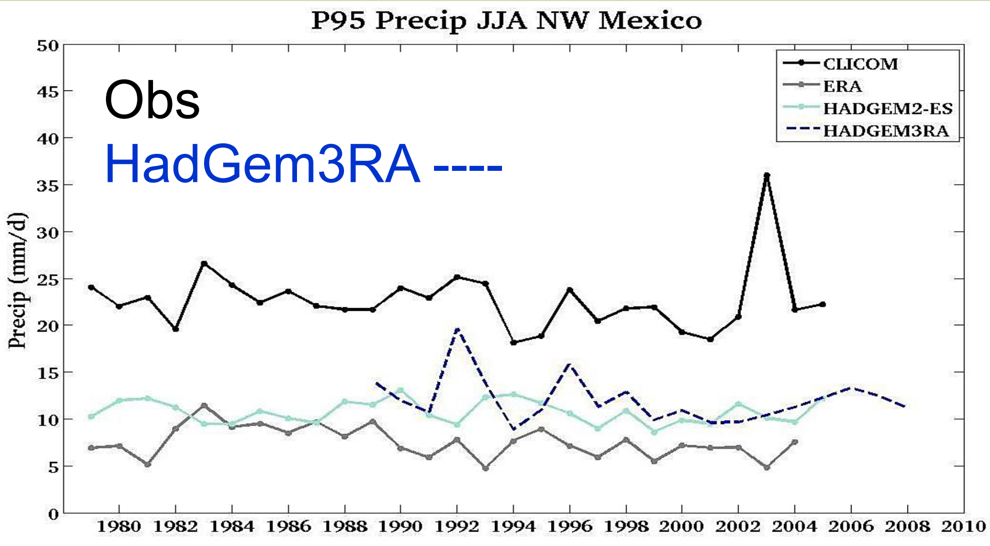




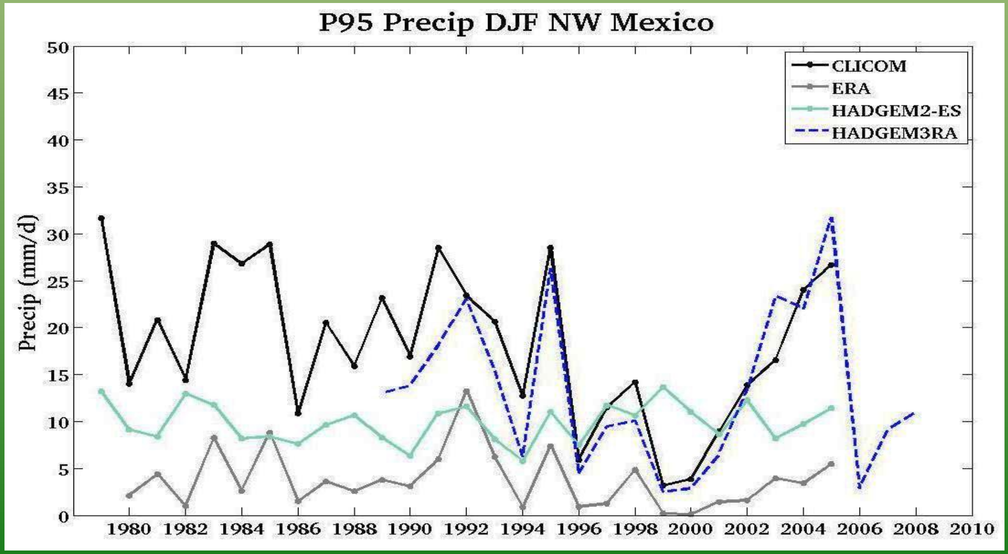
Cavazos, Torres-Alavez, Cerezo-Mota, de Grau

JJA and DJF mean observed thresholds of P95 precipitation (mm/d) in the NAM region

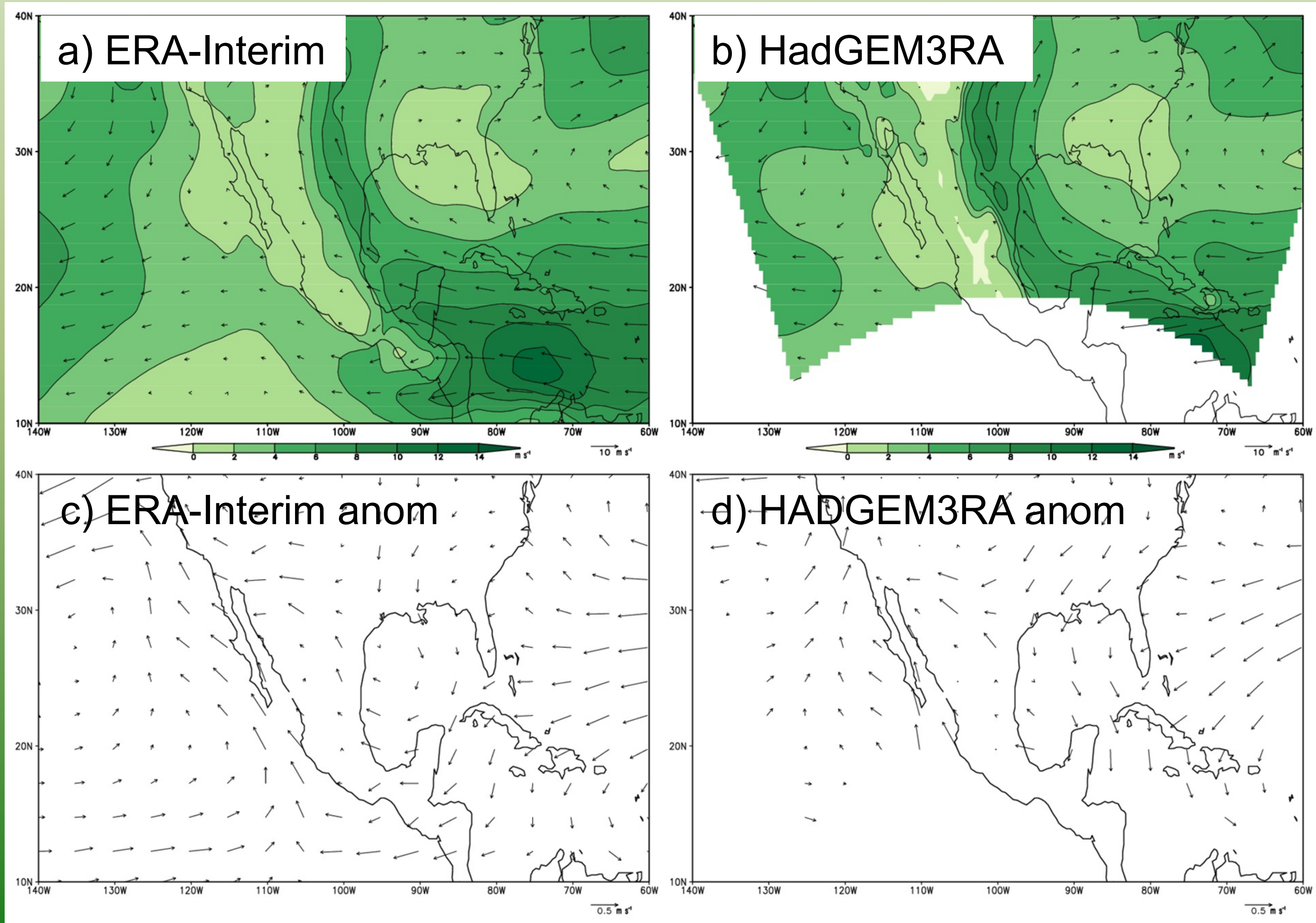
JJA



DJF



Summer (JJA) mean wind vector composites at 850 mb during days with extreme precipitation events (> P95) for 1979-2005



Vertically integrated MF and MF Convergence (mm/d)

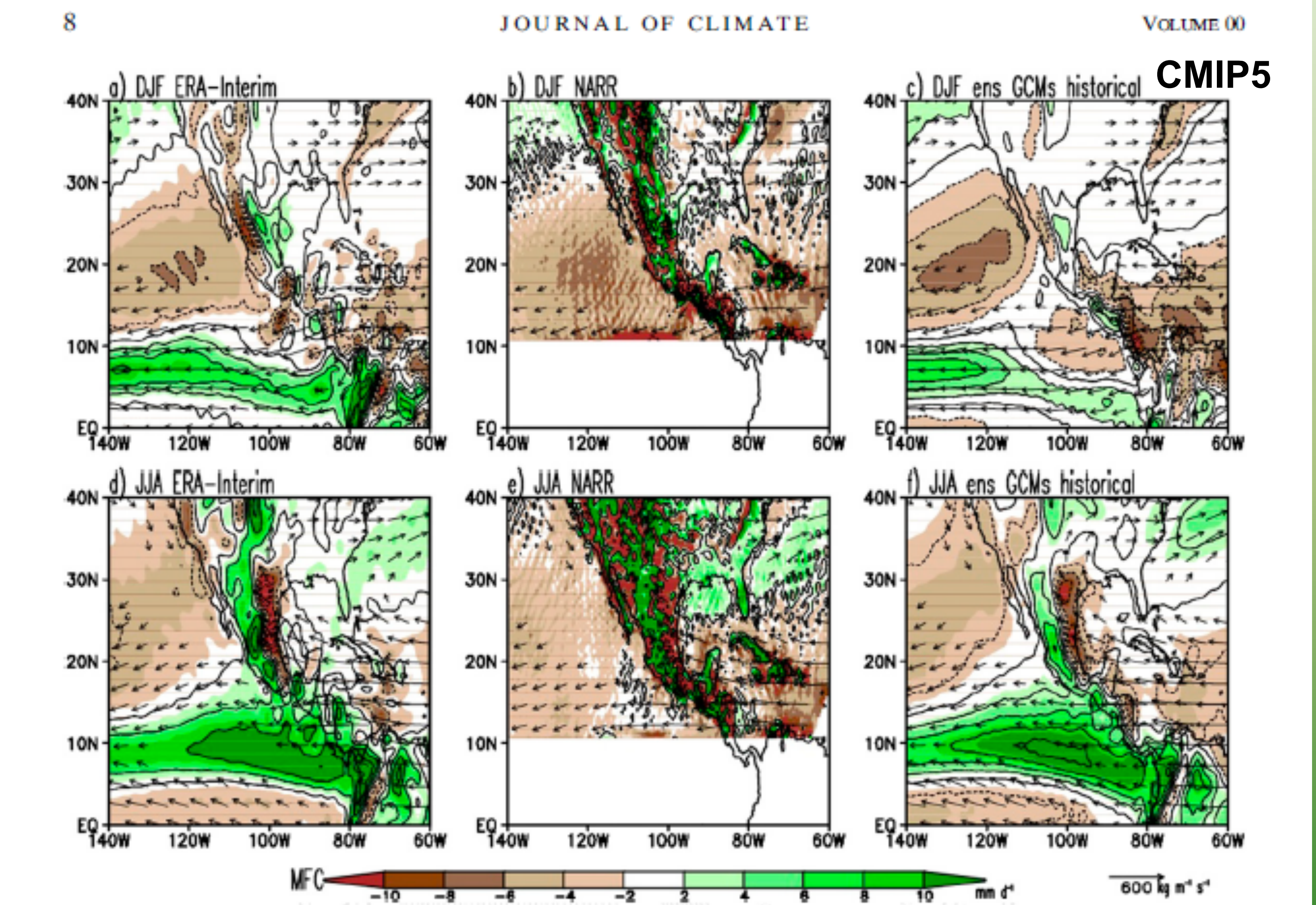


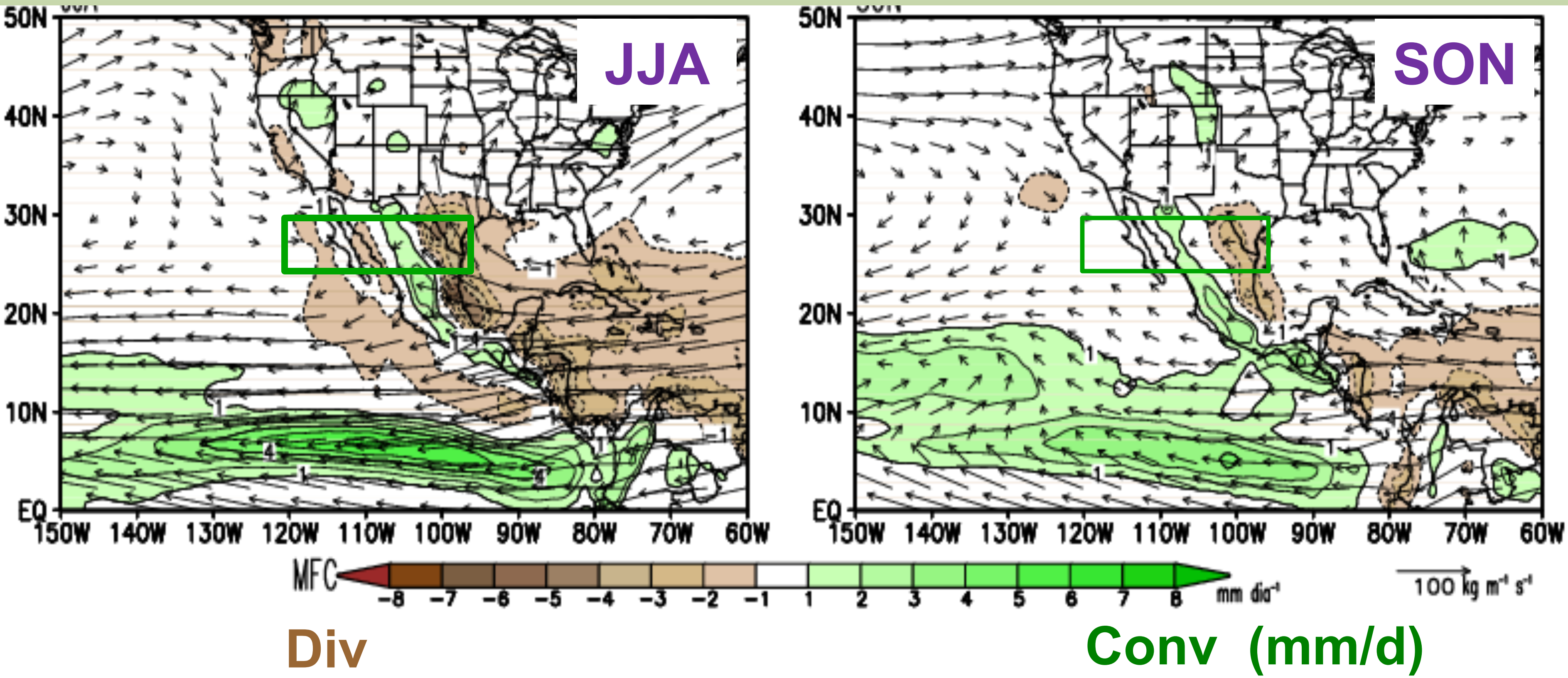
FIG. 5. Mean seasonal vertically integrated moisture flux (vectors; kg $m^{-1} s^{-1}$) and its convergence (shading; mm day^{-1}) for (a),(d) ERA-Interim, (b),(e) NARR, and (c),(f) ens_GCMs during the historical period (1979–2004) for (top) December–February (DJF) and (bottom) JJA.

Torres-Alavez et al. 2014, J. Climate

Concluding remarks for RCMs
→ Parent GCM with small biases

- CCA2 domain better captures summer and winter features relevant for the whole region
- Thermal gradients between the Gulf of Mexico/Caribbean region and the Eastern Pacific (Franco-Fuentes et al. 2014)
  → Precipitation in Mexico, CLLJ intensity, MSD, TCs
- Land-sea thermal contrast: MSD, land-sfc schemes
  → Diro et al. 2012
- Size of the Pacific and Atlantic warm pools (Kozar and Mizra 2013; Martinez-Sanchez and Cavazos 2014; Wang et al. 2008; Franco-Fuentes et al. 2014)
  → Tropical cyclones, CLLJ, ENSO, Subtrop. highs
- Surface and mid-tropospheric land-sea thermal contrast (Turrent and Cavazos 2009; Torres-Alavez et al. 2014) → Onset of the NA Monsoon, precipitation, stability
- Winter teleconnections, ENSO, extremes

Change in QV y MFC (Sfc to 200 hPa) (2075-2099 minus Historic)



Coastal monsoon region:
Stronger Div and weakened monsoon trough, especially in July

(Canadian Group)

Clim Dyn (2013) 41:3167–3201
DOI 10.1007/s00382-013-1737-5

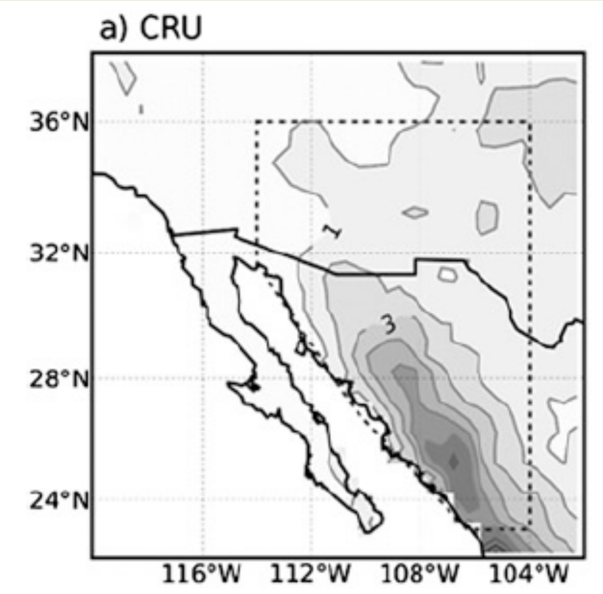
Present climate and climate change over North America as simulated by the fifth-generation Canadian regional climate model (CRCM5)

Leo Šeparović · Adelina Alexandru ·
René Laprise · Andrey Martynov · Laxmi Sushama ·
Katja Winger · Kossivi Tete · Michel Valin

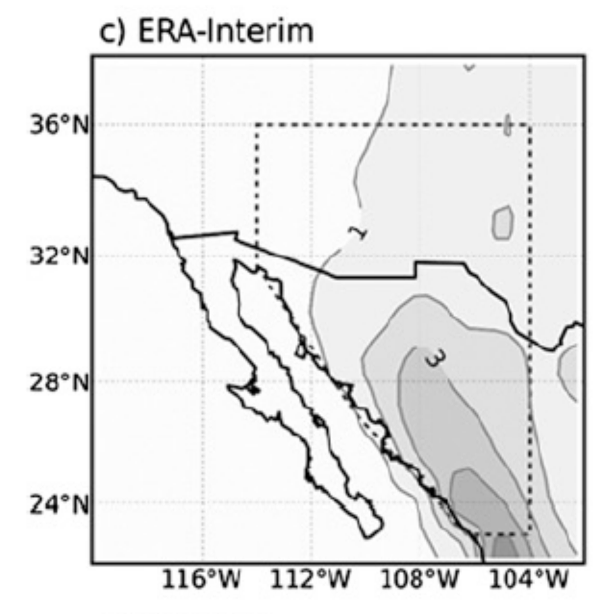
Important: Prescribed lower boundary conditions (SSTs and sea-ice concentration)

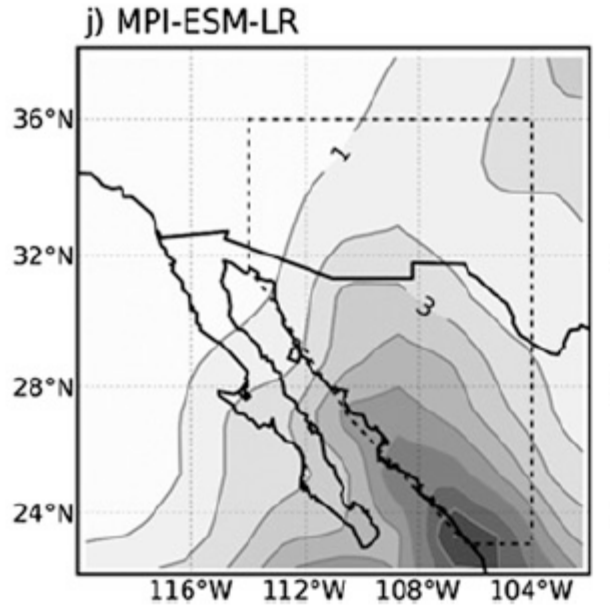
- **The selection of CGCMs for regional downscaling is critical** for the quality of RCM simulations and is usually based on the quality of CGCM simulations in the region of interest (e.g., Pierce et al. 2009; Bukovsky et al. 2013) and its **ability to reproduce the observed lower boundary conditions** (Separovie et al. 2013).
- **CRCM5 shows a cold/warm bias** in the Pacific consistent with Martynov et al. (2013)

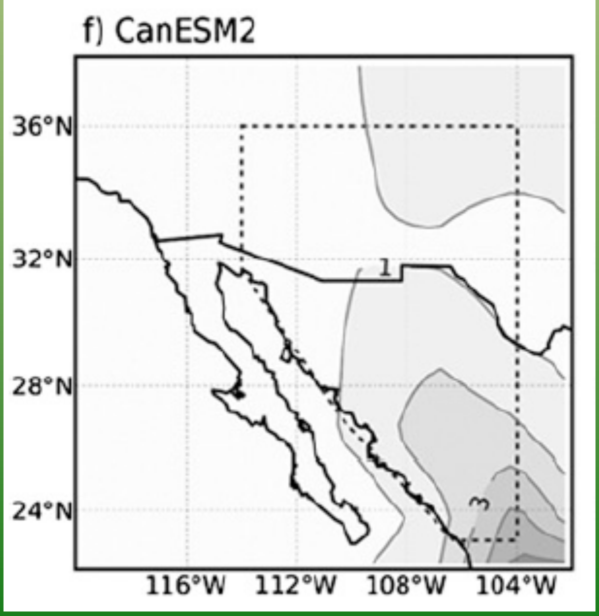
JJAS monsoon precipitation using CMIP5 GCMs
(Torres-Alavez et al. 2014, J. Climate)



(2013), while CanESM2 is unable to reproduce the annual cycle. A recent study by Martinez-Sanchez and Cavazos (2014) showed that HadGEM2-ES includes a very good representation of the annual cycle of sea surface temperatures (SST) of the eastern tropical Pacific, while the SSTs in CanESM2 are highly overestimated from April to December, which may be partially responsible for the dry precipitation bias in the NAM region. ➔ Reversed land-sea thermal contrast







(Swiss-Can Group)

Reanalysis-driven climate simulation over CORDEX North America domain using the Canadian Regional Climate Model, version 5: model performance evaluation

A. Martynov · R. Laprise · L. Sushama ·
K. Winger · L. Šeparović · B. Dugas

(Clim Dyn, 2013)

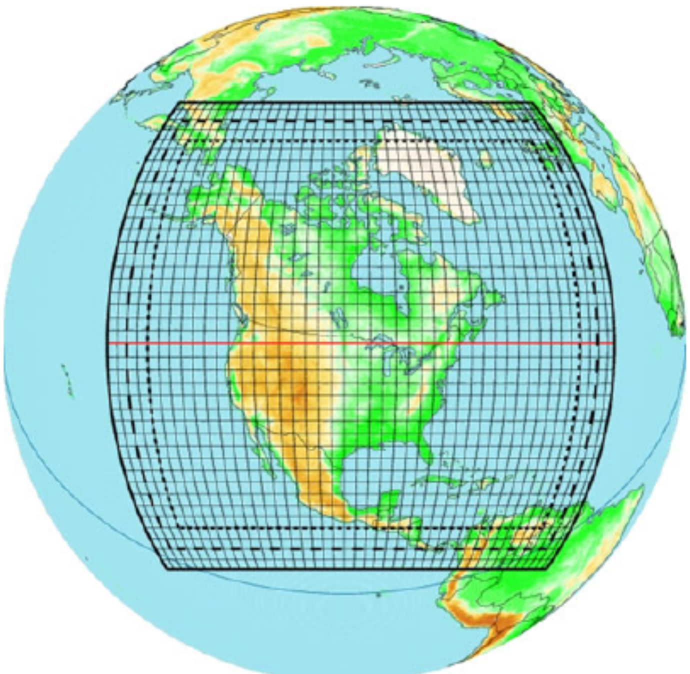


Fig. 1 The simulation grid: rotated lat-lon 212 × 200 points grid on 0.44° horizontal grid mesh (only every 5th grid point is displayed). The limits of the external 'halo' and the Davies sponge zones (each 10 grid point wide) are indicated by the *dashed* and *dotted lines*, respectively. The remaining free innermost domain consists of 172 × 160 grid points. The grid equator is shown in *red*

Abstract The performance of reanalysis-driven Canadian Regional Climate Model, version 5 (CRCM5) in reproducing the present climate over the North American COordinated Regional climate Downscaling EXperiment domain for the 1989–2008 period has been assessed in comparison with several observation-based datasets. The model reproduces satisfactorily the near-surface temperature and precipitation characteristics over most part of North America. Coastal and mountainous zones remain problematic: a cold bias (2–6 °C) prevails over Rocky Mountains in summertime and all year-round over Mexico; winter precipitation in mountainous coastal regions is overestimated. The precipitation patterns related to the North American Monsoon are well reproduced, except on its northern limit. The spatial and temporal structure of the Great Plains Low-Level Jet is well reproduced by the model; however, the night-time precipitation maximum in the jet area is underestimated. The performance of CRCM5 was assessed against earlier CRCM versions and other RCMs. CRCM5 is shown to have been substantially improved compared to CRCM3 and CRCM4 in terms of seasonal mean statistics, and to be comparable to other modern RCMs.

CRCM5

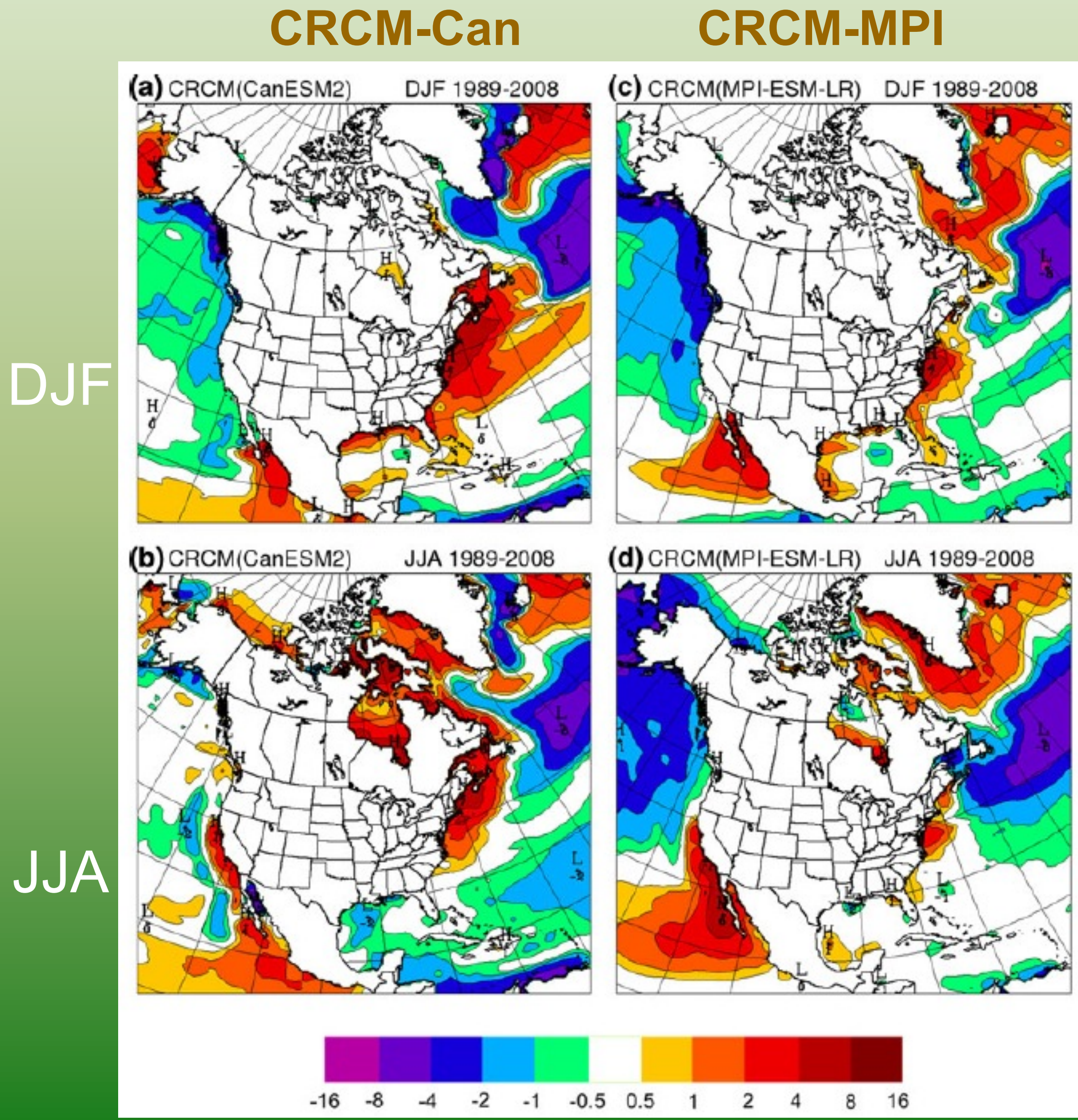
Cold & wet bias

GPLLJ OK

Regional Improvement

SST bias (^{o}C)

Both CRCM-Can and CRCM-MPI exhibit **a cold bias** of 2–6^{o}C off the midlatitude Pacific Coast in winter and a **warm bias** off the subtropical Pacific Coast in all seasons. This warm bias is exceptionally large in CRCM-MPI in summer when it reaches 6^{o}C and also extends farther northward. Both models also have considerable SST biases in the Atlantic, warm bias off the East Coast **and a strong cold bias in north-central Atlantic**



Vol. 52: 31–48, 2012
doi: 10.3354/cr01049

CLIMATE RESEARCH
Clim Res

Published March 22

Contribution to CR Special 29 'The regional climate model RegCM4'

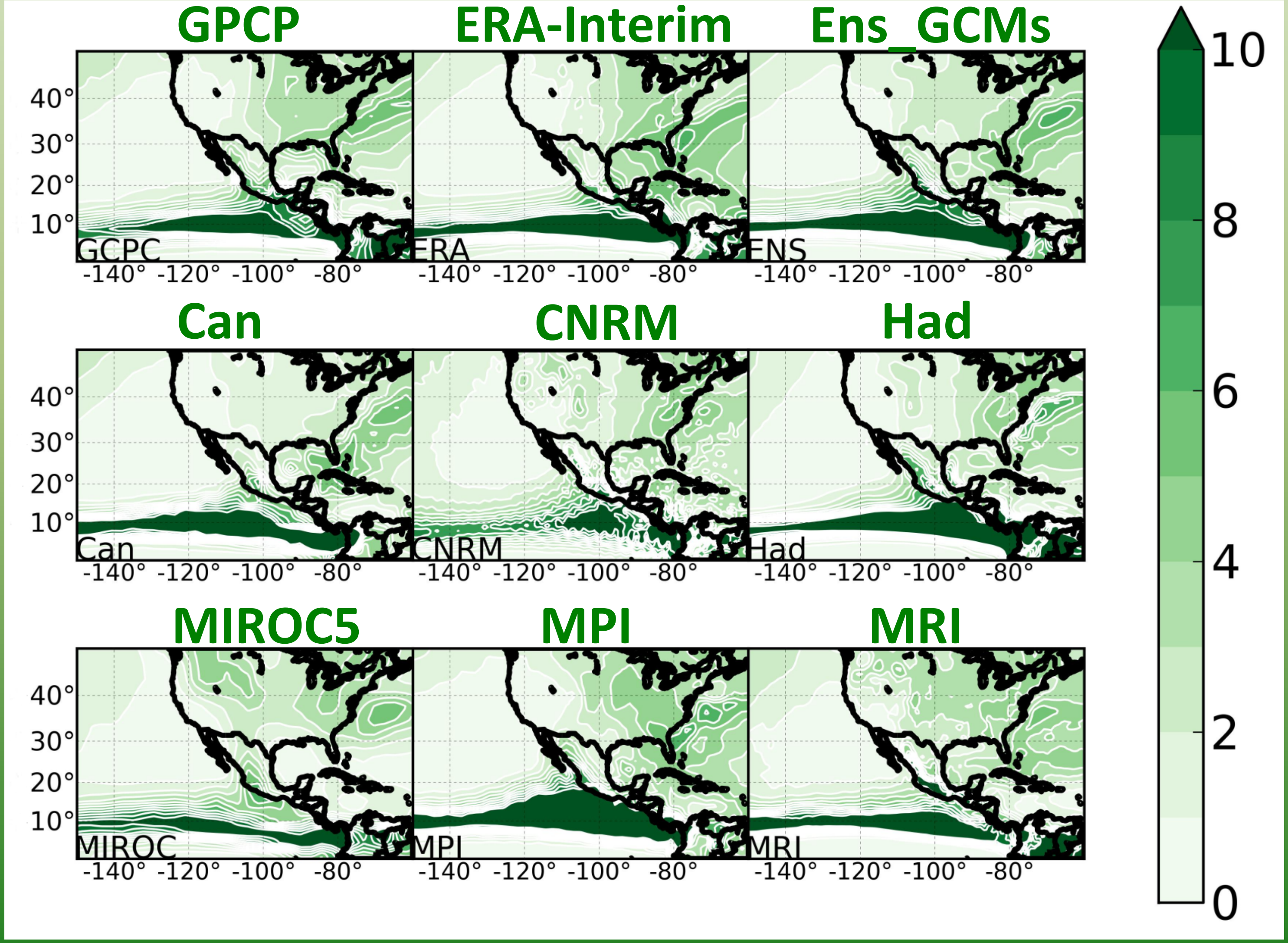
OPEN ACCESS

Sensitivity of seasonal climate and diurnal precipitation over Central America to land and sea surface schemes in RegCM4

G. T. Diro[1,*], S. A. Rauscher[2], F. Giorgi[1], A. M. Tompkins[1]

ABSTRACT: Multi-annual simulations over the Central America CORDEX domain are conducted with the latest version of regional climate model RegCM4 driven by ERA-Interim reanalysis fields. The RegCM4 system can reproduce both the annual cycle and the spatial patterns of mean summer precipitation over Central America and Mexico. Regional circulation features are also reproduced, although the intensity of the Caribbean Low-Level Jet is underestimated and it is located too far south. Over most land areas, RegCM4 surface air temperatures are lower than observations by 1 to 3°C, which however may also be related to biases in the reanalysis forcing data. The model can realistically simulate the amplitude of the convective diurnal cycle in areas where the convective triggering is dominated by non-local gravity wave effects. However, the simulation of the phase of the diurnal cycle of convection is less satisfactory, with the peak precipitation occurring earlier than observed, a common fault in atmospheric models. Sensitivity experiments are carried out to investigate the model sensitivity to land surface and a prognostic diurnal sea surface temperature scheme. Use of the Community Land Model (CLM) instead of the Biosphere-Atmosphere Transfer Scheme (BATS) results in a warmer and drier land surface and a better simulation of the seasonal average spatial pattern of precipitation. However, with BATS, RegCM4 has a more realistic simulation of the mid-summer drought over the region. The impact of the prognostic sea surface temperature (SST) scheme is generally small. In general, neither of these surface physics upgrades results in a clearly superior model performance.

Observed and historic CMIP5 JJA Precip (mm/d) during 1979-2004



Torres-Alavez et al. 2014, J. Climate

Separovie et al. 2013

Regional Validations

Two transient climate-change RCM downscaling experiments over the North American CORDEX domain using the CRCM5 driven at the lateral boundaries and ocean surface by ERA and 2 CMIP5 models, CanESM2 and MPI-ESM:

Driven-simulations:
CRCM-ERA40
CRCM-Can
CRCM-MPI

Validation: The ERA-driven CRCM5 simulation has a high skill in realistically reproducing **the North American Monsoon, the Great Plains Low-Level Jet** and its influence on the precipitation diurnal cycle in summer.

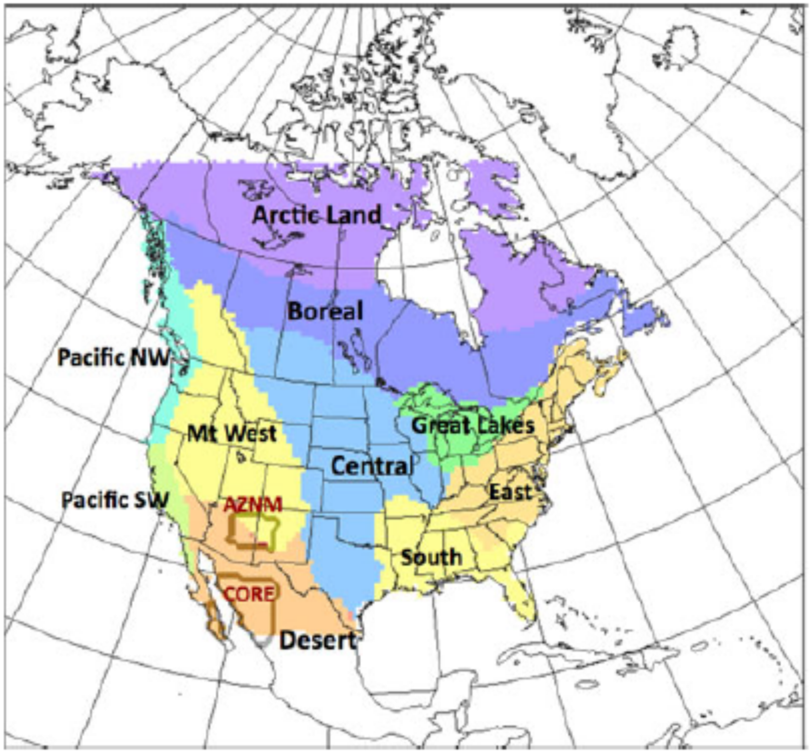
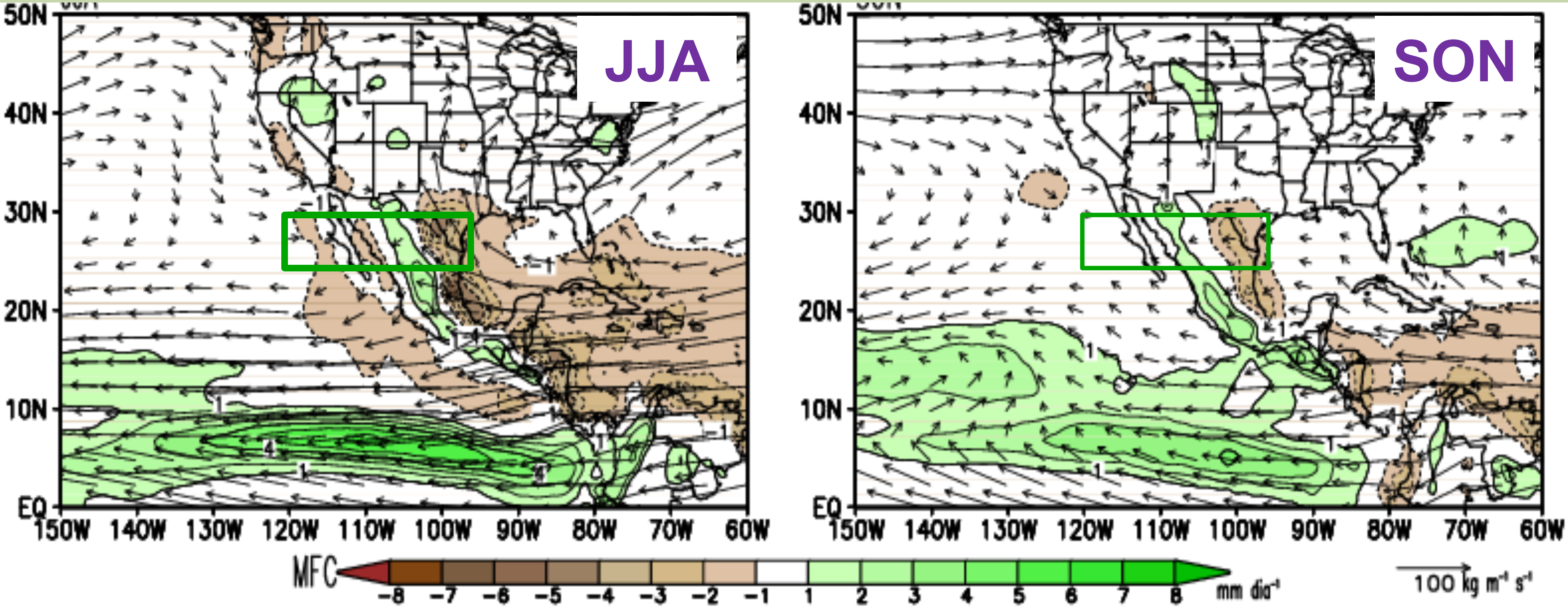


Fig. 8 Map of regionalization adopted from Bukovsky (2011)

Change in QV y MFC (Sfc to 200 hPa)
(2075-2099 minus Historic)

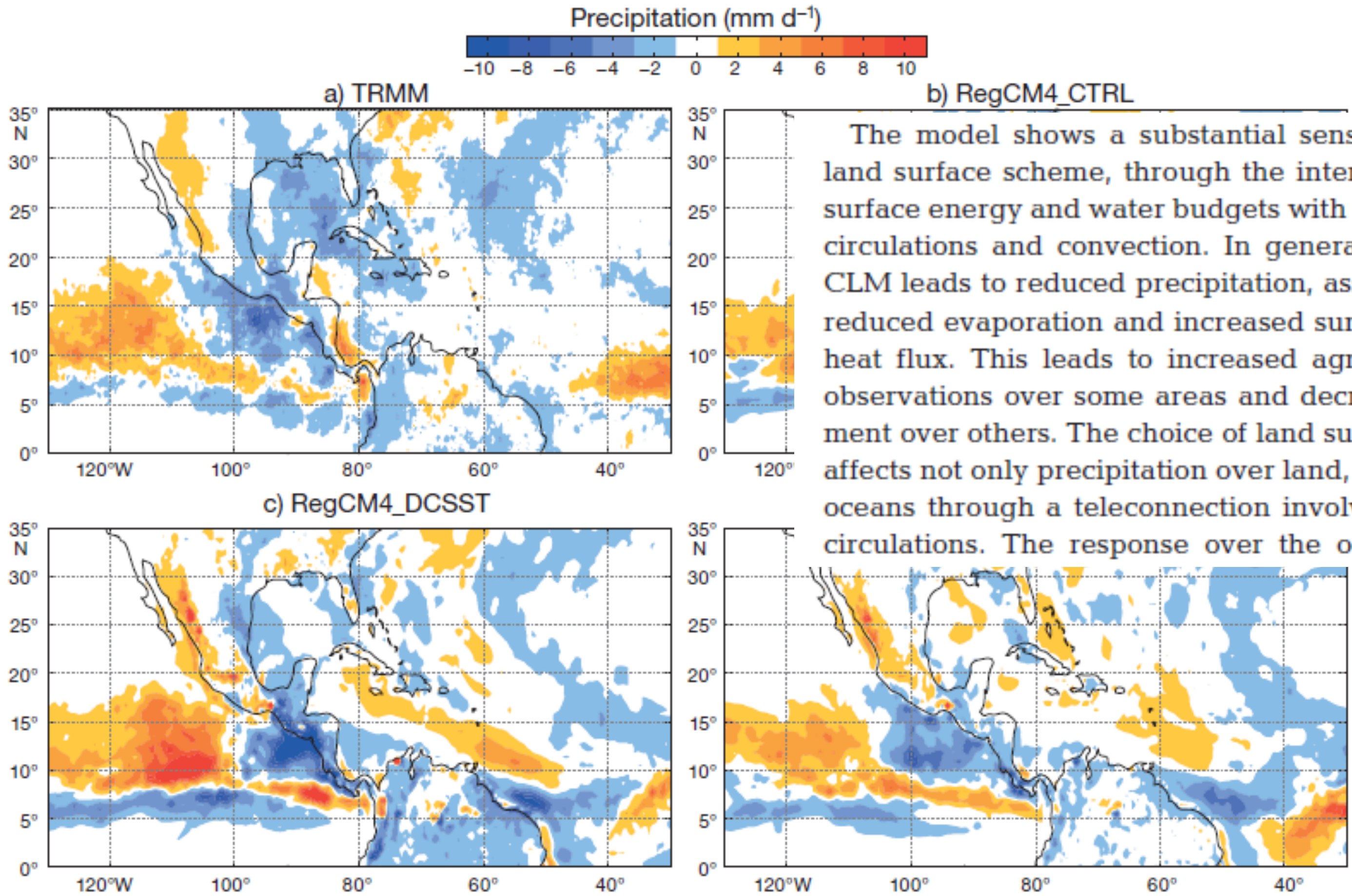


Div **Conv (mm/d)**

Coastal monsoon region:
Stronger Div and weakened monsoon trough, especially in July

early afternoon over land (Dai et al. 1999). I
comparison of our simulations suggests that the
of CLM produces a slightly earlier precipitation p
than BATS, and the use of the DCSST scheme
duces a later peak, than the standard configurat
however, these effects are not pronounced.

Diro et al. 2012 – 2 land surface schemes



The model shows a substantial sensitivity to the land surface scheme, through the interaction of the surface energy and water budgets with the overlying circulations and convection. In general, the use of CLM leads to reduced precipitation, associated with reduced evaporation and increased surface sensible heat flux. This leads to increased agreement with observations over some areas and decreased agreement over others. The choice of land surface scheme affects not only precipitation over land, but also over oceans through a teleconnection involving regional circulations. The response over the ocean regions

Fig. 5. Mid-summer drought precipitation 1998–2002. (a) TRMM, (b) RegCM4_CTRL, (c) RegCM4_DCSST, and (d) RegCM4_CLM

JJA 925 hPa meridional wind (m/s)

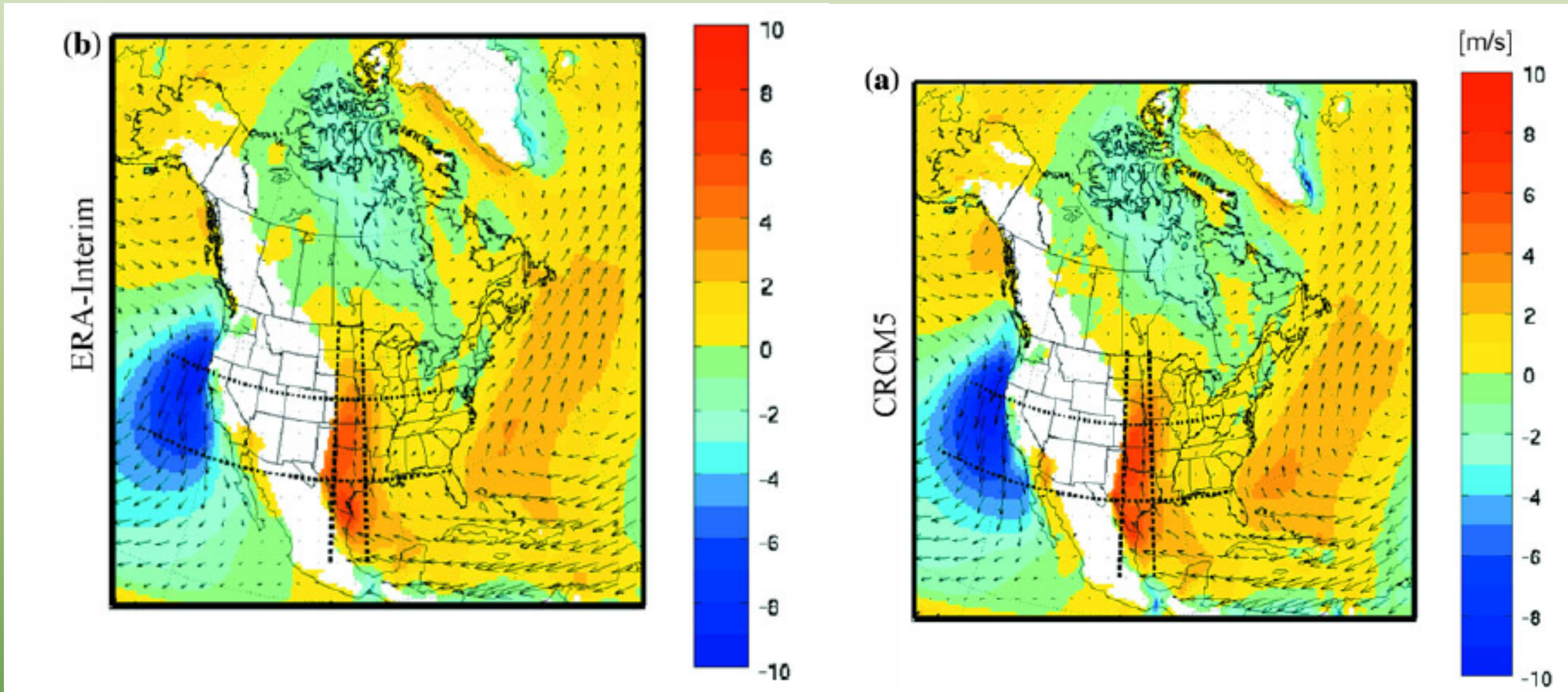


Fig. 22 Mean JJA meridional (in *color*) and total horizontal (*arrows*) winds (m/s) at 925 hPa, for the 1998–2008 period, for a CRCM5 simulation and **b** ERA-Interim reanalysis. The intersection of the zonal (30°N–40°N) and meridional (95°W–100°W) bands (*black dotted lines*) define the GPLLJ domain

(Martynov et al., 2013)

Regional metric validation: NA Monsoon

JJA and DJF Precipitation (m/d)

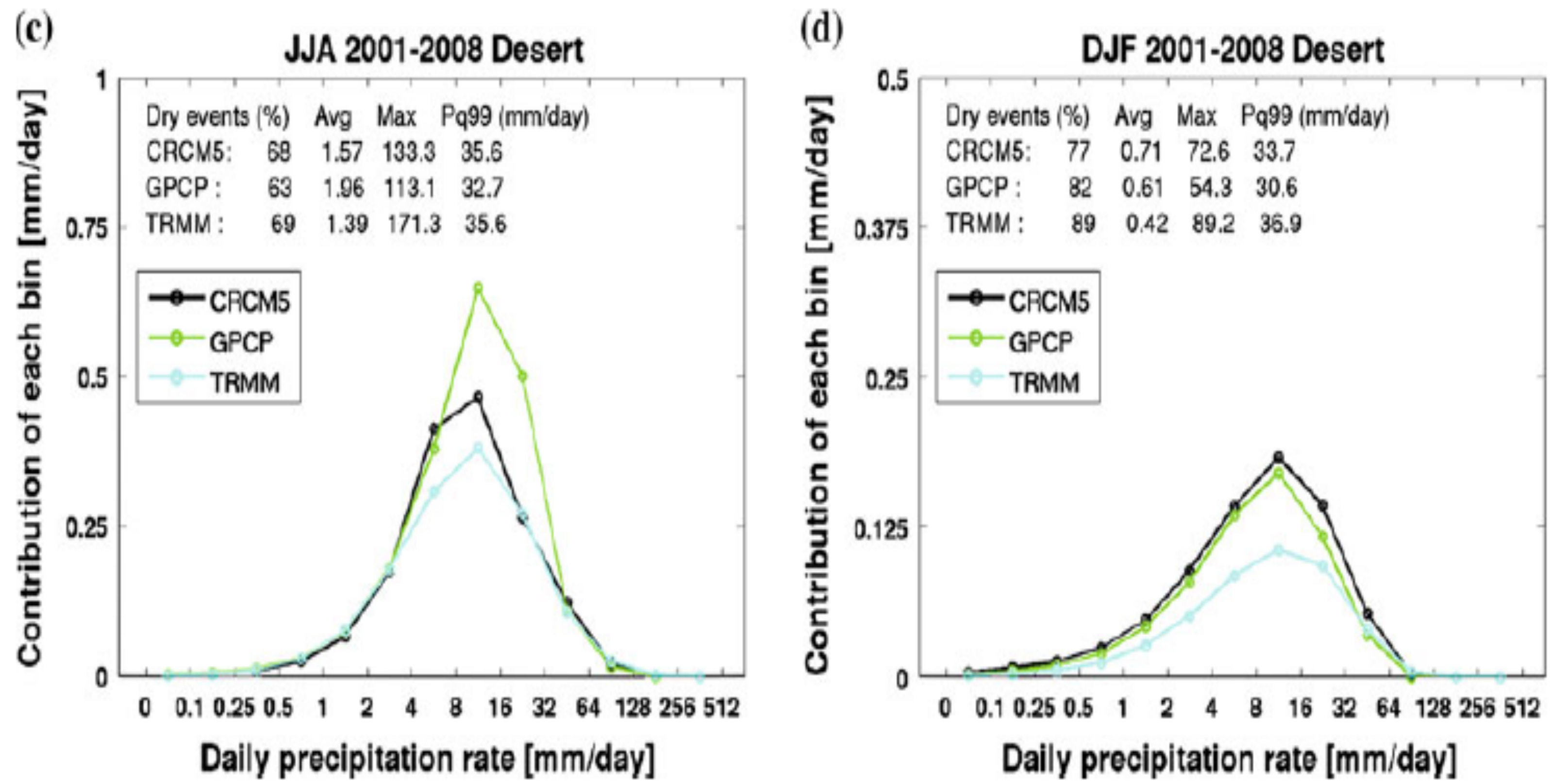
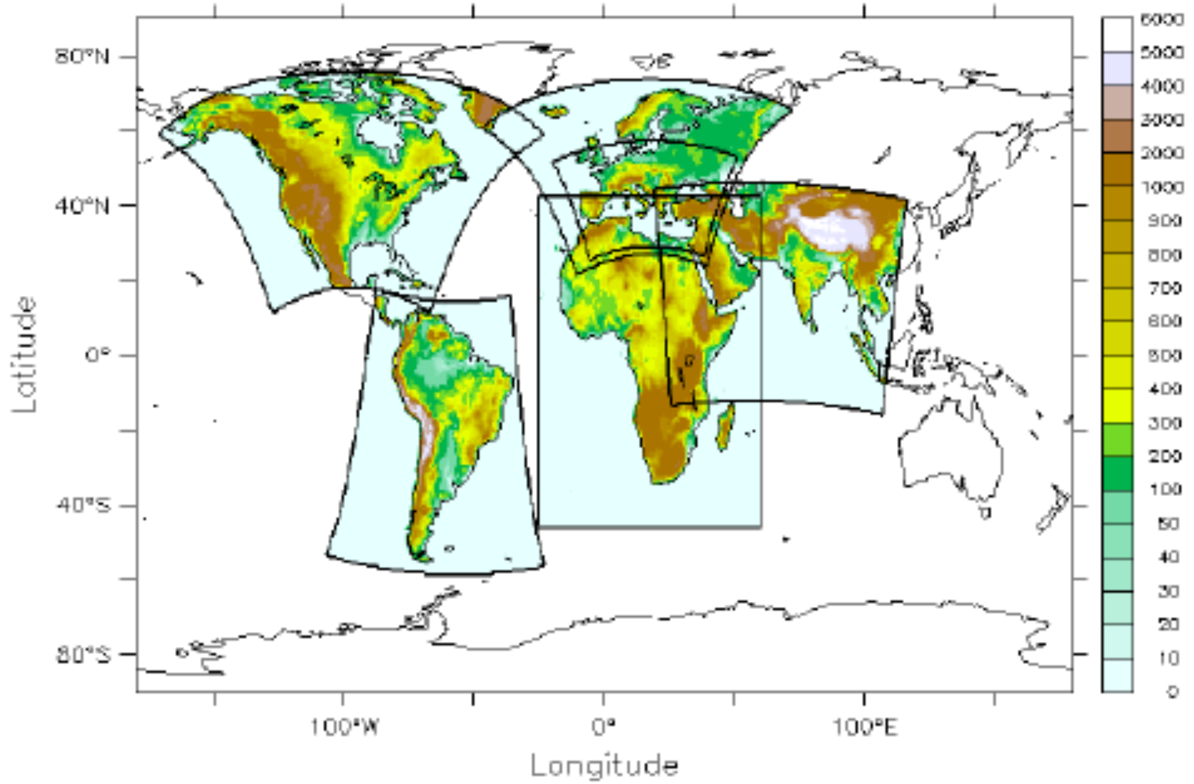


Fig. 17 Same as Fig. 10, but for the Desert subdomain

Original CORDEX Regions

Figure 1. Orography (m) of the 6 COordinated Regional Climate Downscaling EXperiment (CORDEX) model domains.



Jacob et al. 2012

Extremes in regional models – CMIP5 - NARCCAP

Clim Dyn (2013) 40:59–80
DOI 10.1007/s00382-012-1393-1

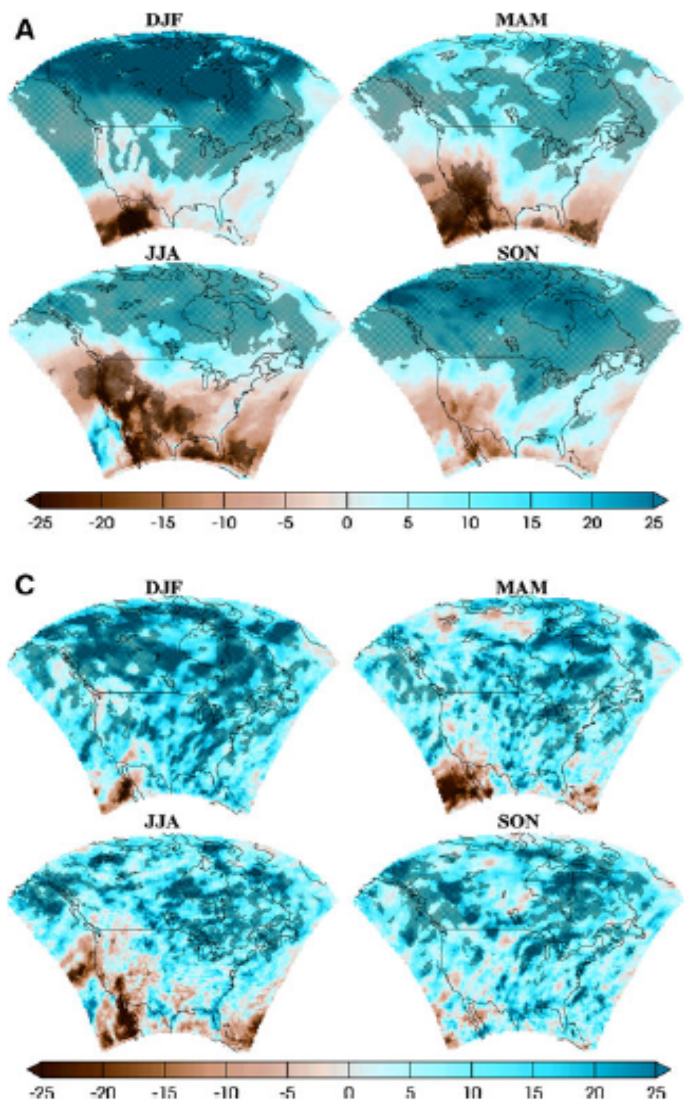
Very extreme seasonal precipitation in the NARCCAP ensemble: model performance and projections

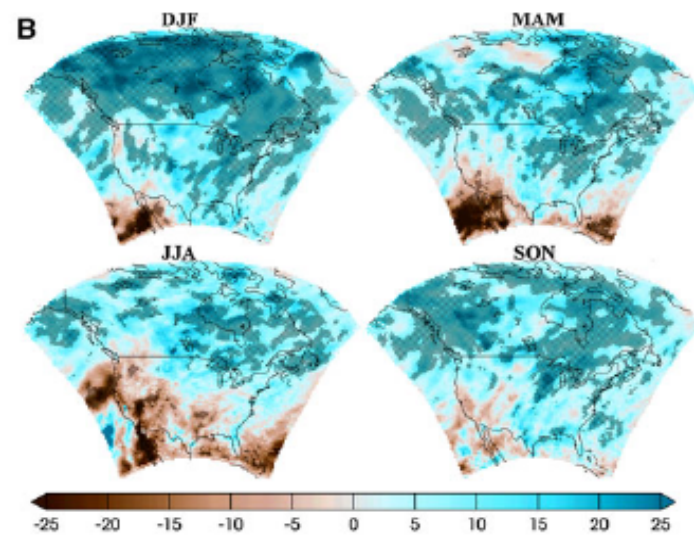
Michael F. Wehner

Mean NARCCAP RCM ensemble
Changes 2038-2070 minues 1968-1999 (Wehner 2013).

(a) Mean precip (%)

(b) Max daily precip





(c) 20-yr return value of max daily precip

Fig. 7 **a** Multi-model average percent change in the seasonal mean precipitation from the recent past (1968–1999) to the future (2038–2070). Regions where the signal to noise ratio exceeds unity are hatched. **b** Multi-model average percent change in the average seasonal maximum daily precipitation from the recent past (1968–1999) to the future (2038–2070). Regions where the signal to noise ratio exceeds unity are hatched. **c** Multi-model average percent change in the 20-year return value of the seasonal maximum daily precipitation from the recent past (1968–1999) to the future (2038–2070). Regions where the signal to noise ratio exceeds unity are hatched (Units: percent)

Land–Sea Thermal Contrast and Intensity of the North American Monsoon under Climate Change Conditions

ABRAHAM TORRES-ALAVEZ, TEREZA CAVAZOS, AND CUAUHTEMOC TURRENT

Future Changes in MFC (Torres-Alavez et al. 2014)

J. Climate 2014

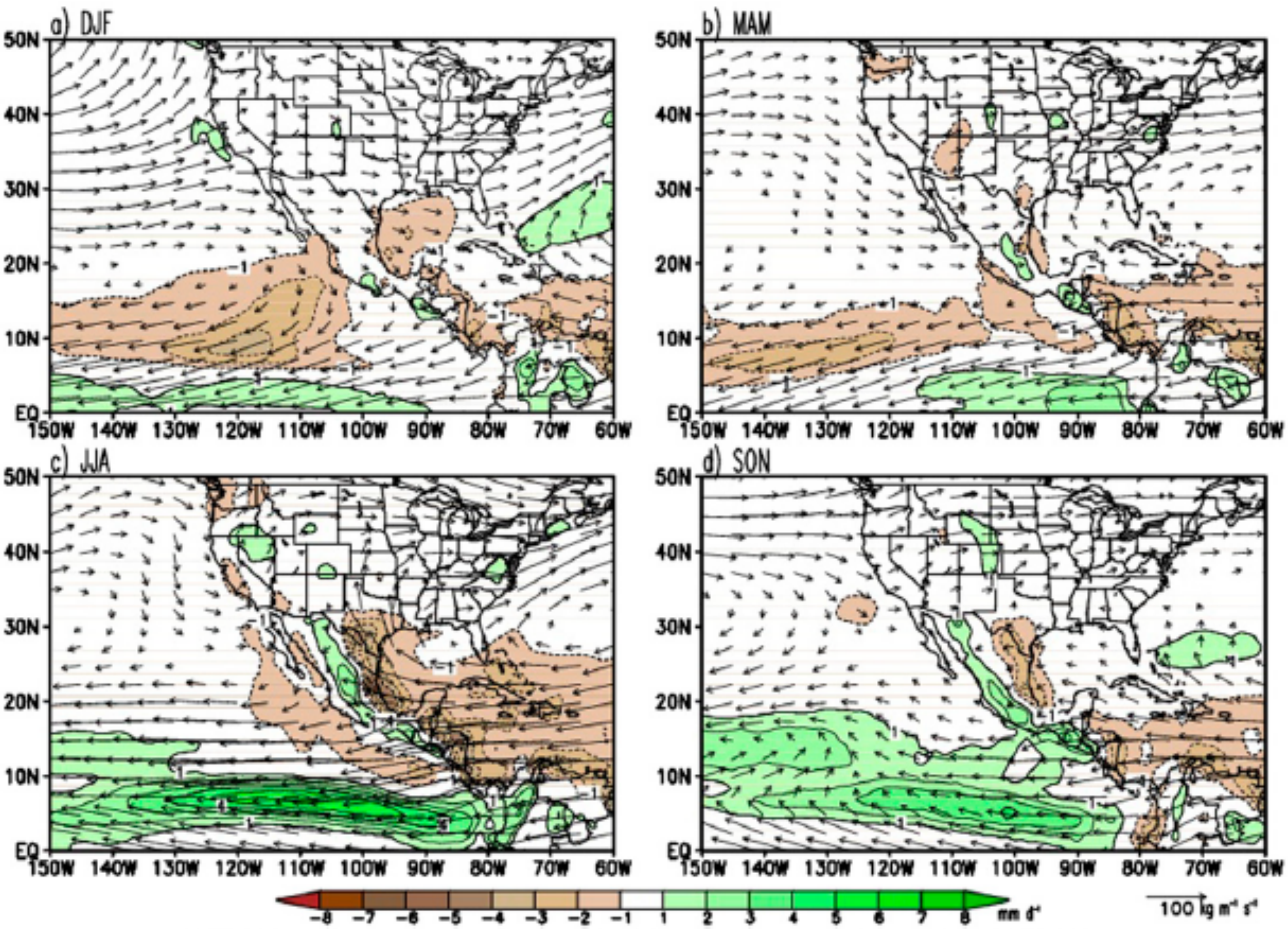


FIG. 10. Mean seasonal differences between the ens_GCMs RCP8.5 projections (2075–99) and the historical period (1979–2004) for the vertically integrated moisture flux (vectors; kg $m^{-1} s^{-1}$) and its convergence (shading; mm day^{-1}).

NAM – monsoon retreat problem (21 GCMs of the CMIP5)

15 NOVEMBER 2013 GEIL ET AL. 8787

SPECIAL
North America in CMIP5 Models
COLLECTION

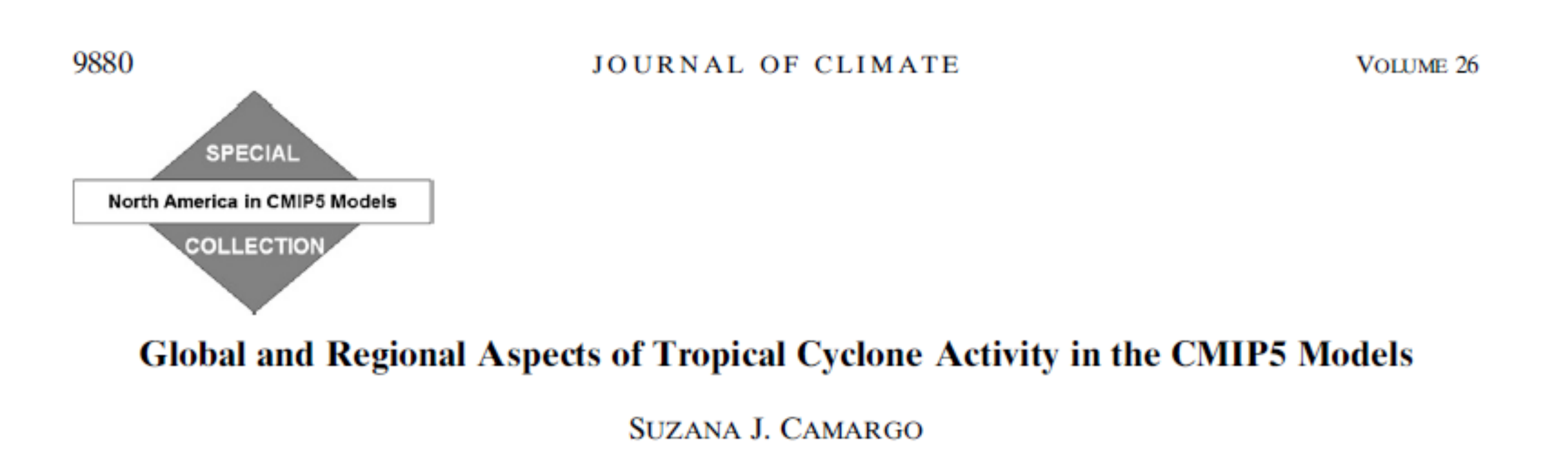
Assessment of CMIP5 Model Simulations of the North American Monsoon System

KERRIE L. GEIL, YOLANDE L. SERRA, AND XUBIN ZENG

large-scale circulation patterns at a low level usually have realistic representations of the NAMS, but even the best models poorly represent monsoon retreat. Difficulty in reproducing monsoon retreat results from an inaccurate representation of gradients in low-level geopotential height across the larger region, which causes an unrealistic flux of low-level moisture from the tropics into the NAMS region that extends well into the post-monsoon season. Composites of the models with the best and worst representations of the NAMS indicate that

1-month phase lags, respectively. The only model that captures all characteristic features of the annual cycle with the proper timing is the Met Office Hadley Centre (MOHC) HGE model; however, this model is too wet for 11 out of 12 months. Of the small and moderate

Fuentes et al. 2014



9880 JOURNAL OF CLIMATE VOLUME 26

SPECIAL
North America in CMIP5 Models
COLLECTION

Global and Regional Aspects of Tropical Cyclone Activity in the CMIP5 Models

SUZANA J. CAMARGO

Camargo et al. 2014

TC tracks from Obs and CMIP5 models (Camargo et al.)

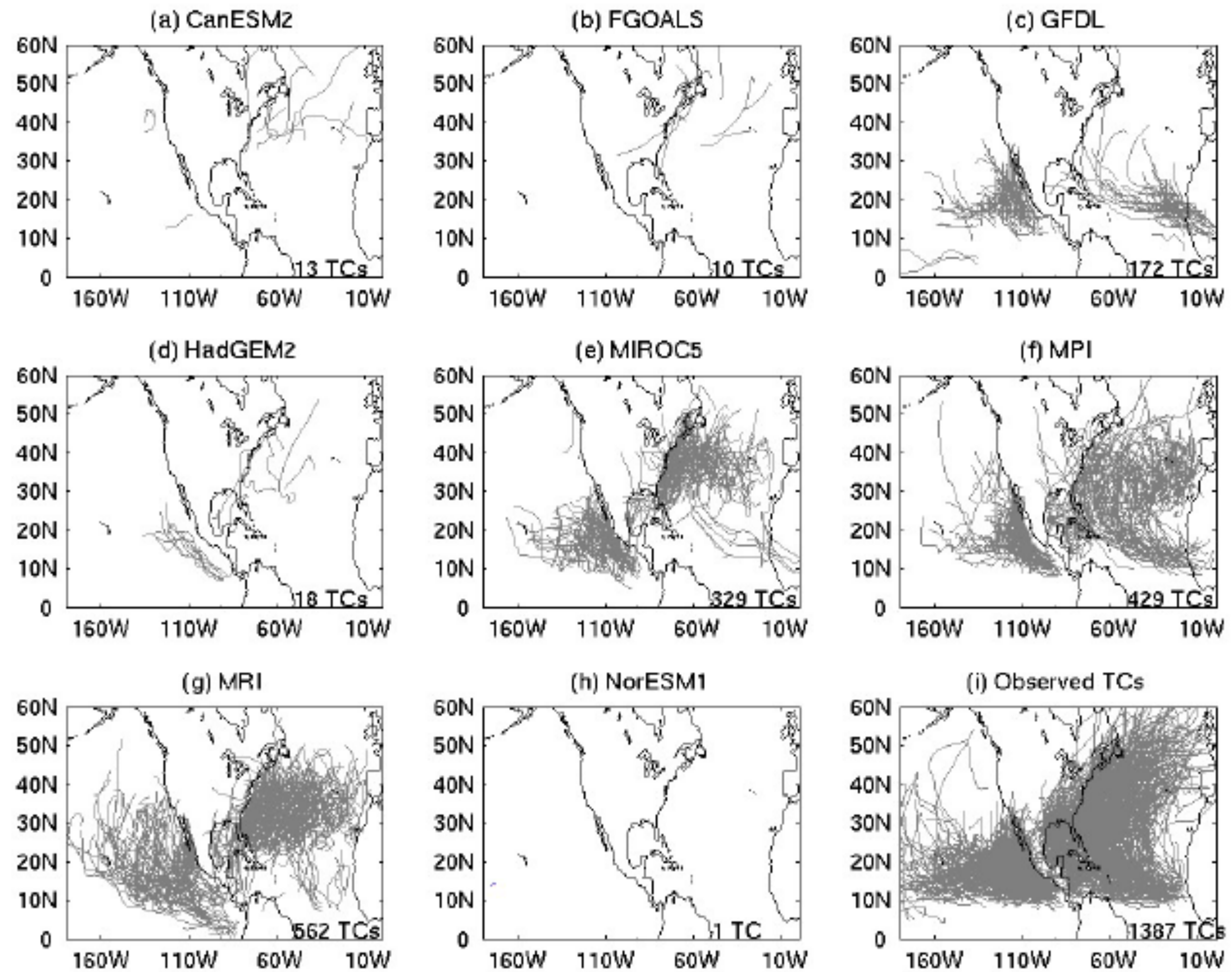


FIG. 6: North Atlantic and eastern North Pacific TC tracks in 8 CMIP5 models (historical

TC tracks from Obs and CMIP5 models (Sheffield et al. 2013)

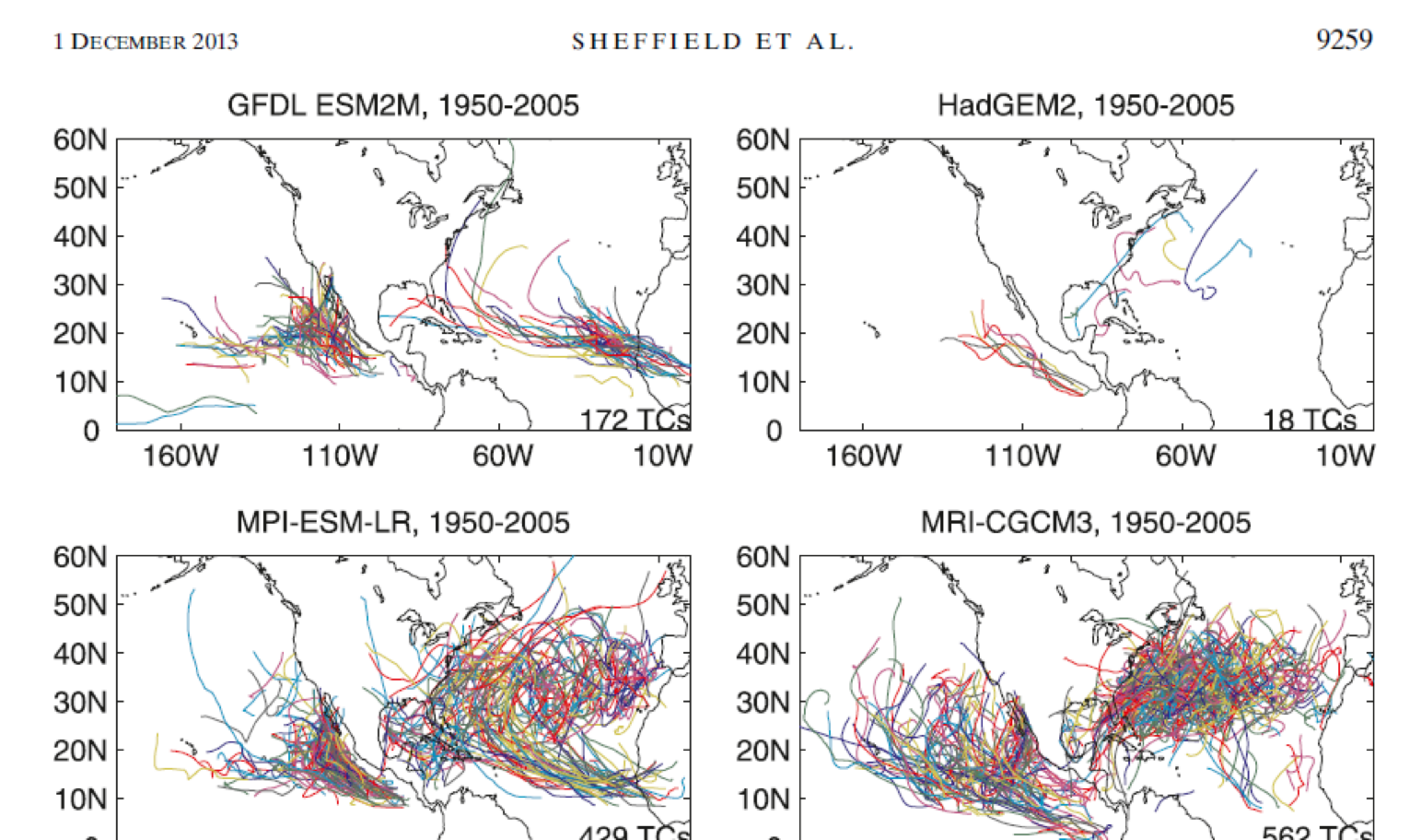
SPECIAL
North America in CMIP5 Models
COLLECTION

North American Climate in CMIP5 Experiments. Part II: Evaluation of Historical Simulations of Intraseasonal to Decadal Variability

JUSTIN SHEFFIELD,[a] SUZANA J. CAMARGO,[b] RONG FU,[c] QI HU,[d] XIANAN JIANG,[e] NATHANIEL JOHNSON,[f] KRISTOPHER B. KARNAUSKAS,[g] SEON TAE KIM,[h] JIM KINTER,[i] SANJIV KUMAR,[i] BAIRD LANGENBRUNNER,[j] ERIC MALONEY,[k] ANNARITA MARIOTTI,[l] JOYCE E. MEYERSON,[j] J. DAVID NEELIN,[j] SUMANT NIGAM,[m] ZAITAO PAN,[n] ALFREDO RUIZ-BARRADAS,[m] RICHARD SEAGER,[b] YOLANDE L. SERRA,[o] DE-ZHENG SUN,[p] CHUNZAI WANG,[q] SHANG-PING XIE,[r] JIN-YI YU,[s] TAO ZHANG,[p] AND MING ZHAO[t]

observed teleconnections, with implications for future projections examined in part three of this paper. In terms of intraseasonal variability, almost half of the models examined can reproduce observed variability in the eastern Pacific and most models capture the midsummer drought over Central America. The multimodel mean replicates the density of traveling tropical synoptic-scale disturbances but with large spread among the models. On the other hand, the coarse resolution of the models means that tropical cyclone frequencies are underpredicted in the Atlantic and eastern North Pacific. The frequency and mean amplitude of ENSO are generally well reproduced, although teleconnections with North American climate are widely varying among models and only a few models can reproduce the east and central Pacific types of ENSO and connections with U.S. winter temperatures. The models capture the spatial pattern of Pacific decadal oscillation (PDO) variability and its

TC tracks from Obs and CMIP5 models (Sheffield et al. 2013)



TC frequency from Obs and CMIP5 models (Camargo et al.)

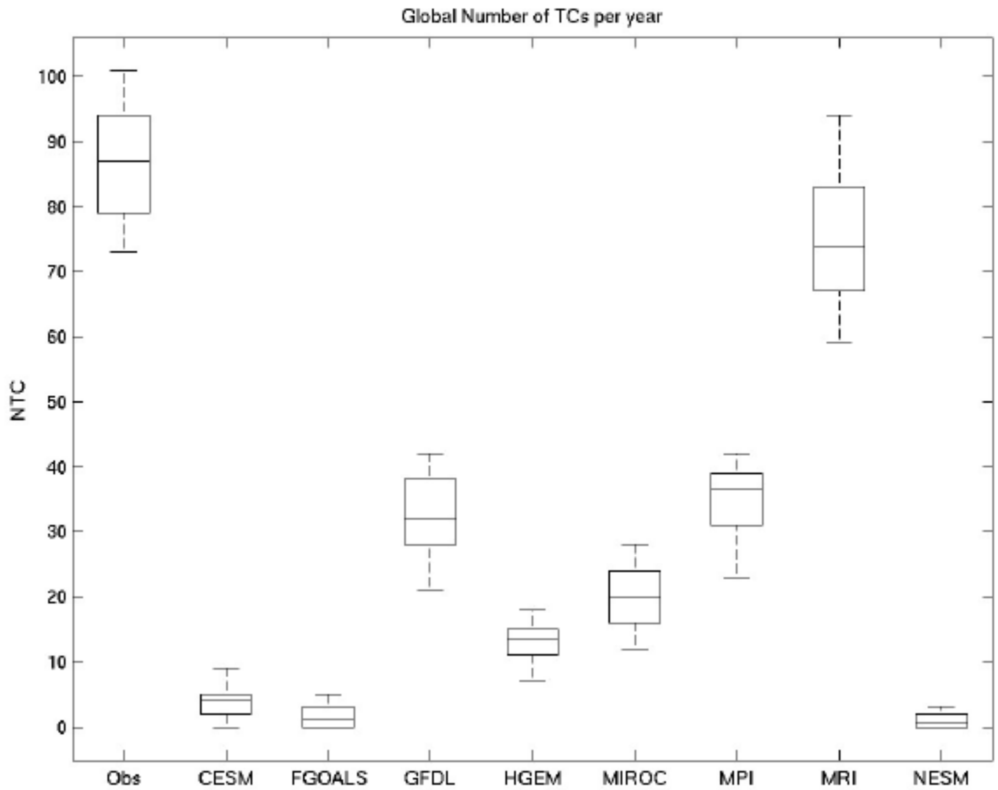


FIG. 3: Distribution of the global number of TCs per year in each of the models for the historical runs and in observations in the period 1980-2005: CanESM2 (CESM), HadGEM2 (HGEM), NorESM1 (NESM). When more than one ensemble member is available, all ensemble members are used in the distribution (FGOALS, MPI, MRI). The box denotes the range of the 25th to 75th percentiles of the distributions, with the median marked by the line inside the box and the values outside of the middle quartile being

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 CMIP5 GCMs and RegCM4 CORDEX simulations

Fuentes-Franco et al. 2014

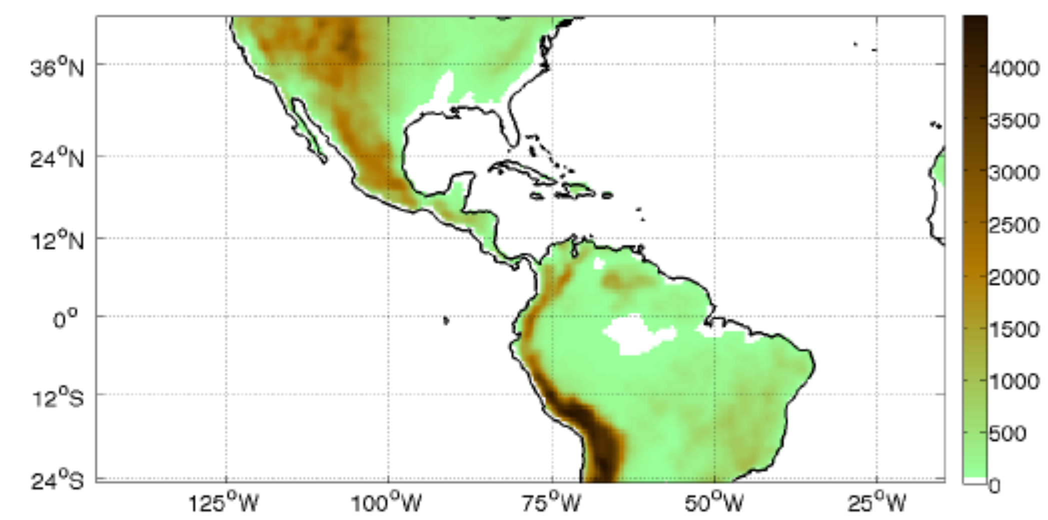


Figure 1. Topography of the Central America CORDEX domain. Colorbar units: meters.

Future Monsoon Changes
(RCP8.5: 2075-2099) – (1979-2004)

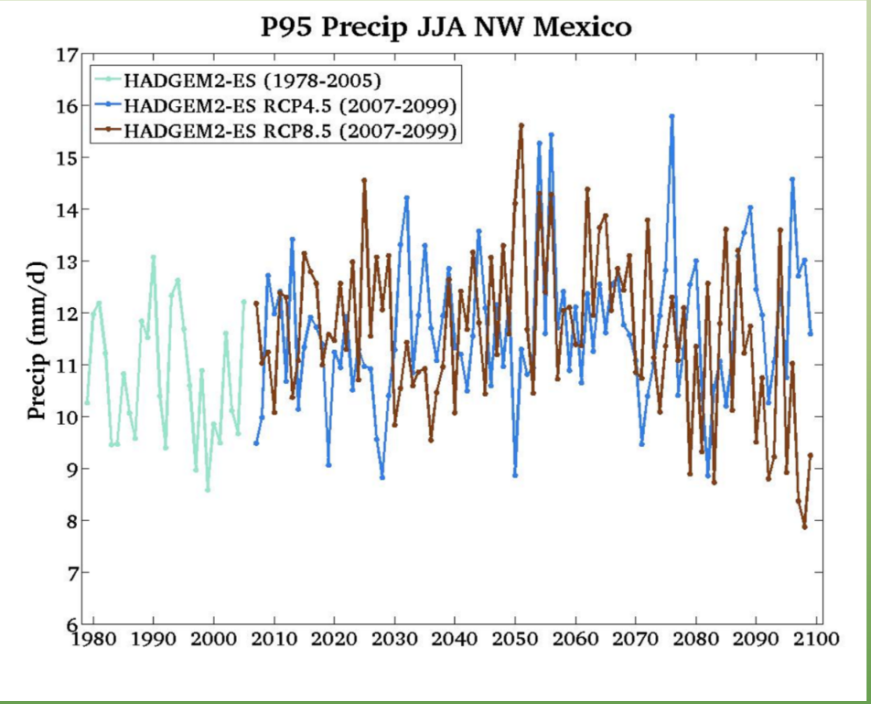
CONCLUSIONS

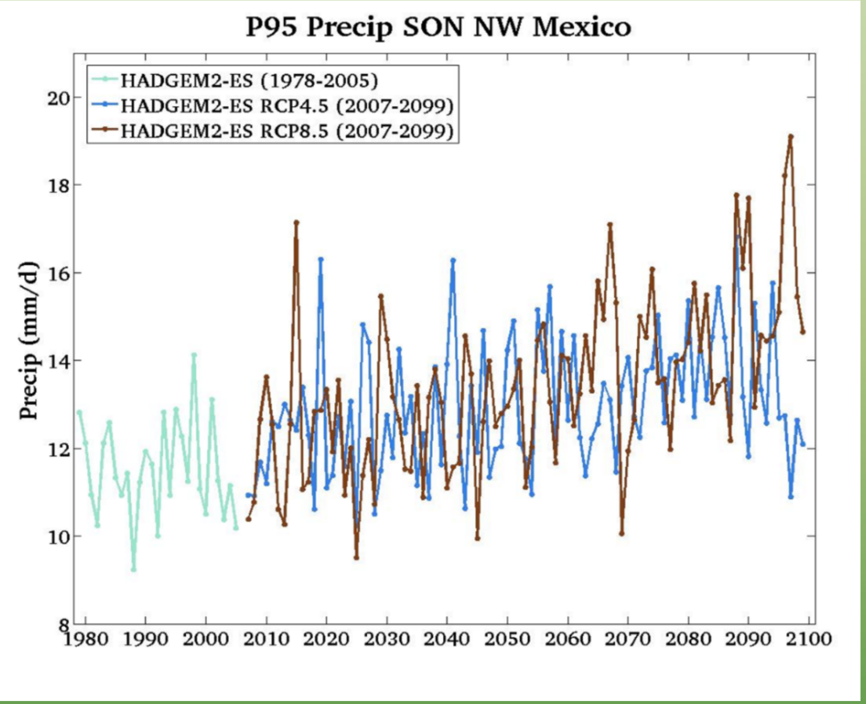
We analyzed daily and seasonal precipitation extremes in the North American monsoon region based on the 95 percentile (P95) thresholds for the 1979-2005 historical period, and the expected changes in 2075-2099 under the RCP8.5 scenario.

The validation of historical extreme precipitation exceeding the 95th percentile over the North America monsoon show that the regional model HadGEM3RA reproduces adequately the interannual variability and intensity of the P95 thresholds during all seasons while the ERA and the HadGEM2-ES underestimate them.

In the future, the model HadGEM2-ES projects a decrease in the P95 threshold of summer precipitation and an increases of it in the fall, which could be attributed to larger positive anomalies of the moisture during fall than in summer over the NAM region (Figure. 5) associated to the positive changes in the surface moisture flux over the mouth of the Gulf of California in the autumn.

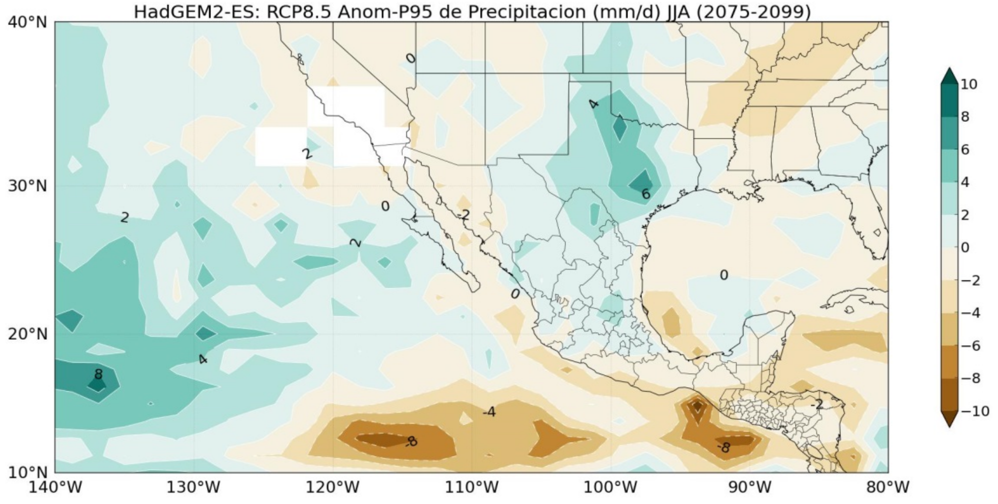
Seasonal mean thresholds of P95 precipitation (mm/d) in the NAM region for the RCP8.5 scenario

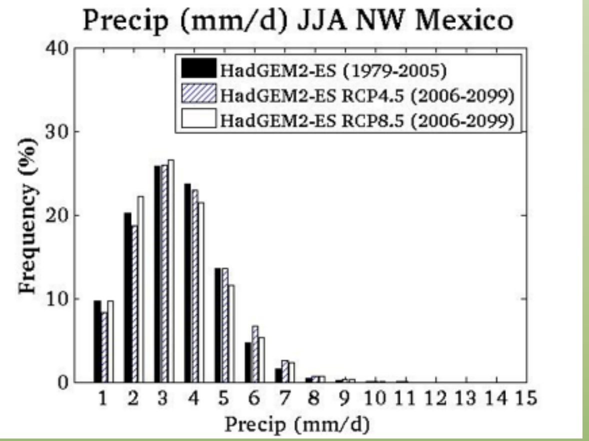




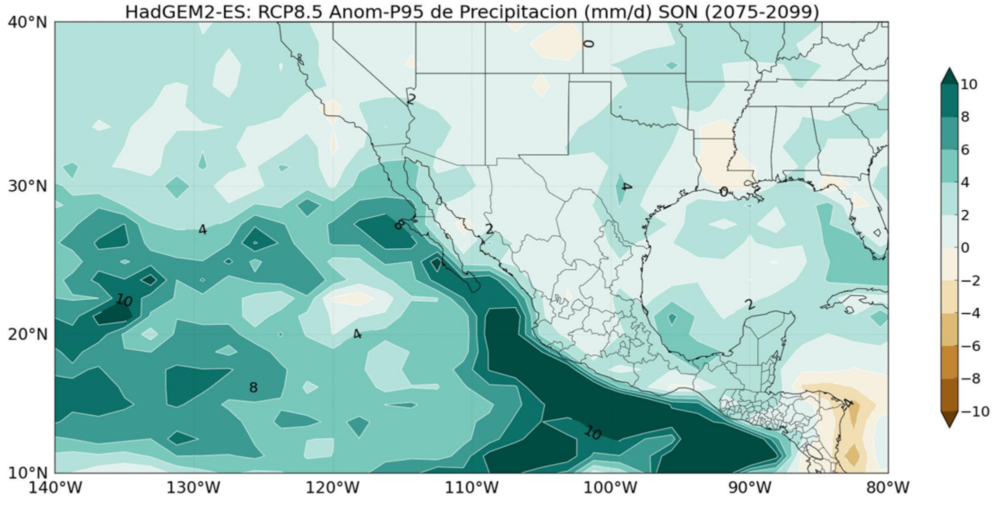
Changes in seasonal 95th percentile of daily precipitation (in mm) for the 2075–2099 period (RCP8.5 scenario) relative to the 1979–2005

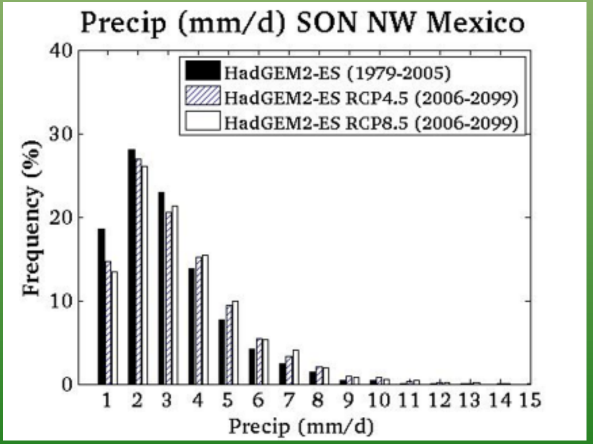
JJA





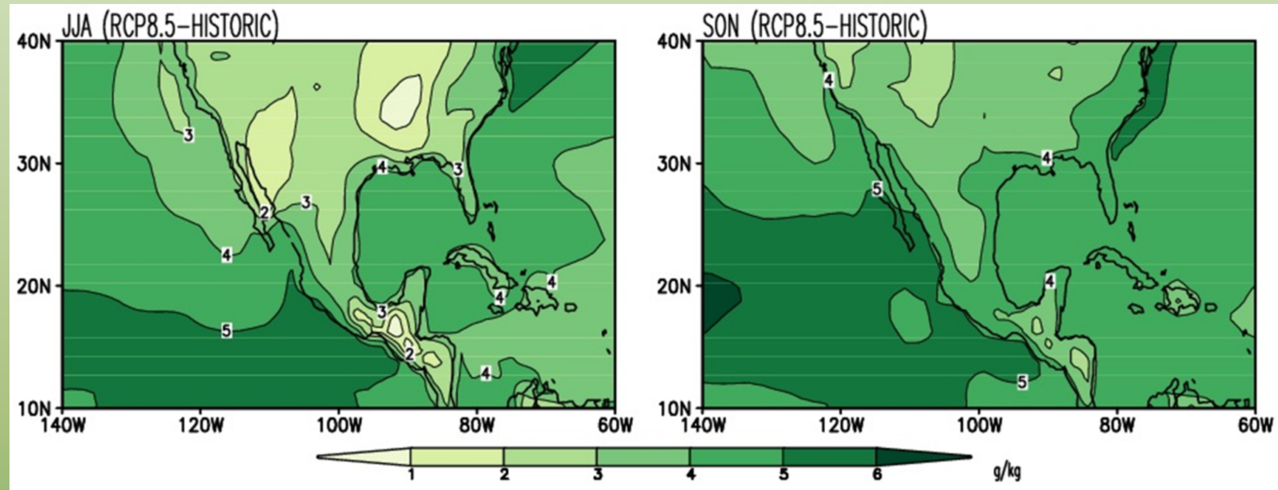
SON



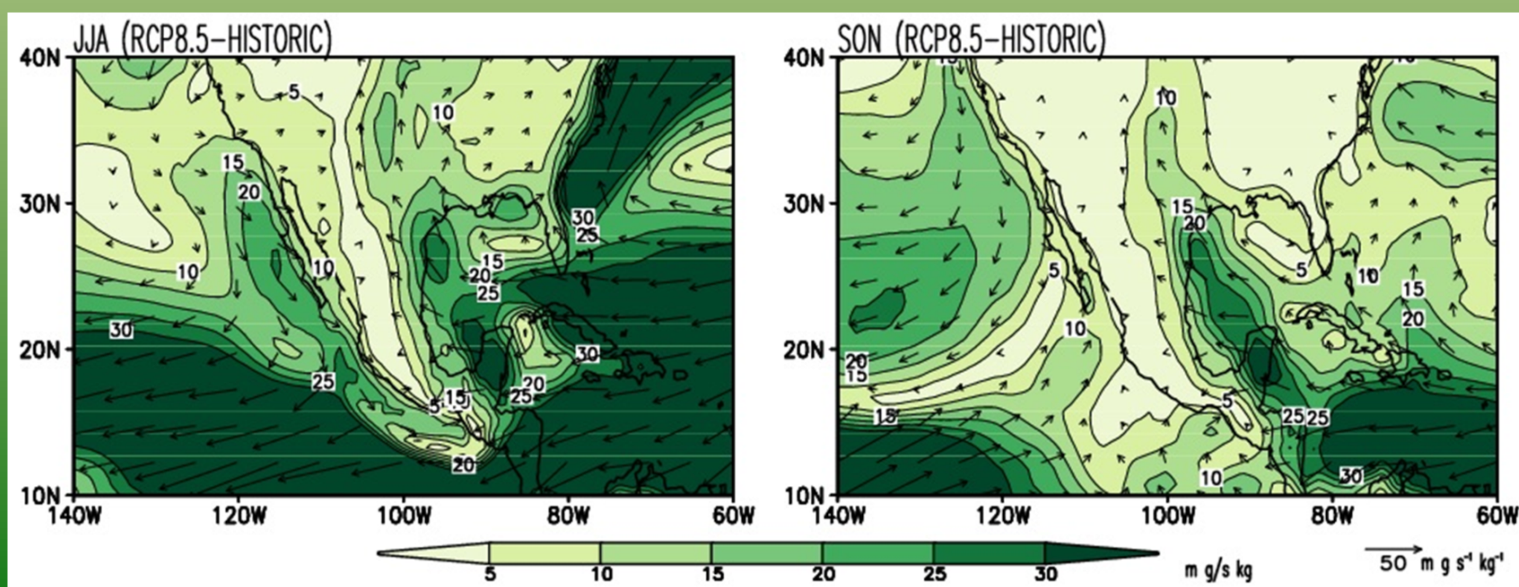


Changes in seasonal surface (10m) moisture content SON and moisture flux during days with extreme precipitation events (> P95) for the 2075–2099 period (RCP8.5 scenario) relative to the 1979–2005

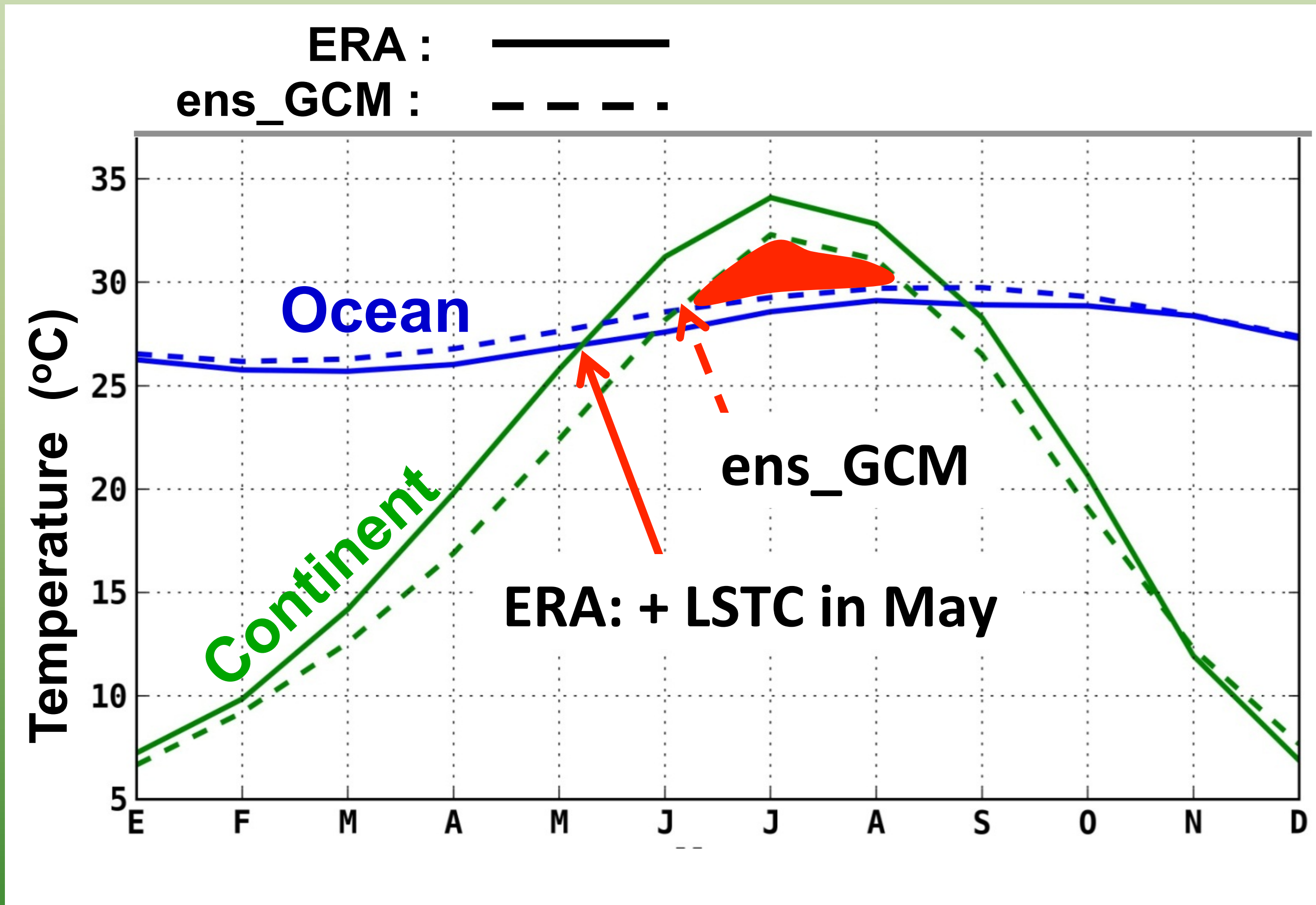
q10m

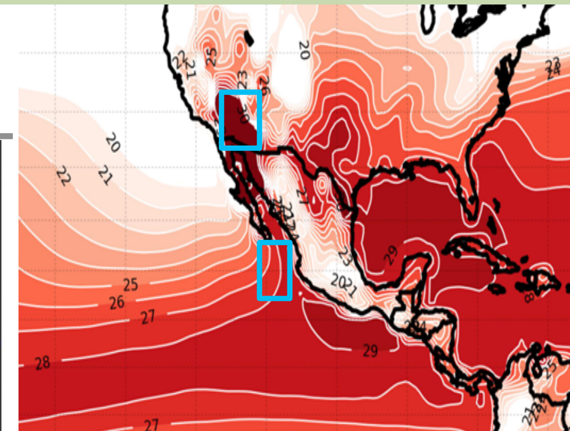


q flux 10m



Annual Cycle of Tskin (°C) for Land and Sea: ERA Interim and ens_GCM (1979-2004)





(Turrent & Cavazos 2009, Geophys. Res. Lett.)

CCA-UNAM, Remo-MPI

El 28/03/2014 07:41 a.m., Benjamin Martinez escribió:
Que tall Tere, estamos hacienda algunas cosas usando el modelo
REMO acoplado Al modelo oceanic del MPI. Tenemos corridas
a 100, 50, 25 y 17 km tanto en modo oceanico como acoplado.
Estamos apenas analizando las corridas historicas (1950-2005)
y esta planeado hacer unas proyecciones. De cordex no hemos
Usado nada pero podriamos ver si existe algo que pudieramos
Utilizar para comparar.

Estamos viendo lo del Jet de niveles bajos del Caribe. En otro articulo simplemente mostramos la convergencia de la solución numérica a las observaciones al incrementar la resolucion, enfatizando el acoplamiento y como el acoplado a 17 km simula bastante bien el campo de precipitación. En otro mas que apenas estamos inicando, se ve lo del monzon. Esos son los temas por ahora.