Intense Precipitation Events in Mexico City

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Changes in precipitation timing

(Jauregui y Romales, 1996)

TACUBAYA (West)

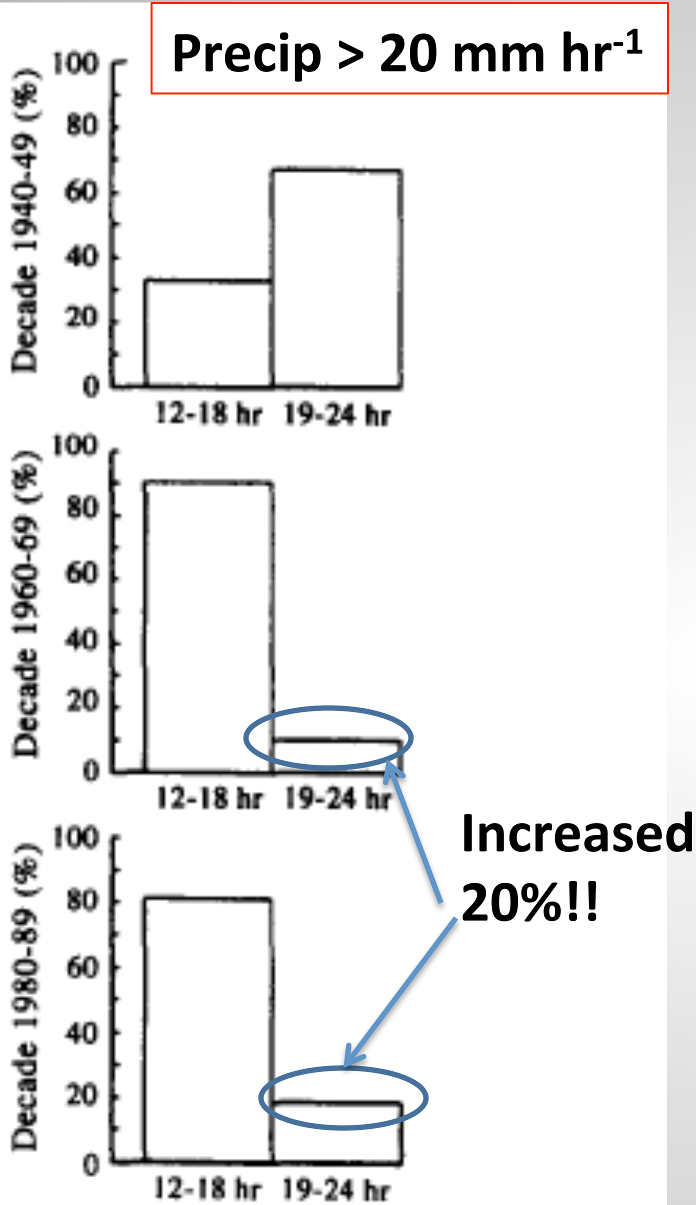


Fig. 4. Frequency of intense rainfall events > 20 mm h^{-1} for three decades by time of day in Mexico City.

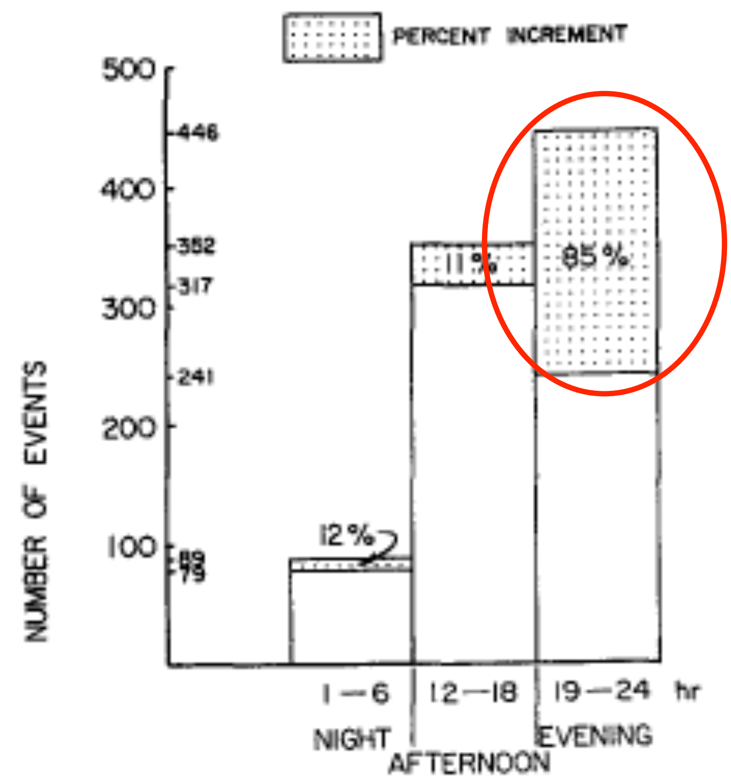
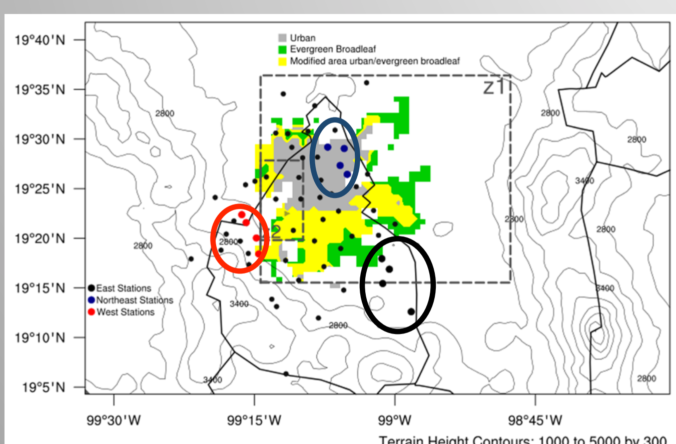
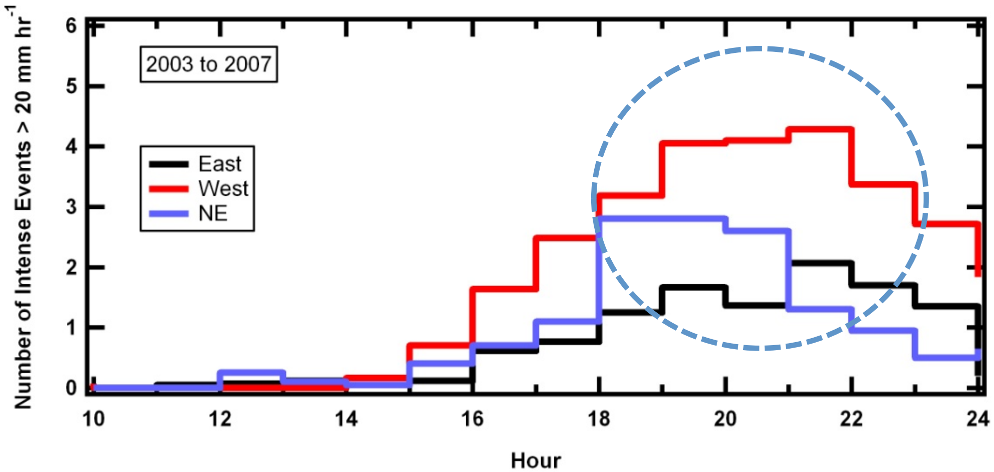
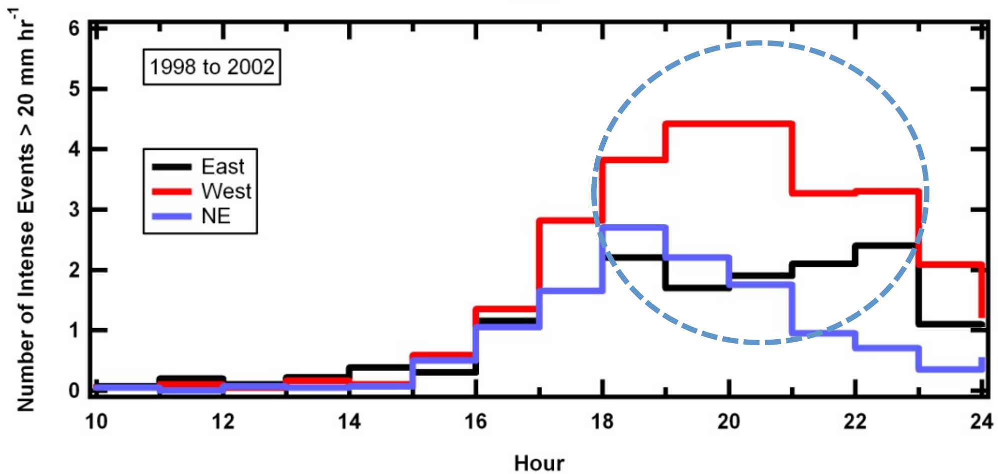


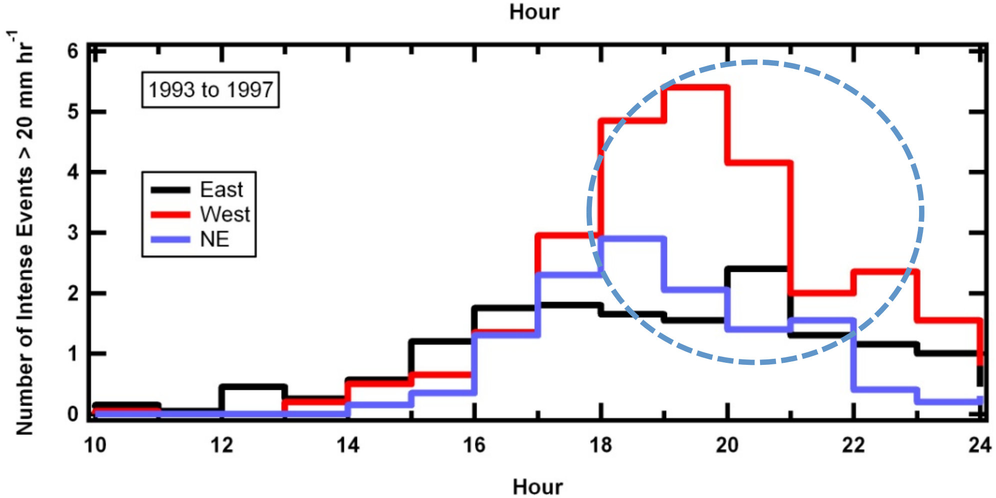
Fig. 5. Frequency of rainfall events (July–September) > 1 mm h^{-1} for two decades 1941–1950 and 1981–1990 for three periods during the day at the Tacubaya Observatory.

Changes on the hourly distribution of intense precipitation events (Precip > 20 mm/hr)







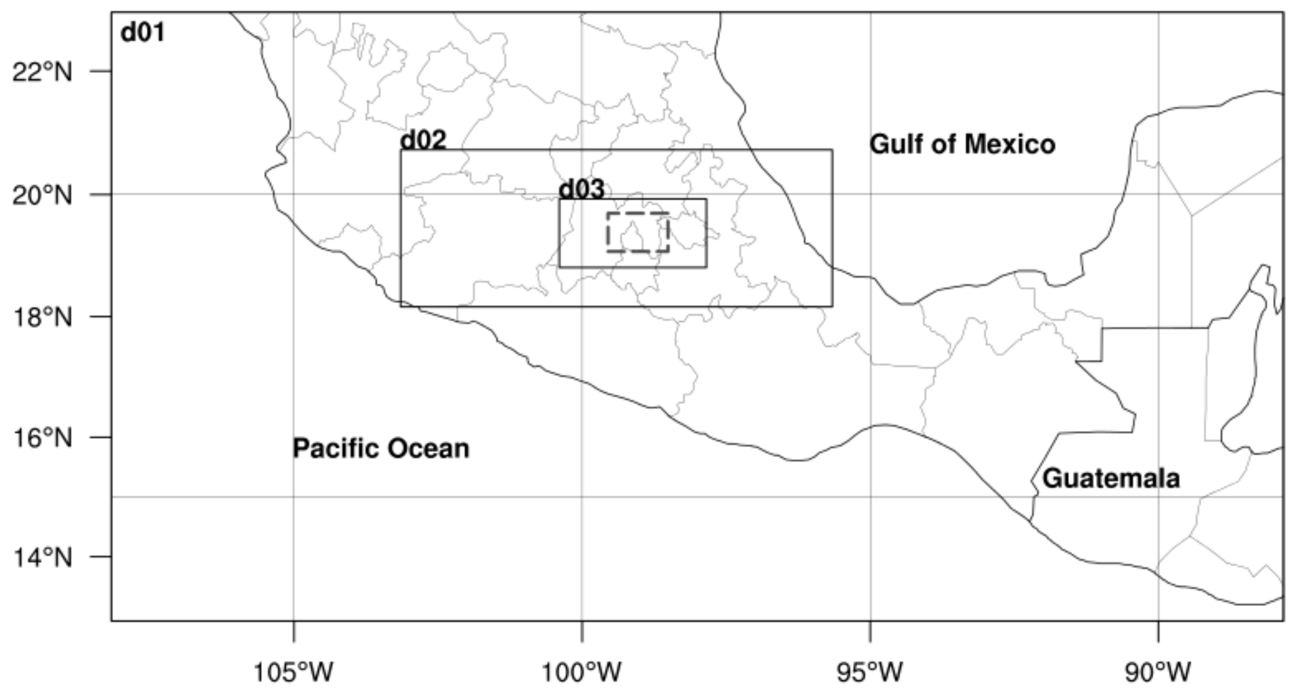


Defined two hypothesis

Changes on the timing and frequency of intense precipitation events can be related with:

1) Changes on the cloud microphysical properties due to an increase of emissions. Using CCN as a proxy for emissions.

2) Changes on the land use/land cover over the Mexico City Basin



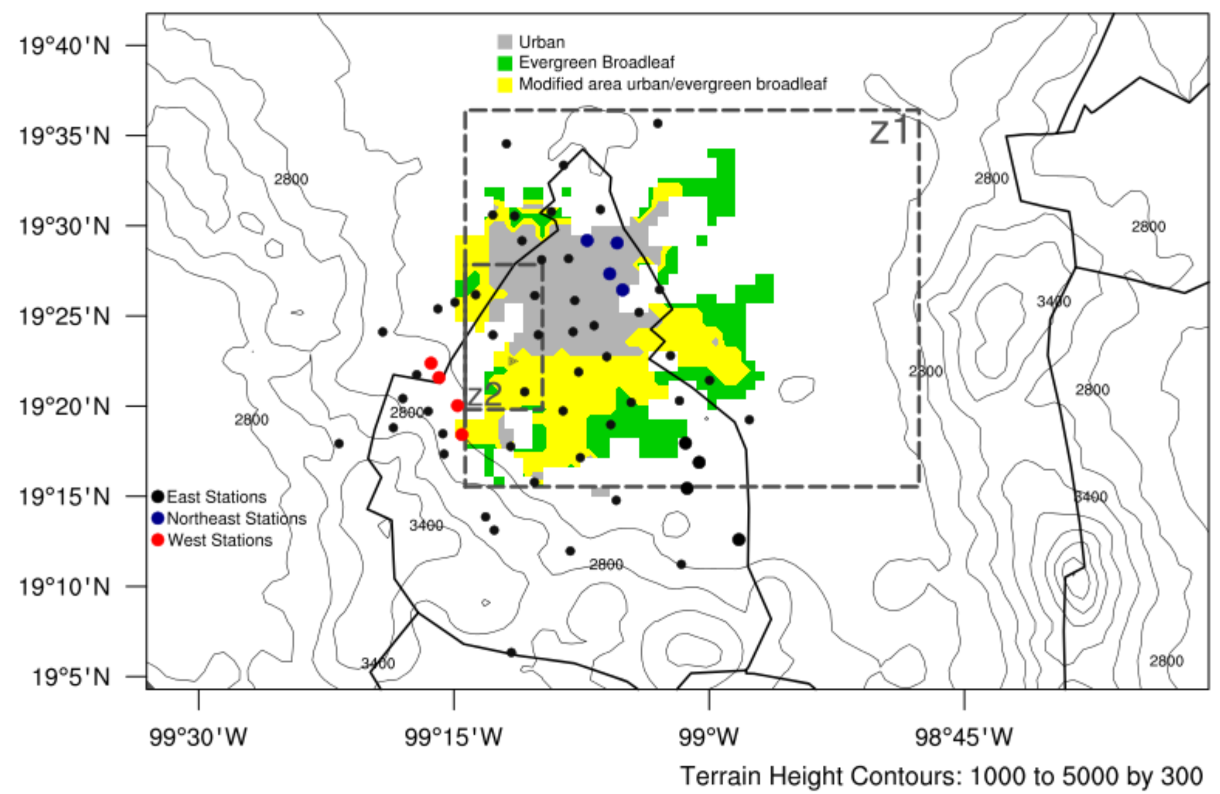
Used WRF v3.4

Computational domains with 9km, 3km y 1km spatial resolution

27 vertical levels

IC and BC from NARR

Land Surface Model:	Noah-lsm
Boundary Layer Parameterization:	YSU
Microphysics Parameterization:	Thompson
Cumulus Convection Param.:	Kain-Fritsch (d01,d02)



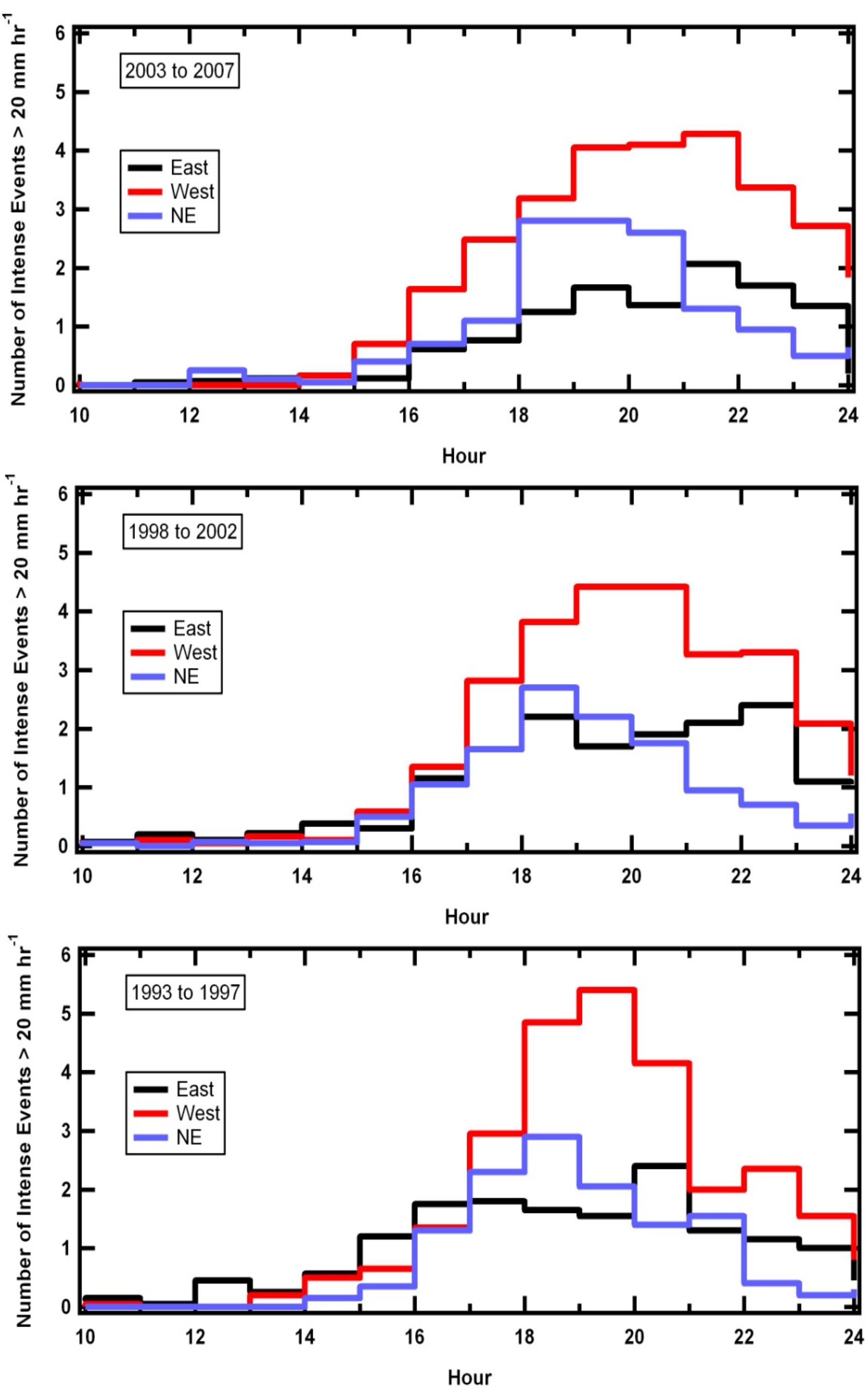
Ten Septembers between 2002-2011 were simulated

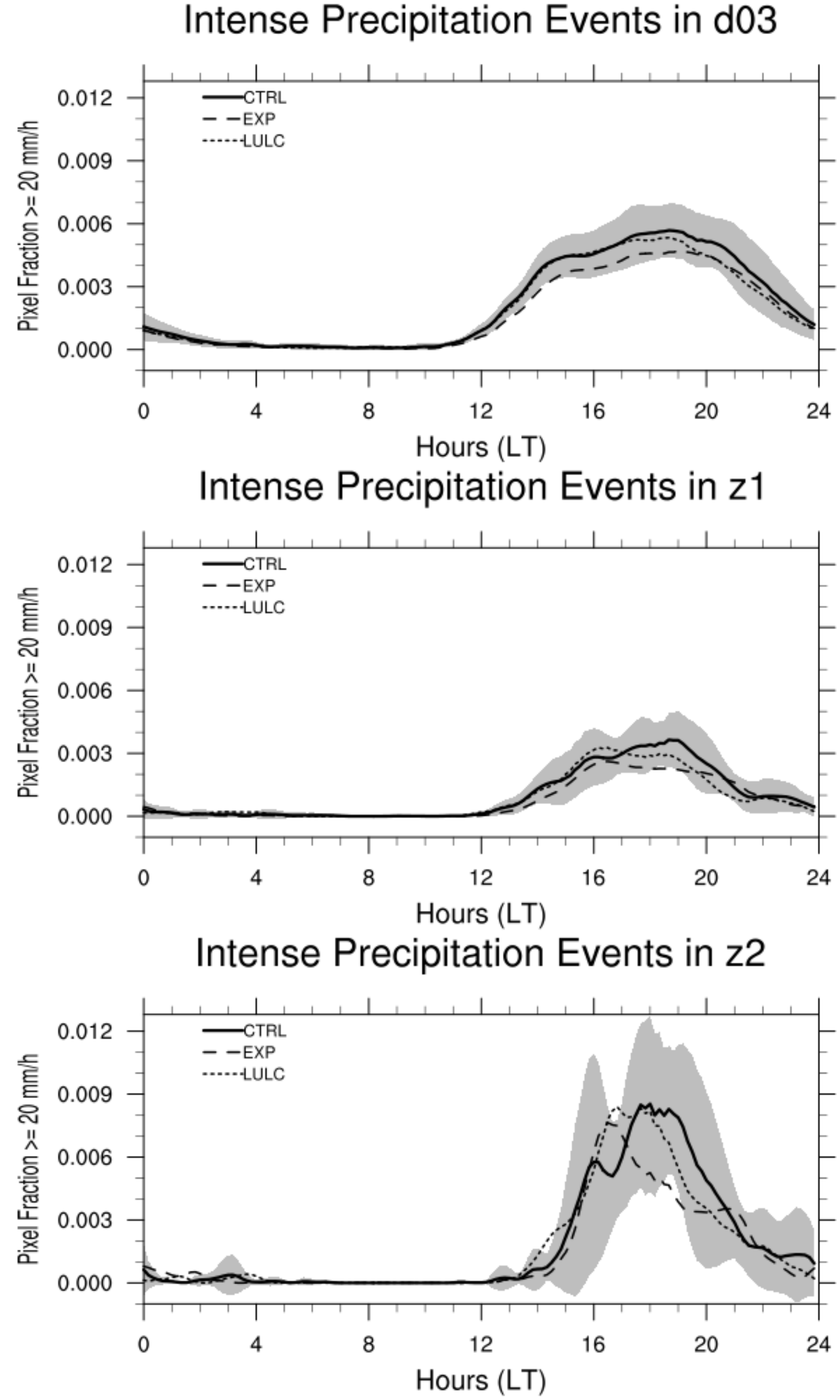
Three different numeric experiments were designed:

CTRL: Simulations were done with USGS 1993 Land cover

EXP: Prescribed droplet number concentration was modified inside MP param. from 600 cm^{-3} to 1200 cm^{-3}

LULC: Part of the urban area was substituted by vegetation according to what is present on USGS 1993 land cover data


2003 to 2007
East
West
NE
Number of Intense Events > 20 mm hr⁻¹
Hour
1998 to 2002
East
West
NE
Number of Intense Events > 20 mm hr⁻¹
Hour
1993 to 1997
East
West
NE
Number of Intense Events > 20 mm hr⁻¹
Hour


Intense Precipitation Events in d03
CTRL
EXP
LULC
Pixel Fraction >= 20 mm/h
Hours (LT)
Intense Precipitation Events in z1
CTRL
EXP
LULC
Pixel Fraction >= 20 mm/h
Hours (LT)
Intense Precipitation Events in z2
CTRL
EXP
LULC
Pixel Fraction >= 20 mm/h
Hours (LT)

Conclusions

- Observations show that there have been changes on the distribution of hourly precipitation. Most of the intense precipitation events (Precip > 20 mmh-1) occur during night (19-24 h).
- Numeric simulations show that there is a possible influence of both (MP and LULC) on the timing of intense precipitation events
- The model indicates that both changes (LULC and MP) tend to move the maximum to early in the evening.

Soil Moisture Effect On Simulated Diurnal Cycle of Precipitable Water Vapor in the North American Monsoon Region

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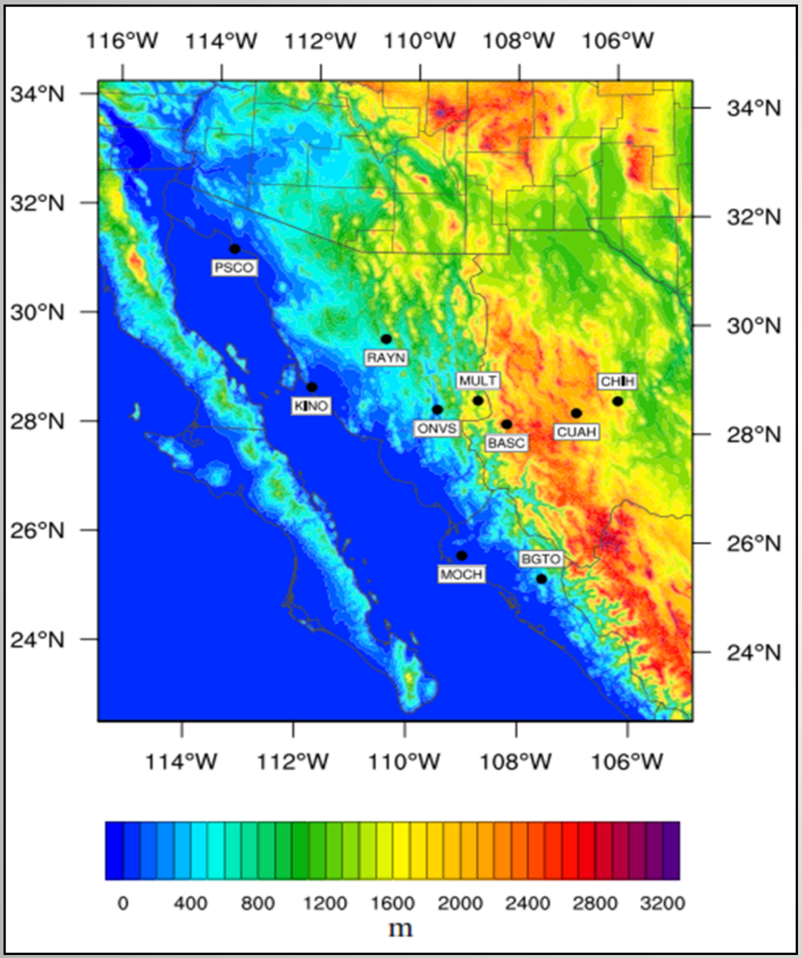
THE UNIVERSITY OF ARIZONA.

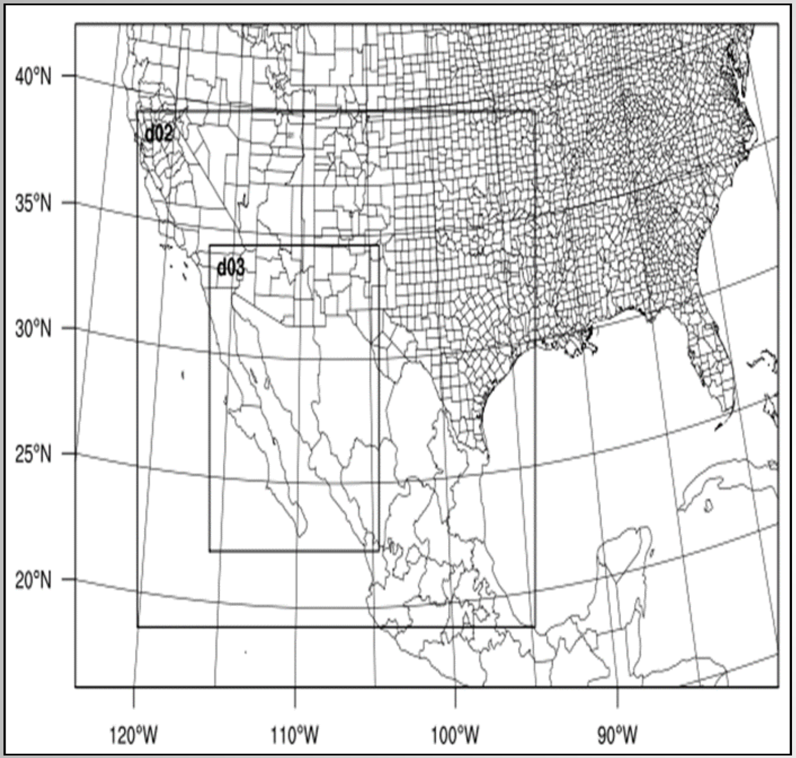
North American Monsoon GPS Transect Experiment 2013



- Ten GPS-Met stations
- Three transects: Coastal, esast-west (2)
- PWV each 5 min
- April to September 2013
- Look at the precipitation gradient over mountains

BAMS: Serra et al, 2016 (in press)

Numeric Experiment Design

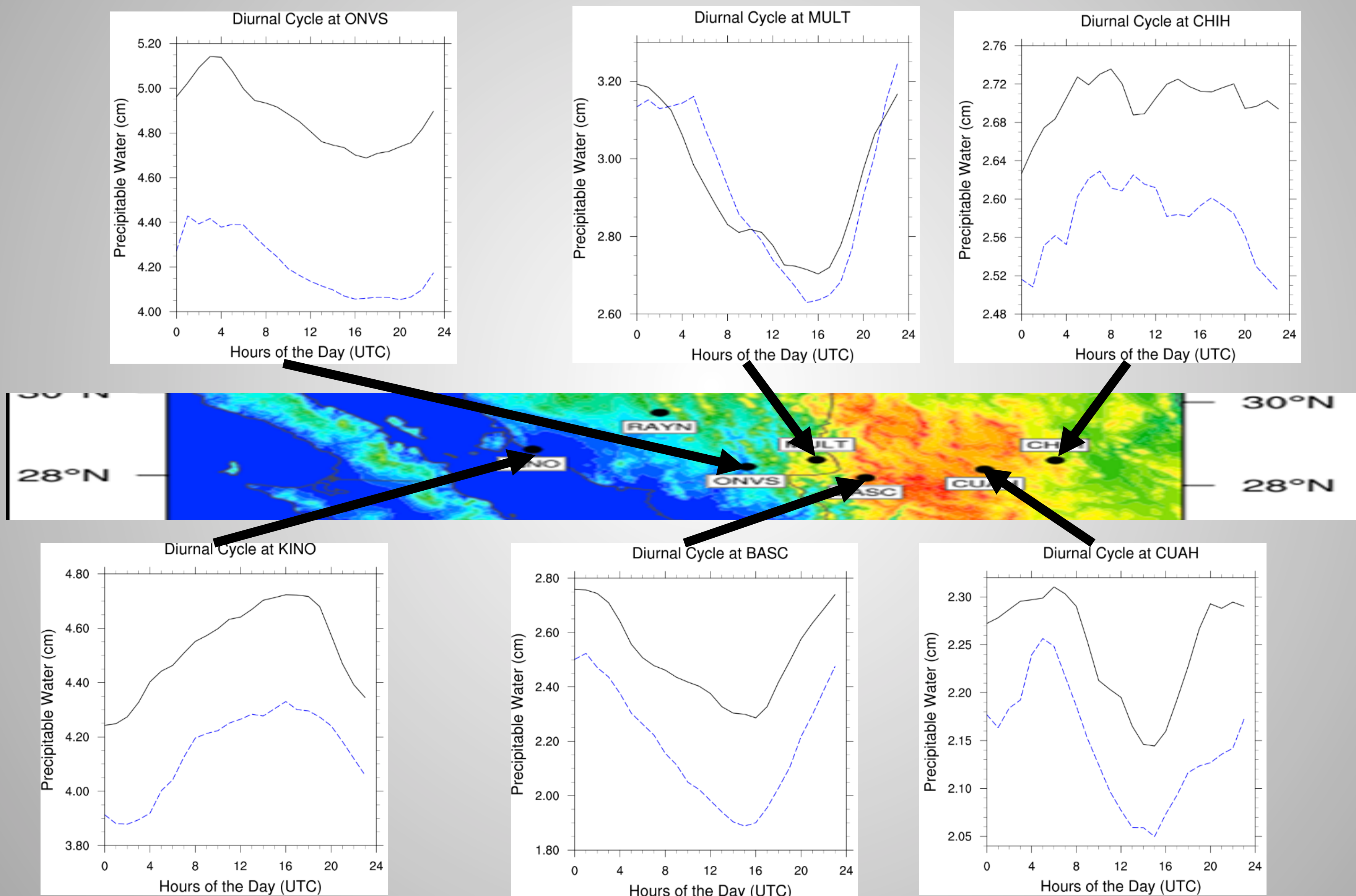


- Weather Research & Forecasting (WRF) version 3.6.1
- 30 km, 10 km and 2.5 km spatial resolution
- 40 vertical levels
- IC & BC from ERA Interim
- 2012 MODIS Land Cover
- 26th June to 20th July 2013
- Spectral Nudging

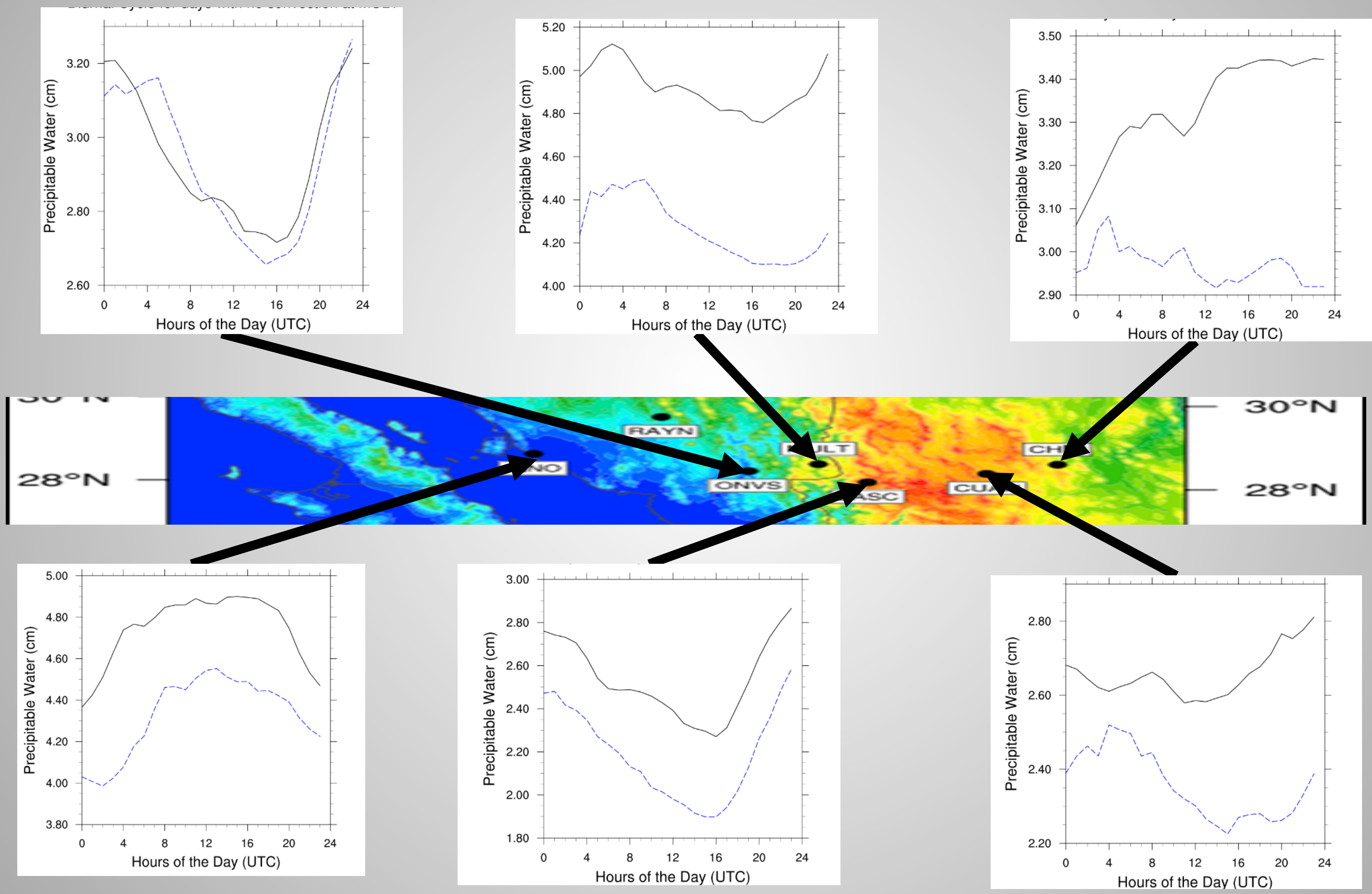
- Yonsei University PBL scheme
- Kain-Fritsch Cumulus (d01, d02)
- Thompson Microphysics scheme
- Noah Land Surface model

Preliminary Results

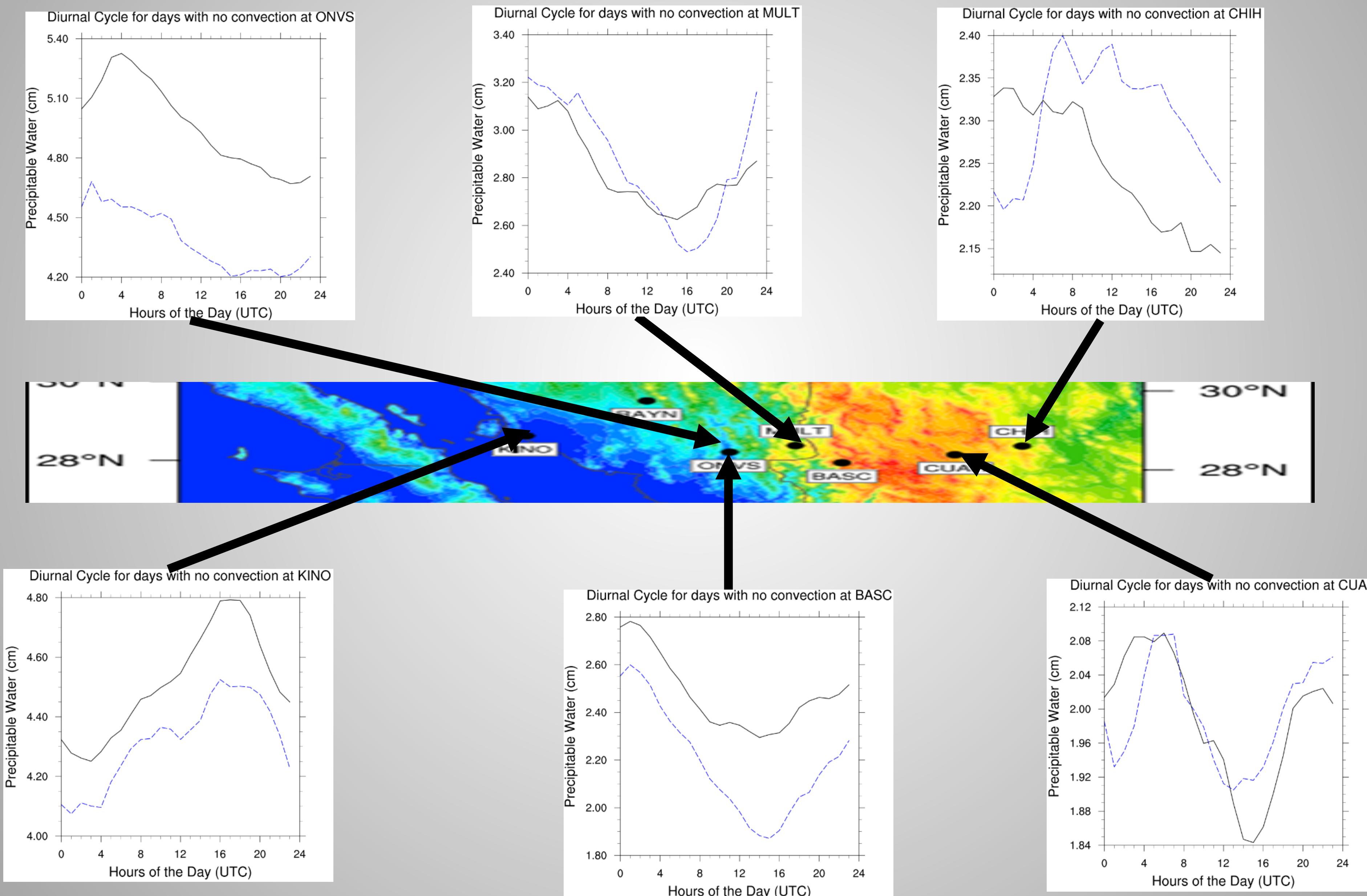
Hourly Average



Convective days



Non-Convective days



ERA Interim Downscaling for Extended Central America CORDEX Domain

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[1]Centro de Ciencias de la Atmósfera, Universidad Nacional Autónoma de México, Coyoacán, México D.F 04510.
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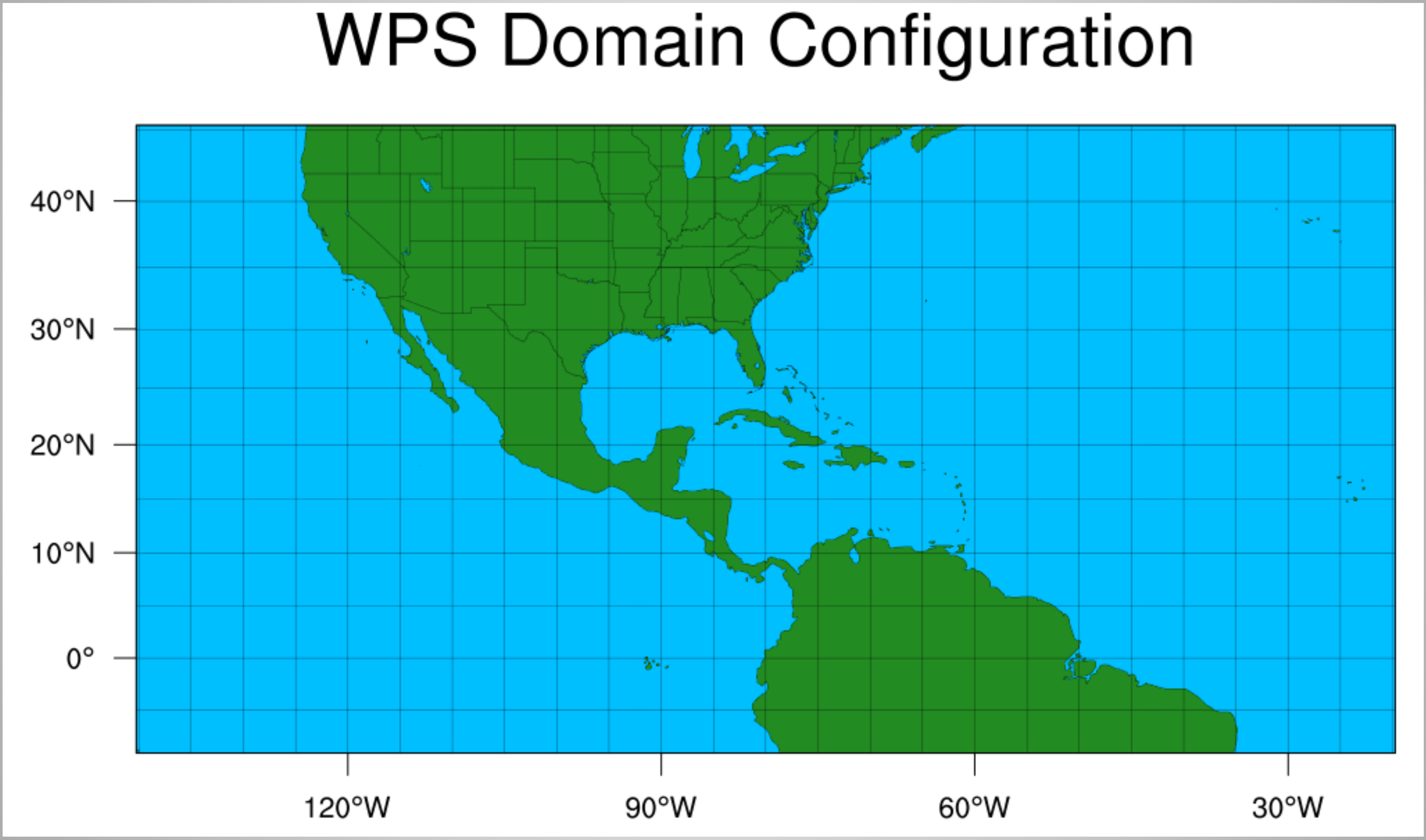
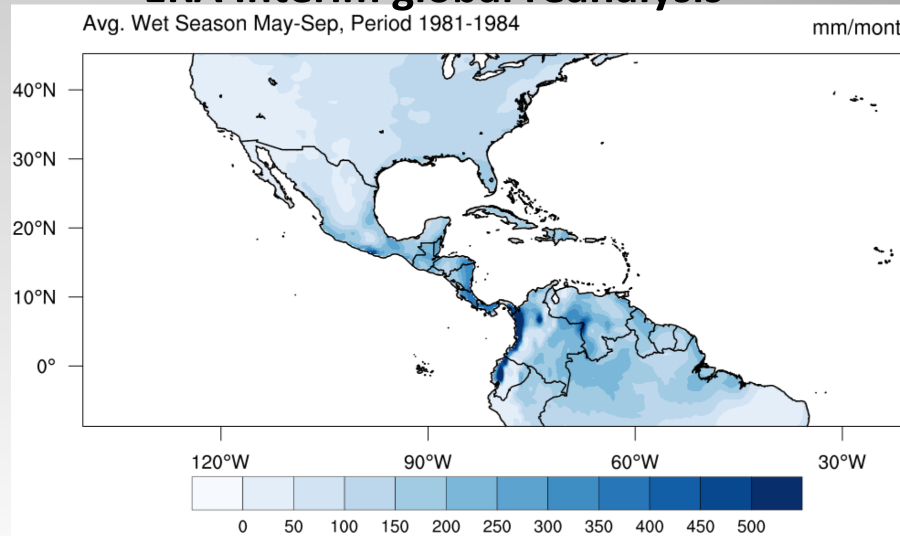
Computational Domain



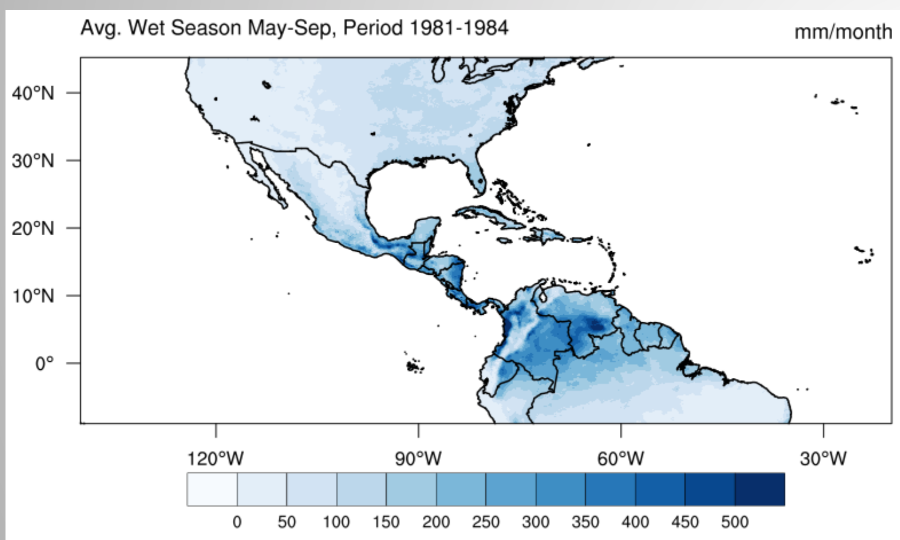
Simulation Details

- Weather Research and Forecasting model (WRF) version 3.5.1
- 25 km spatial resolution and 40 vertical levels
- Yonsei University PBL scheme
- Kain-Fritsch Cumulus scheme
- WSM3 Microphysics scheme(Qr, Qc)
- Noah Land Surface Model
- ERA Interim data for IC and BC
- Adaptative time step
- Spectral Nudging

ERA Interim global reanalysis

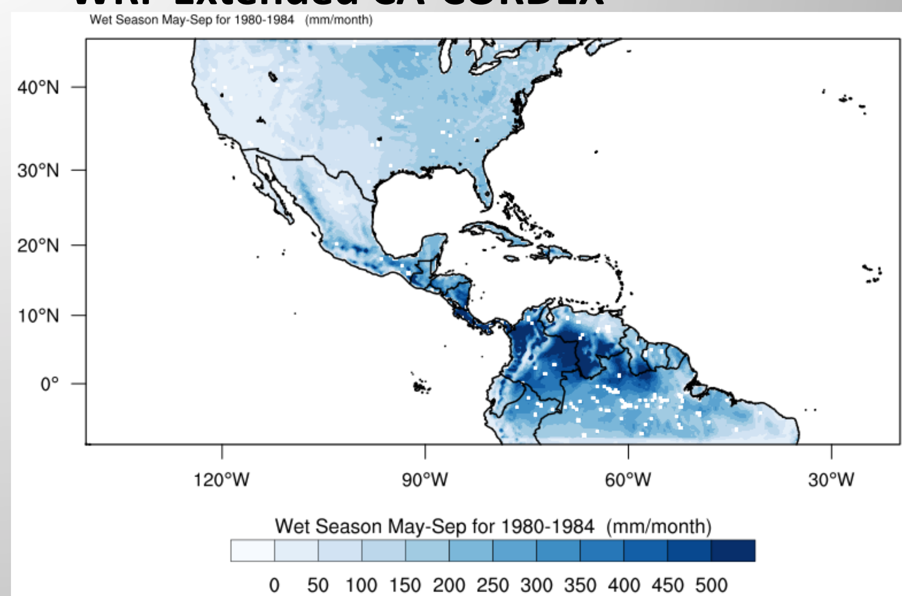


Gridded Observations (CHIRPS)



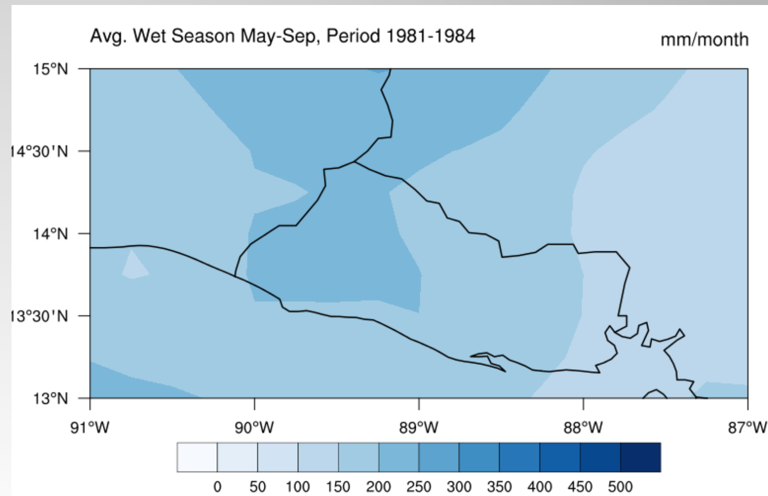
Regional model applied

WRF Extended CA-CORDEX



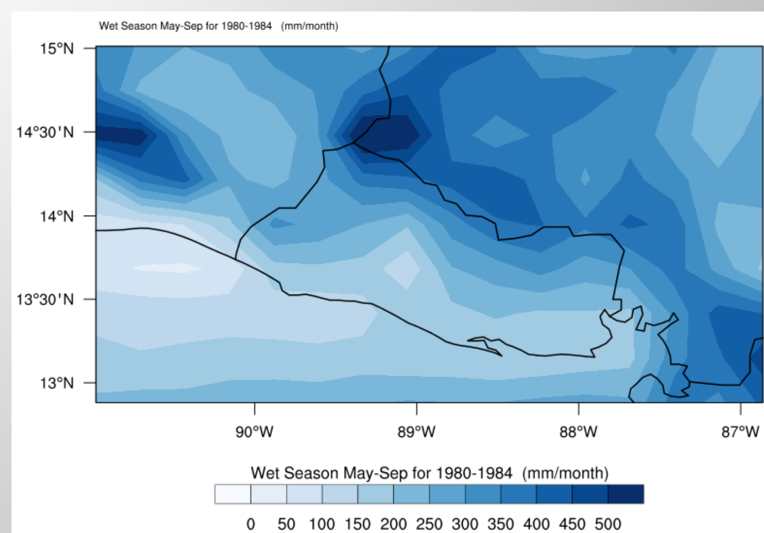
Value Added of a Central American CORDEX model to produce wet season (May-Sep) precipitation in El Salvador

ERA-Interim global reanalysis

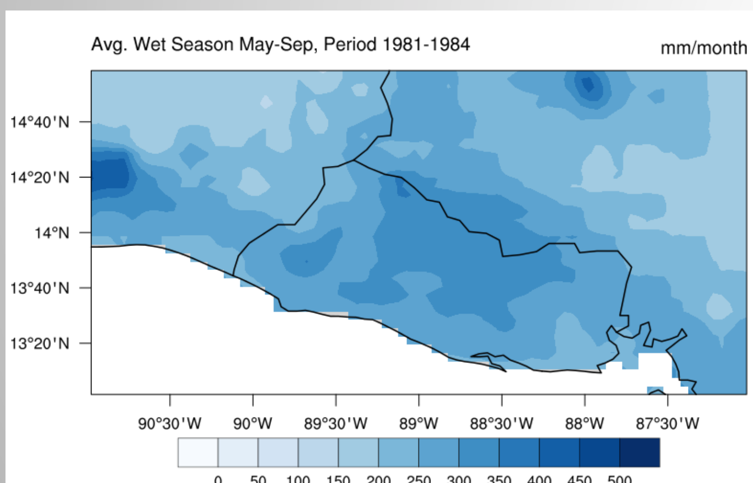


Regional model applied

WRF Central American CORDEX



Gridded observations (CHIRPS)




THANKS!!
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