Assessment of the synoptic forcing associated with extreme precipitation events over Southeastern South America as depicted by RCMs at convective permitting resolution performed within a CORDEX FPS

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Background

• Southeastern South America (SESA) is one of the regions of the world where the deepest and most intense convective storms develop;

• More than 80% of the warm season precipitation is accounted for extreme precipitating systems;

• Ingredients:
  • Moisture supply via the South American Low Level Jet (LLJ) together
  • An orographic low at lower levels
  • a mid level through over the Andes range
To adequately simulate the occurrence of organized deep convection and the associated heavy precipitation

• CORDEX Flagship Pilot Study focused on modelling extreme precipitation events in SESA by means of a variety of tools, including Convection Permitting Models.
Modeling setup

RCMs
- WRF3.8-UCAN (Santander, Spain)
- RegCM4-USP (USP, Brazil)
- WRF3.9-CIMA (CIMA, Argentina)

Boundary Conditions: ERA-Interim
- 20 km resolution
- 4 km resolution (Convection Permitting)

Simulations:
- WL - 72 hs simulations of selected extreme events
- CM – 6-month length simulations

Selected season:
- ONDJFM 2009-2010
- 3 selected extreme events (Daily precip > 95th percentile)
Objectives

• Assessing the ability of Convective Permitting simulations in representing:
  1) Triggering mechanisms of extreme precipitation events
  2) Timing, intensity and spatial extent of the precipitating systems
• Evaluating CM/WL simulations
Analysis

Spatial distribution of the accumulated precipitation for each extreme event

Spatial distribution of key drivers: low level circulation

Timeseries of 6-hourly accumulated precipitation averaged over the 4-km resolution domain

Objective measure of model performance: the Fractional Skill Score

Conclusions
Observations
Maximum 6-hourly precipitation (mm)

RCMs
Observations

Maximum 6-hourly precipitation (mm)

RCMs

CASE 3

2008-11-22 12:00:00
Meridional component of the wind (shadded) and moisture flux convergence (black)

Time of the maximum precipitation intensity

850 Hpa height and difference between 20 km and 4 km simulations
Timeseries of the 6-hourly accumulated precipitation averaged over the 4km domain.
Climate Mode Simulations
ONDJFM 2009-2010

Events with daily precipitation larger than 15 mm/day

Fractional Skill Score (FSS): Measure of the ability in reproducing the spatial distribution of precipitation above a given threshold for individual events

FSS=1 → Perfect simulation
• FSS for individual events (41) (thin lines)
• Average FSS (thick lines)

Thresholds:
75 percentile
90 percentile
95 percentile
99 percentile

(spatial percentile for the daily accumulated precipitation)
Conclusions

• Models’ precipitation is located over regions with moisture flux convergence independently of whether convection is parameterized or not

• Large differences arise in the low level circulation (including the convergence of low level winds) between the driving and the nested simulations, even for Weather-Like simulations

• These differences explain the differences in the precipitation produced in the simulations

• Inspection of a set of individual heavy precipitation events shows that the Convective Premitting simulations improve the capability of reproducing extreme events and their triggering mechanisms
Thank you!

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