1. INTRODUCTION

Developing climate change scenarios at regional scale is very important for the understanding of climate impacts under global warming conditions, directed to the provision of information to be used for vulnerability assessments, and for the design of measures and strategies for climate change adaptation. The regional Eta Model is used by INPE to produce long-term integrations (Chou et al., 2012; Marengo et al., 2012) for A1B emissions scenario. In this study, the Eta Model was configured over South America and Central America, and applied to downscale HadGEM2-ES for RCP 4.5.

2. OBJECTIVES

To assess the climate simulations and projections over South America using the regional climate Eta Model driven by fully coupled Earth System Model HadGEM2-ES of the Met Office Hadley Centre. The evaluation will be focused on DJF and JJA seasons, which are the austral summer and rainy season and the austral winter and dry season, respectively.

3. METHODOLOGY

GCM: HadGEM2-ES

The HadGEM2-ES is a coupled Earth System Model being used by the Met Office Hadley Centre. It was designed to run the major scenarios for IPCC AR5 and comprises Earth system components such as terrestrial and ocean carbon cycle and tropospheric chemistry.

- Atmospheric GCM - N96 and L38 horizontal and vertical resolution
- Ocean GCM with a 1-degree horizontal resolution (increasing to 1/3 degree at the equator) and 40 vertical levels.
- Earth system components:
  - Terrestrial and ocean carbon cycle and tropospheric chemistry.
  - Terrestrial vegetation and carbon is represented by the dynamic global vegetation model, TRIFFID.
  - Ocean biology and carbonate chemistry are represented by diat-HadOCC
  - Tropospheric chemistry is represented by the UKCA model.

RCM: Eta Regional Model

Resolution: 20km/38 layers.
Grid-point model: Arakawa E grid and Lorenz grid
Eta vertical coordinate: Mesinger, 1984; added refinements in Mesinger et al. (2012)
Time integration: 2 level, split-explicit
Adjustment: forward-backward
Horizontal Advection: first forward and then centered
Vertical Advection: Piecewise linear scheme
Prognostic variables: T, q, u, v, p, p0, TKE, cloud water/ice, hydrometeors

Convection scheme: Betts-Miller-Janjic
Cloud simulation: Zhao scheme
Turbulence: Janjic 1994 (MY 2.5), Monin-Obukov surface layer
Radiation: GFDL package
Land surface scheme: Noah scheme, 4 soil layers,
LBC: HadGEM2-ES, updated 6h/6h
Initial soil moisture: monthly climatology
Initial albedo: seasonal climatology
CO2: RCP4.5
SST from HadGEM2-ES simulations

4. RESULTS (Baseline evaluation)

5. CONCLUSIONS

The Eta model reproduced satisfactorily the South America present climate when compared with observational data and reanalysis. The downscaling with Eta model improved the simulation of the seasonal cycle of precipitation and temperature over Brazil and some regions when compared with HadGEM2-ES. The projections suggested increases in DJF and JJA temperature of up to 4 °C in continental South America, with more intense changes occurring in the second half of the twenty-first century. The precipitation projections showed the major changes in summer.

REFERENCES


Acknowledgments: Thanks to BADC (Martin Juckes) for the GCM boundary conditions. Thanks to the programs: PNUD, CIAT and CAPEIS, for partially funding the long term integrations.