Description RCM simulations in CLARIS LPB

Model

Short model name	MM5
Full model name	MM5 Pennsylvania-State University-NCAR nonhydrostatic Mesoscale Model – CIMA version
Institute	Research Center for the Sea and the Atmosphere (CIMA-CONICET/UBA) (www.cima.fcen.uba.ar)
Model version	MM5 V3.7
Contact person name	Silvina A. Solman
Contact person email	solman@cima.fcen.uba.ar
General references	Grell et al., 1993 Solman et al., 2008

Experimental setup

Name of domain	South America
Size of full grid (lon x lat x vertical)	159 x203 x 23
Horizontal resolution	0.5 x 0.5 deg. (approx.)
Type of grid	Regular lat lon
Lateral Boundary Relaxation number of grid points	4
Nudging (if yes, provide some description spectral, variables, levels)	Yes, analysis nudging to winds only above the Planetary Boundary Layer (Stauffer and Seaman, 1990
Boundary zone excluded (grid points)	8
Size of post-processed output grid (lon x lat)	143 x 187

ERA-INTERIM

Time period	1990-2008
Source of boundary condition	ERA INTERIM reanalyses
Initial condition	ERA-INTERIM reanalyses
Spin up period	Dec 1989
Internal reference of simulation	-

General model description

Process:	**Description:**	**Reference:**
Dynamics	Second-order leapfrog time-step	Grell et al. (1993), NCAR

	scheme, but some terms are handled using a time-splitting scheme (for fast waves) . Finite differencing on the B grid, using second-order centered finite differences.	Tech. Note 398.
Radiation	Accounts for long-wave and short-wave interactions with explicit cloud and clear air. The radiation package calculates long-wave radiation through clouds and water vapour. Short-wave absorption and scattering in clear air and reflection and absorption in cloud layers are included.	Stephens (1978) Garand (1983) Stephens (1984)
Cloud fraction		
Turbulence	First-order, non-local scheme based on Troen-Mahrt representation of countergradient term and K profile in the well mixed PBL, as implemented in the NCEP MRF model.	Hong and Pan (1996)
Explicit cloud and precipitation	Cloud and rain water fields predicted explicitly with microphysical processes including ice phase processes.	Hsie et al., 1984
Convection	Entraining/detraining mass flux scheme.	Grell, 1993
Land-surface scheme	Surface processes are represented by Noah Land Surface Model The land-surface model (LSM) predicts soil moisture and temperature in four layers with thicknesses of 10, 30, 60 and 100 cm, as well as canopy moisture and water-equivalent snow depth. The LSM makes use of vegetation and soil type in handling evapotranspiration, and takes into account variations in soil conductivity and the gravitational flux of moisture.	Chen and Dudhia 2001
Fluxes over sea		

Details in model description (use or modify as needed)

Land-surface processes

Specification:	**Description:**	**Reference:**
Land cover map	USGS vegetation/land use	

	data base (25 categories) derived from a 10 min resolution global data base	
Soil map	17 categories	
Orography data	10 min global terrain elevation data generated from USGS 30 sec elevation data.	
No of sub surfaces (tiles)	-	
Overview of tiles:		
Energy balance		
Interactive vegetation	NO	
Soil layers for temperature	4 layer with thickness 5 cm, 25 cm, 70 cm and 150 cm bounded between surface and 300 cm below.	
Soil layers for humidity	Same as for temp.	

Description of diagnostic output

-

References

Chen F, Dudhia J (2001) Coupling and advanced land surfacehydrology model with the Penn State-NCAR MM5 modeling system. Part I: model implementation and sensitivity. Mon Wea Rev 129:569–585.

Garand L (1983) Some improvements and complements to the infrared emissivity algorithm including a parameterization of the absorption in the continuum region. J Atmos Sci 40:230–244.

Grell, G.A., 1993: Prognostic Evaluation of Assumptions Used by Cumulus Parameterizations. *Mon. Wea. Rev.*, **121**, 764–787.

Grell GA, Dudhia J, Stauffer DR (1993) A description of the fifthgeneration Penn System/NCAR Mesoscale Model (MM5). NCAR Tech Note NCAR/TN–398+1A, 107 pp.

Hong S, Pan H (1996) Non-local boundary layer vertical diffusion in a Medium-Range Forecast model. Mon Wea Rev 124:2322– 2339 .

Hsie EY, Anthes RA, Keyser D (1984) Numerical simulation of frontogenesis in a moist atmosphere. J Atmos Sci 41:2581–2594.

Stephens GL (1978) Radiation profiles in extended water clouds: II. Parameterization schemes. J Atmos Sci 35:2123–2132.

Stephens GL (1984) The parameterization of radiation for numerical weather prediction and climate models. Mon Wea Rev 112:826–867

Solman S., Nuñez M. and Cabré M.F (2008): Regional Climate change experiments over southern South America. I: Present Climate. Climate Dynamics, Vol. 30, 533-552.