Regional Climate Simulations of the onset and demise of the pre-wet season and wet season of Northern Northeast Brazil

Francisco das Chagas Vasconcelos Júnior, Adilson Wagner Gandu, Alexandre Araújo Costa, Domingo Cassain Sales, Luiz Martins Araújo Júnior

CLIVAR VAMOS Workshop on Modeling and Predicting Climate in the Americas
4 - 6 June 2012 – Petrópolis, Rio de Janeiro, Brazil.

INTRODUCTION

Determination of the onset of rainy season is important for power generation, agriculture, start planting (Liebmann and Marengo, 2001);

Numerical Modeling has a potential importance to assess the change of onset and demise of the rainy period in Northern Northeast Brazil (NNB);

Precipitation and precipitable water behavior have been used for determining the monsoon onset/ demise (Lu *et al.*, 2009);

OBJECTIVE

To evaluate the ability of RAMS (regional climate simulations) in representing the onset and demise pre-wet season (PWS) and wet season (WES) of NNB;

METHODOLOGY

Model setup

Regional Atmospheric Modeling System (RAMS) 6.0 (Cotton *et al.*, 2003) forced by ERA-Interim reanalysis from 1989 to 2007 (Simmons *et al*,. 2006);

Horizontal grid comprises 252 by 136 points (50 km), centered at 10S, 73W. Vertical grid has 29 levels; Lateral nudging 3 points; Central nudging – 12 hs;

Four simulations have been tested:

Experiment	Convection scheme	Nudging in center
KFCN	Kain-Fritsch	Yes
KFSN	Kain-Fritsch	No
KUCN	Kuo	Yes
KUSN	Kuo	No

METHODOLOGY

CORDEX “Central America” domain;
Area analyzed is depicted by red rectangle;

METHODOLOGY

- Observational Data

Daily mean precipitable water – ERA Interim (Simmons *et al*,. 2006);

Daily precipitation from Liebmann and Allured (2009) interpolated on 1ºx1º grid;

METHODOLOGY

Method from Liebman and Marengo (2001) adapted by Bombardi and Carvalho (2009) was used;

$$S = \sum_{i=pent0}^{73} (P(i) - \overline{P})$$

P(i) is the mean rainfall for pentad; $\overline{P}$ is the climatological annual mean pentad rainfall;

$$\frac{dS}{dt} > 0 \rightarrow onset$$

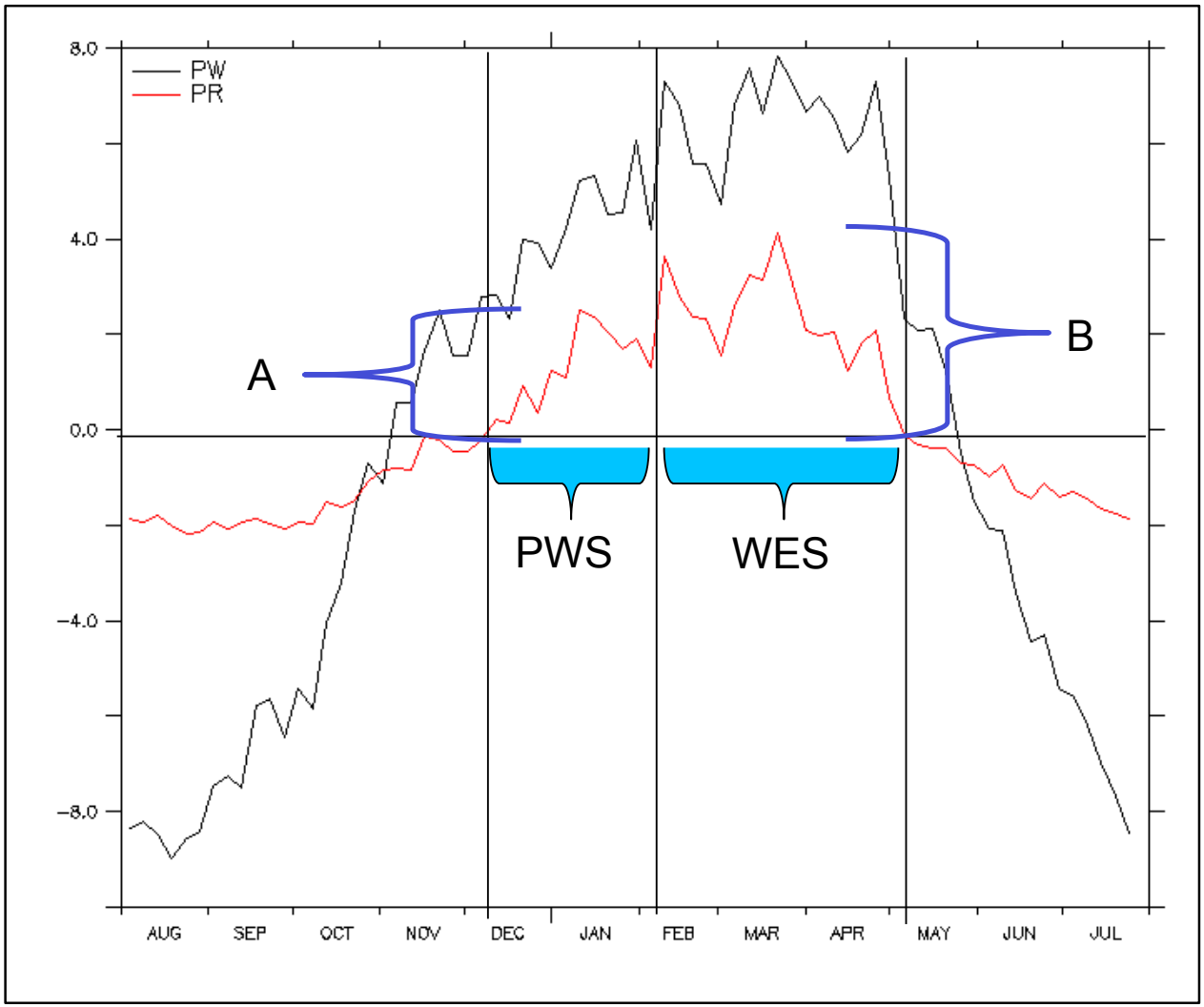
$$\frac{dS}{dt} < 0 \rightarrow demise$$

In order to compare, the same procedure was carried out for precipitable water;

RESULTS

Observation - dS/dt;

PR – precipitation (mm/day/pentad) and PW – precipitable water (mm/pentad).



$A \approx B/2$

onset PWS – 07/12

onset WES – 05/02

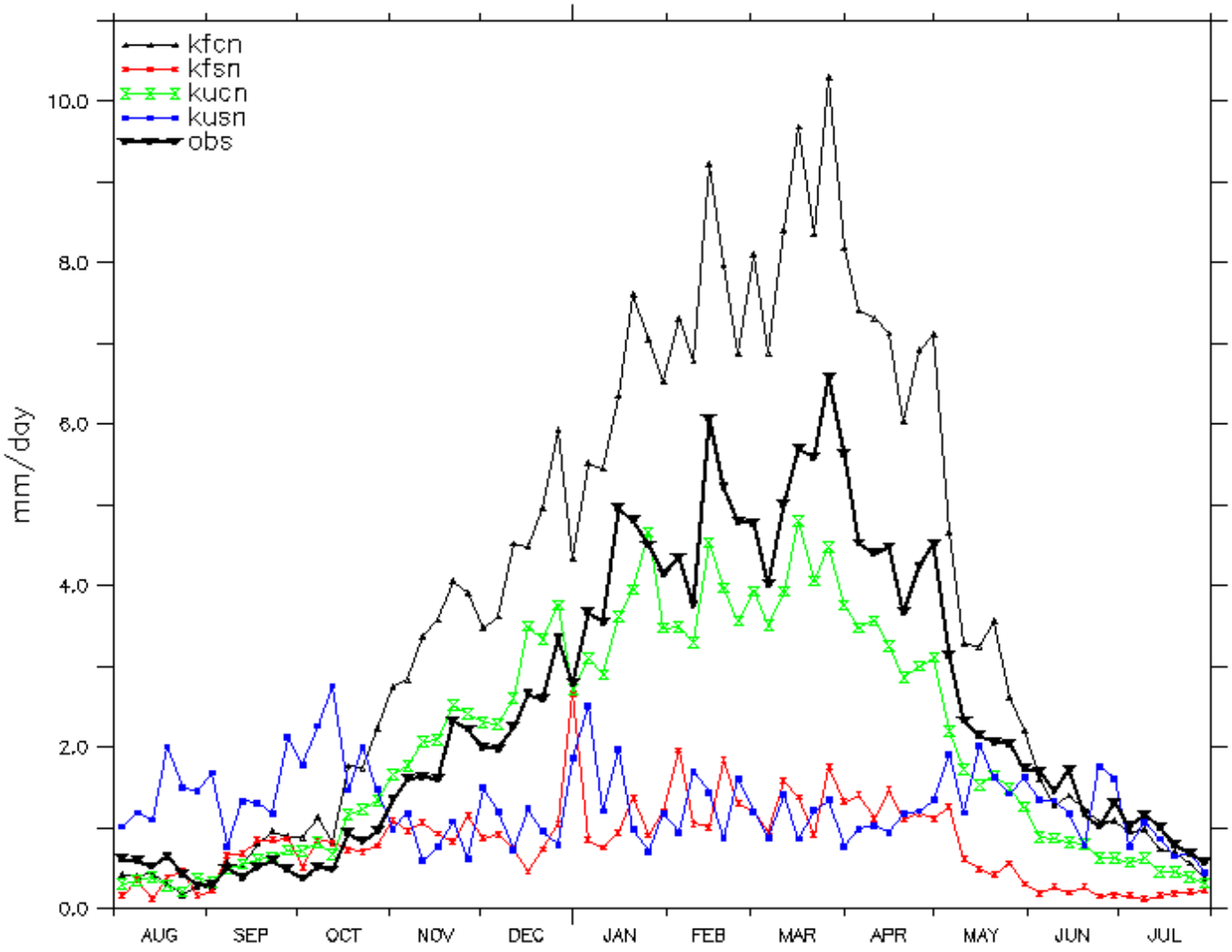
demise WES – 06/05

RESULTS

Observation - Precipitation and precipitable water normalized

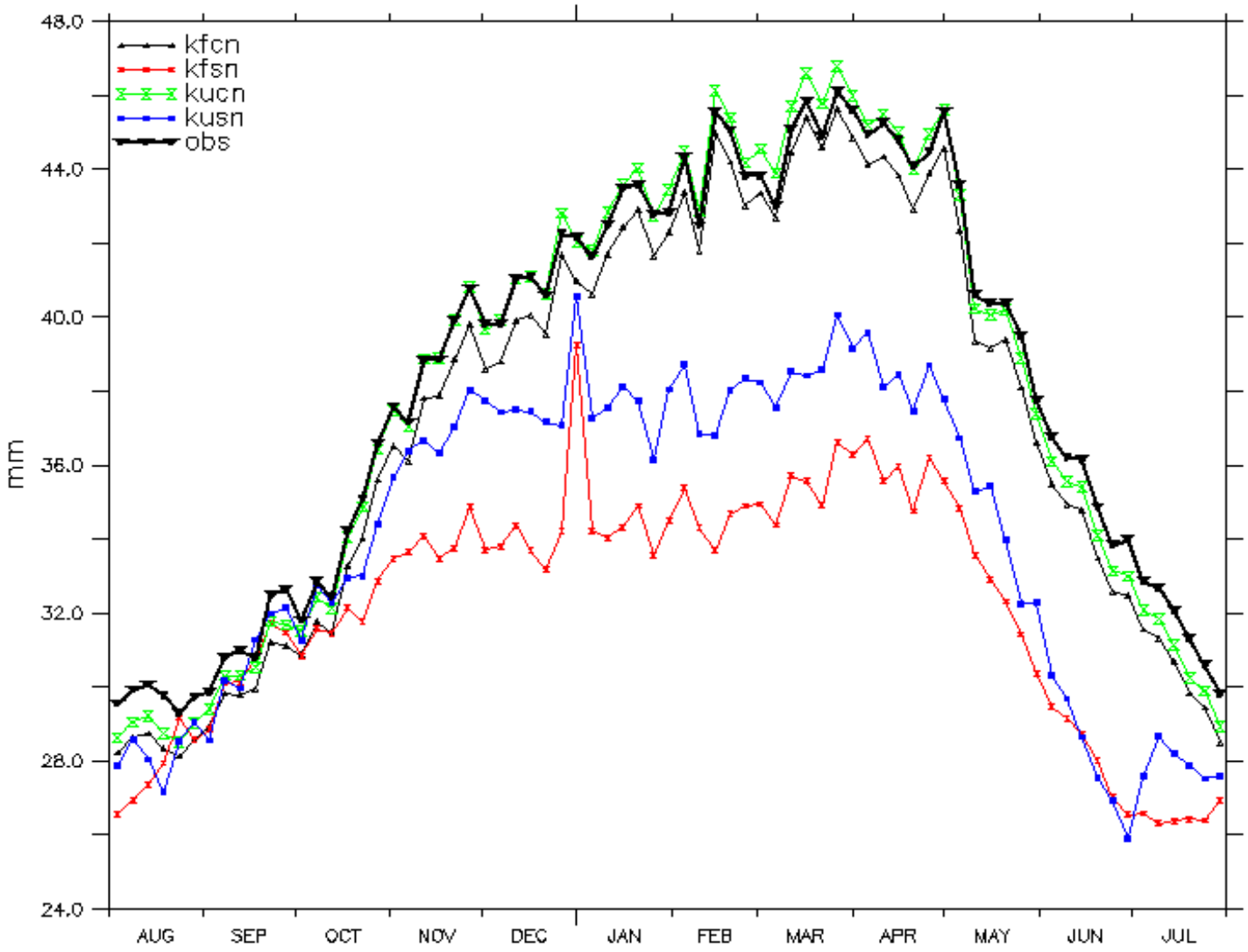
RESULTS

Climatology - Precipitation in pentads – model x observation



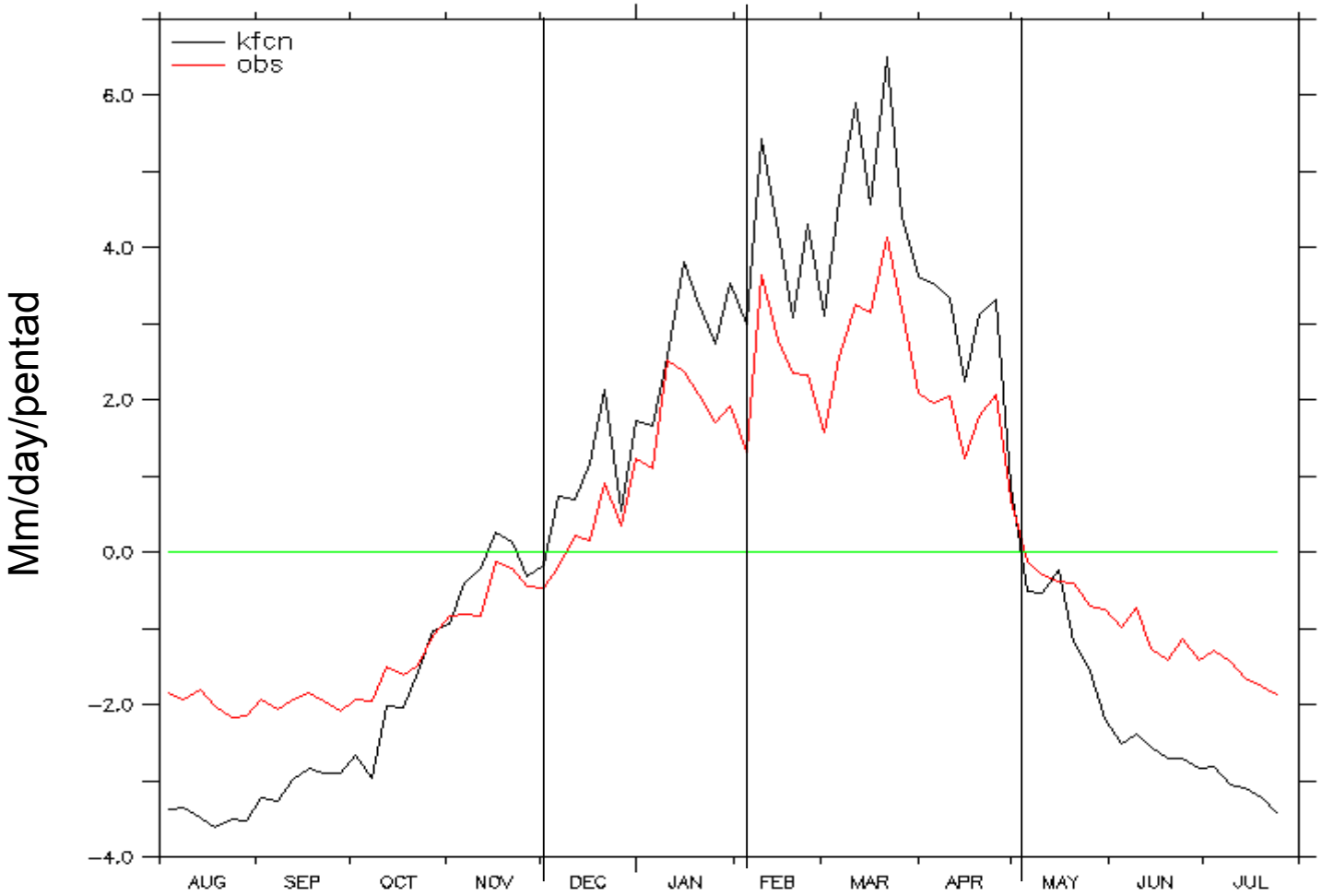
RESULTS

Precipitable water in pentads – model x observation

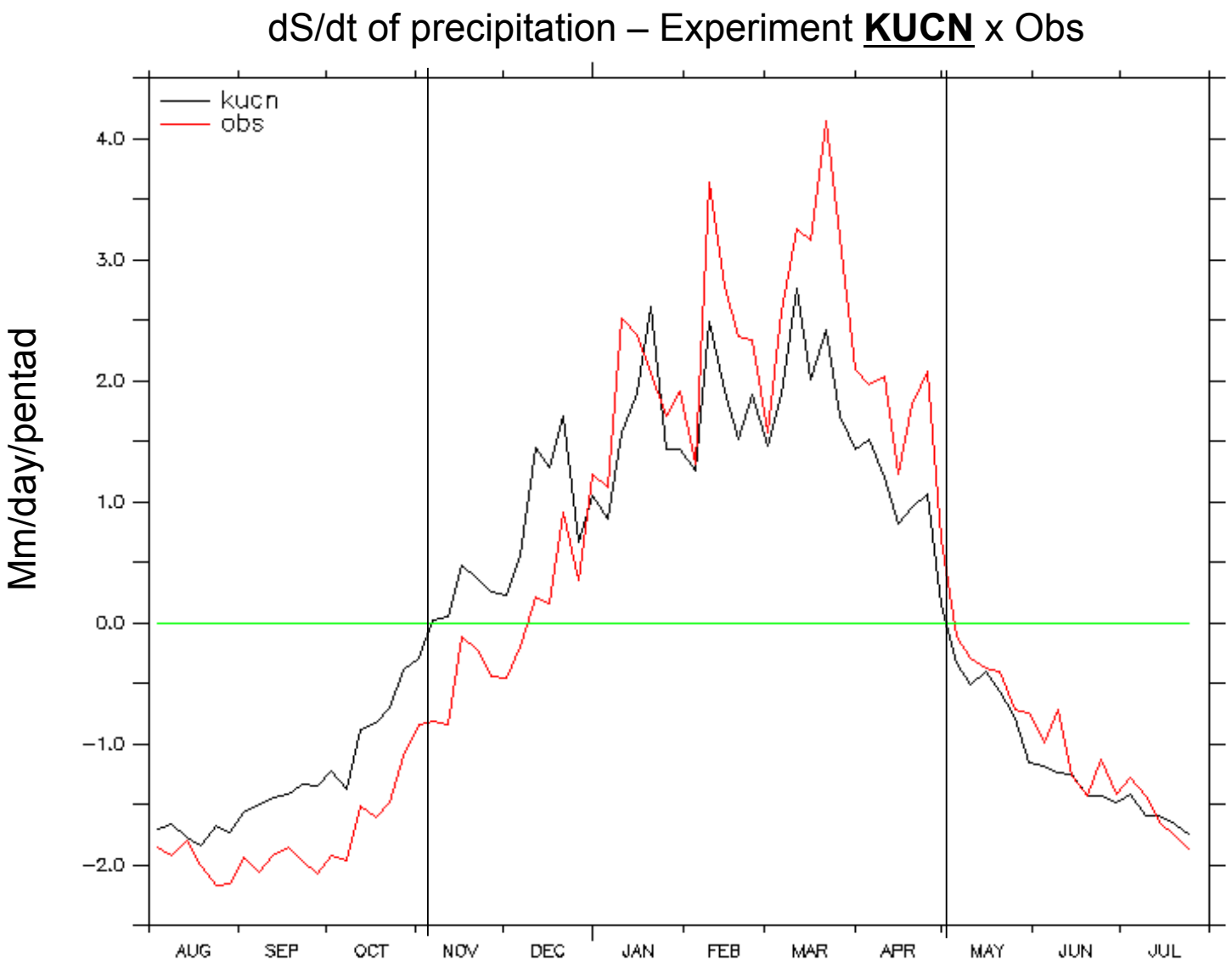


RESULTS

dS/dt of precipitation – Experiment **KFCN** x Obs



RESULTS


dS/dt of precipitation – Experiment KUCN x Obs
kucn
obs
Mm/day/pentad
4.0
3.0
2.0
1.0
0.0
−1.0
−2.0
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL

Summary

Simulations with no nudging did not describe the annual cycle; Precipitable water in simulations with nudging is governed by the forcing data;

KFCN experiment showed that the onset of PWS occurs 2 pentads earlier than observed and WES is 3.5 mm/day more humid;

KUCN showed that “PES” starts roughly 6 pentads earlier due to its dry bias. This experiment did not show the transition between PES and WES;

KFCN experiment yielded three peaks of precipitation coincident with observation: in the onset of PWS, in the onset of WES and in the middle of WES;

KFCN did not introduce error when determining the onset and demise of the PWS/WES of Northeast Brazil.

REFERENCES

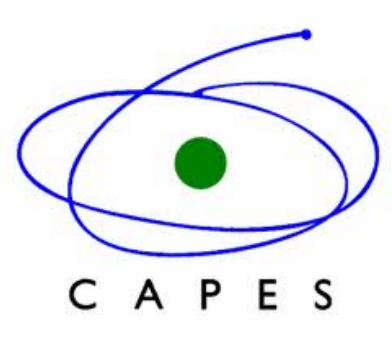
Cotton, W.R., R.A. Pielke, Sr., R.L. Walko, G.E. Liston, C.J. Tremback, H. Jiang, R.L. McAnelly, J.Y. Harrington, M.E. Nicholls, G.G. Carrió.P. McFadden, 2003: RAMS 2001: Current status and future directions. Meteor. Atmos Physics, 82, 5-29.

Liebmann B, Allured D (2005) Daily precipitation grids for South America. Bull Am Meteorol Soc 86:1567–1570.

Liebmann B, Marengo JA (2001) Interannual variability of the rainy season and rainfall in the Brazilian Amazon Basin. J Clim. 14:4308–4318.

SIMMONS, A., UPPALA, S., DEE, D., KOBAYASHI, S., 2006: ERA-Interim: New ECMWF reanalysis products from 1989 onwards. ECMWF. Newsletter 110: 26–35. *Newsletter* **110**: 26–35.

ACKNOWLEDGMENTS



Thank you!!!