

Regional Climate Forecasting with Dynamic Vegetation

by

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OBJECTIVES:

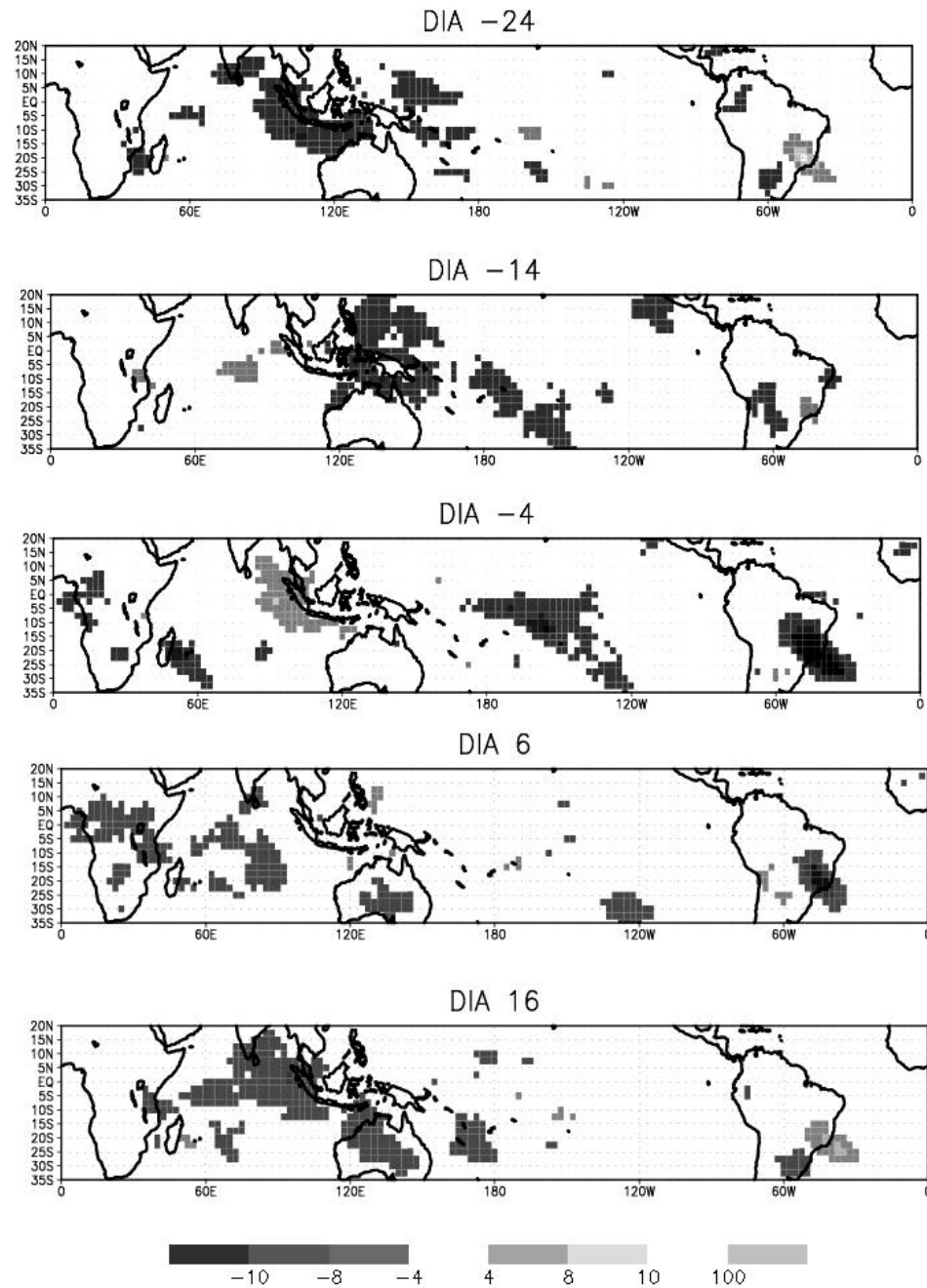
To investigate the effect of an interactive vegetation dynamics model on the regional climate forecast of the onset and offset of the rainy season in Central and Southeast Brazil.

MOTIVATION

- **Onset and offset of the rainy season in Central and Southeast Brazil: monsoon type phenomena (sudden onset at the end of September) and a gradual offset by April (Kousky 1988; Silva Dias and Marengo, 1999).**
- **The correct forecast of the length of the rainy season, and of its beginning, is of considerable interest for agriculture and hydroelectric plant management.**
- **Onset and offset are related to global scale changes in the circulation (Sugahara 1991; Silva Dias and Marengo 1999; Rao et al., 1996 and to the intraseasonal variability (Madden-Julian oscillation) on the time scale of 20-50 days (also global) as shown by Casarin and Kously (1986) Mo and Paegle (1997) and Marton and Silva Dias (2001);**

Composite of Outgoing Long Wave Radiation

Marton and Silva Dias,
2001



•However, vegetation undergoes substantial seasonal and intraseasonal cycles (Liu et al 1994). Possible feedbacks between surface processes which are controlled by vegetation and the onset/offset of the rainy season in Brazil are discussed in Rocha and Silva Dias (1996) from a theoretical point of view.

•Increased vegetation cover -> enhanced evapotranspiration and strengthen hydrological cycle

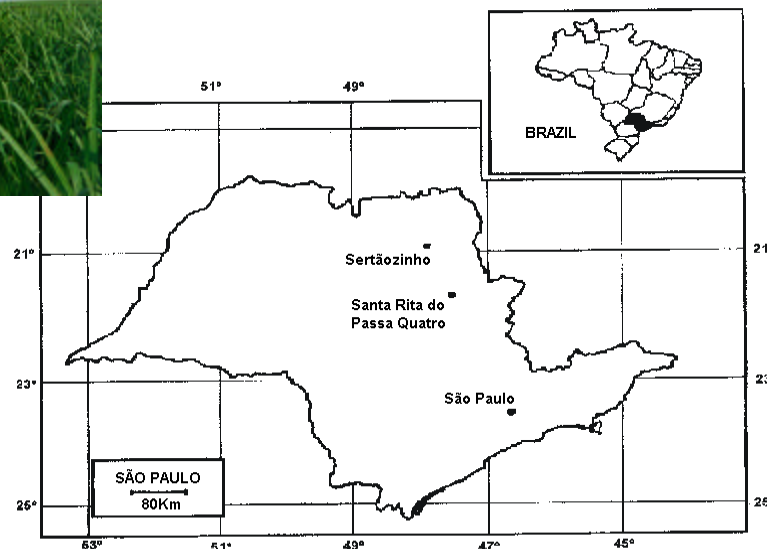
•Decreased canopy conductance weakens hydrological cycle

**Role of vegetation feedbacks in short term
climate variability:**

memory of the system



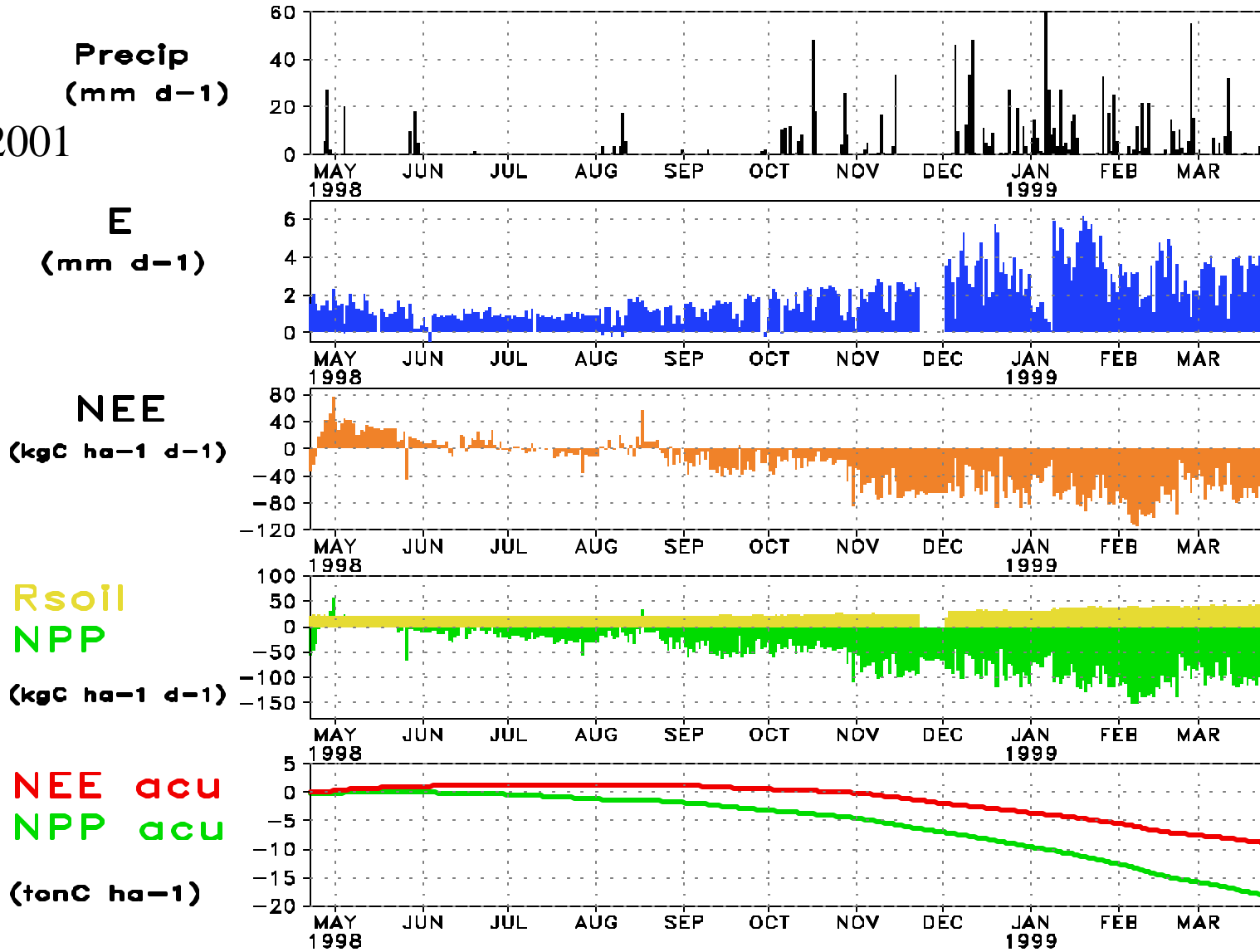
Project funded by
FAPESP (Dr. Humberto
Rocha)



Agronomic Institute of Campinas
and UNICAMP experience on crop
physiology will also be needed

FLUXOS CO2 E H2O @ CANA-DE-ACUCAR

Rocha 2001

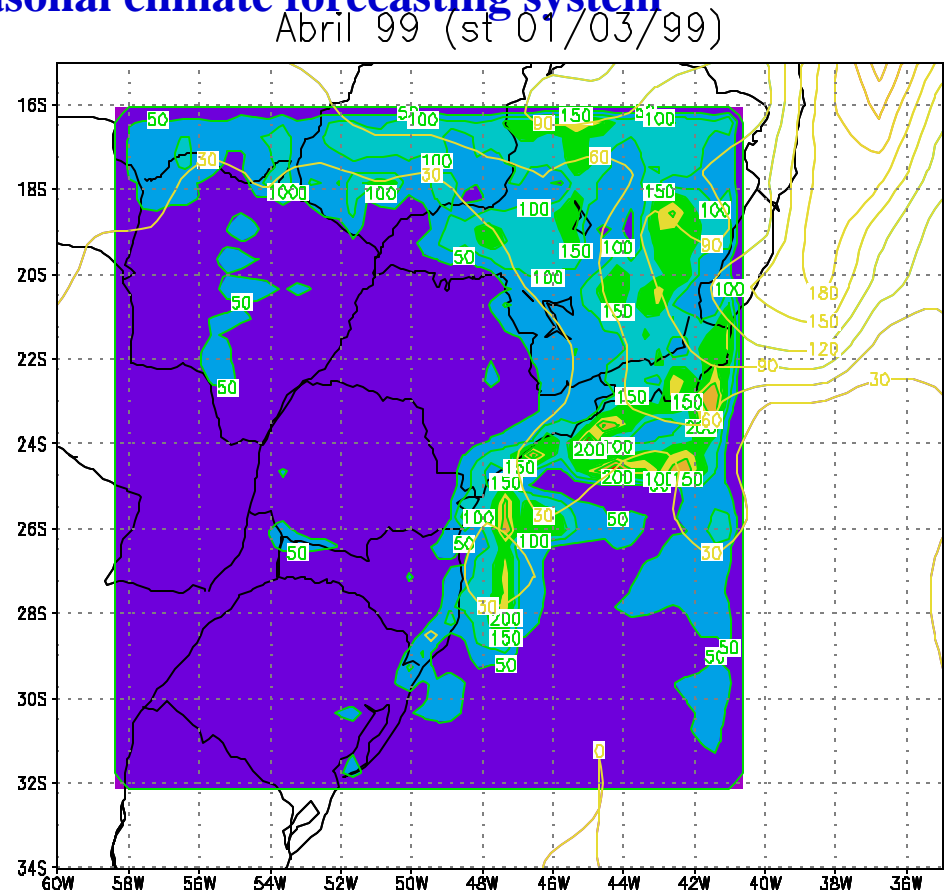


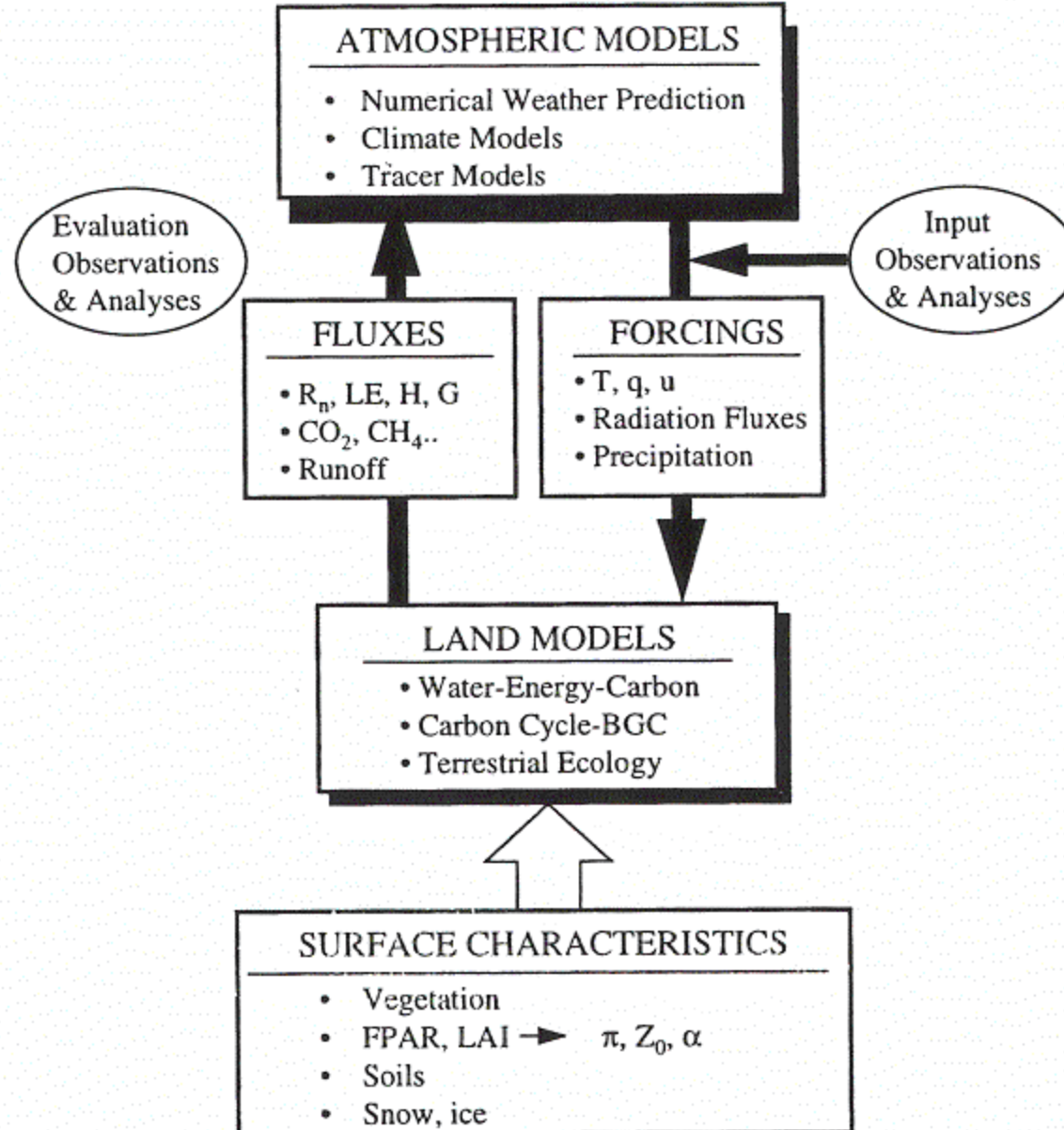
Regional Climate Forecast:

- DOWSCALLING with the Regional Atmospheric Modeling System- two grids: 160 km e 40 km (in “almost” real time since November 1999 at the Laboratory for Meteorology Applied to Regional Atmospheric Systems - MASTER-IAG/USP)
- RAMS surface component is based on LEAF (Pielke et al (1998))
- Driven by members of the CPTEC seasonal climate forecasting system (operational)

Proposal: Couple RAMS to an ecosystem model system to predict the vegetation characteristics (such as LAI, albedo, carbon content).

- CENTURY (Parton et al.,1998)
- GEMTM - Global Energy and Mass Transfer Model (Eastman et al. 2001)





After Sellers, P., et. al.; B.A.M.S. V77(9) Sep 1996

Team:

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Basic computational requirement

- RAMS version 4.3 is a paralelized application for distributed memory machines;**
- The IAG team has extensive experience with the code (since 1990) and participated in the paralelization effort through a FINEP grant**
- RAMS is operationally used at MASTER lab for weather and climate forecast (and research applications) in a PC cluster (350Mhz) with 16 processors and a fast myrinet connection (already saturated);**
- Recently installed a faster PC cluster with 1Ghz processors.**

PRODUCTS:

- **Science issue: role of surface processes in climate variability and interaction with carbon fixation/release by plants and soil;**
- **Operational product:**
 - **improve regional climate forecasting on the timescale of 1-3 mo. under operation at MASTER lab (products available at www.master.iag.usp.br);**
 - **products on carbon balance and crop productivity**