

# The Local, Regional and Global Hydroclimatological Aspects of Amazon Deforestation: An LBA perspective

Roni Avissar

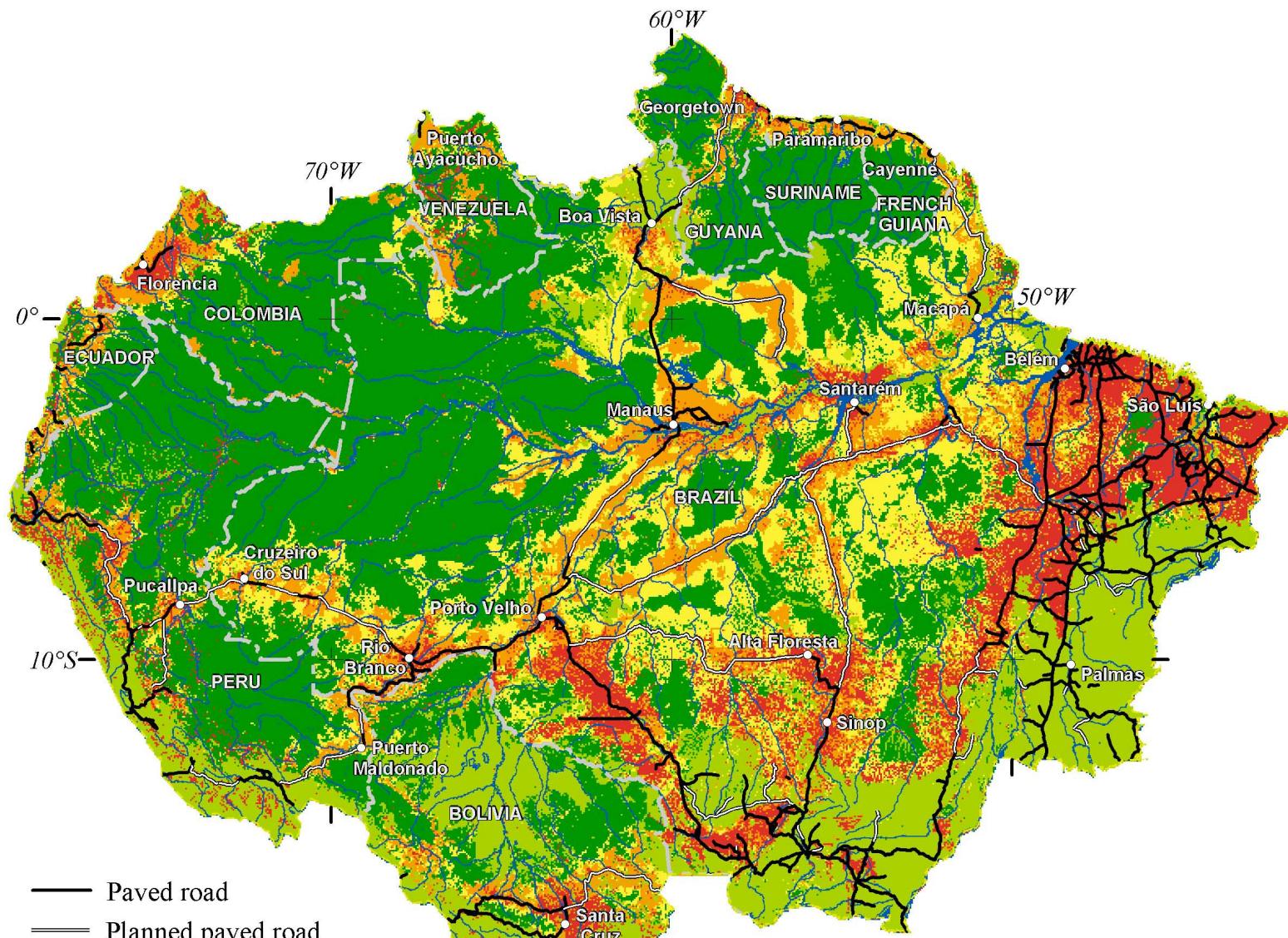
Department of Civil and Environmental Engineering  
Duke University

and

David Werth, Natalia Hasler, Renato Ramos da Silva and Robert Walko

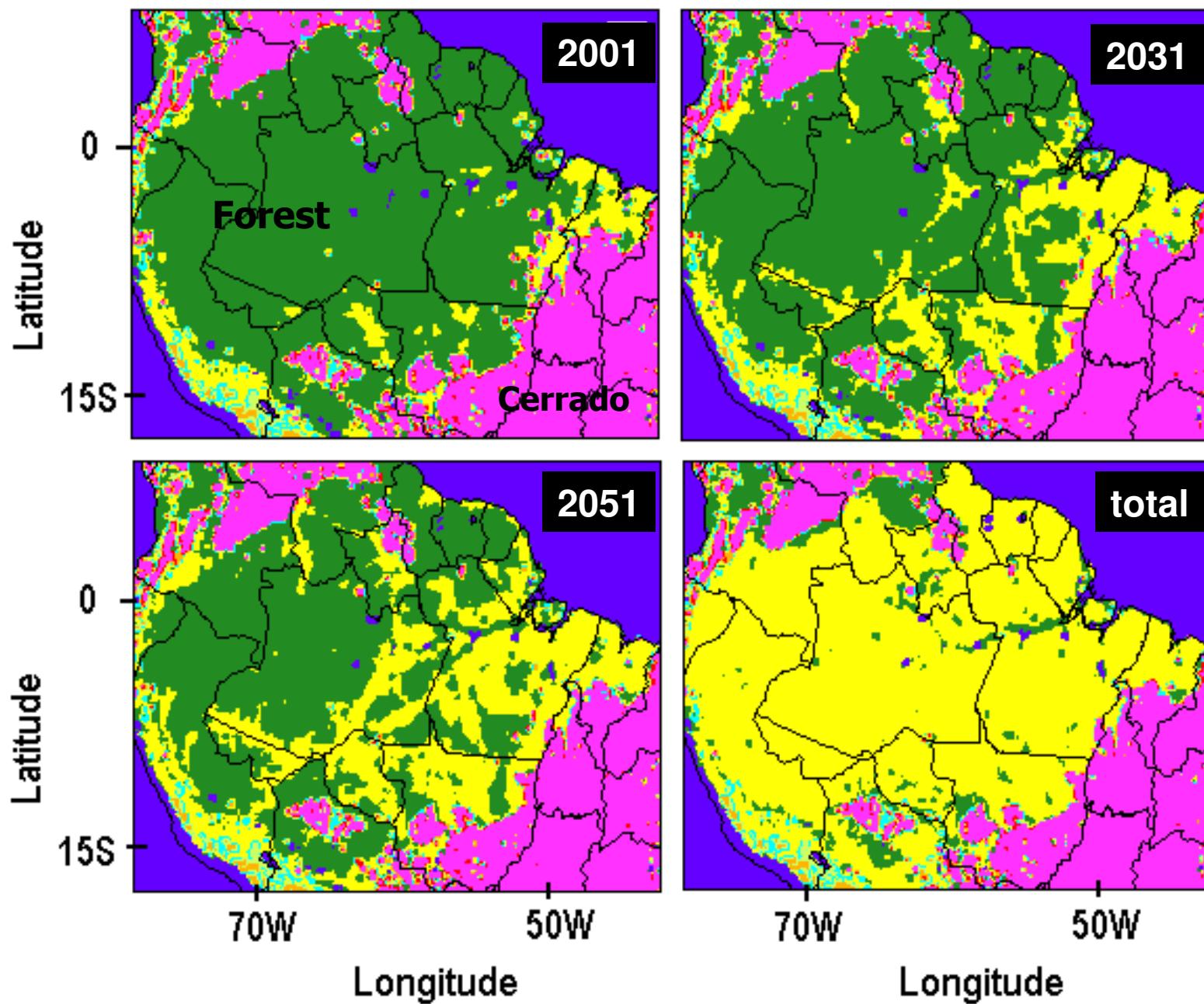
LBA ECO Meeting  
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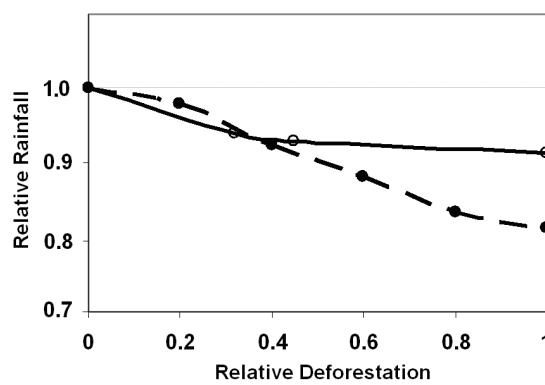
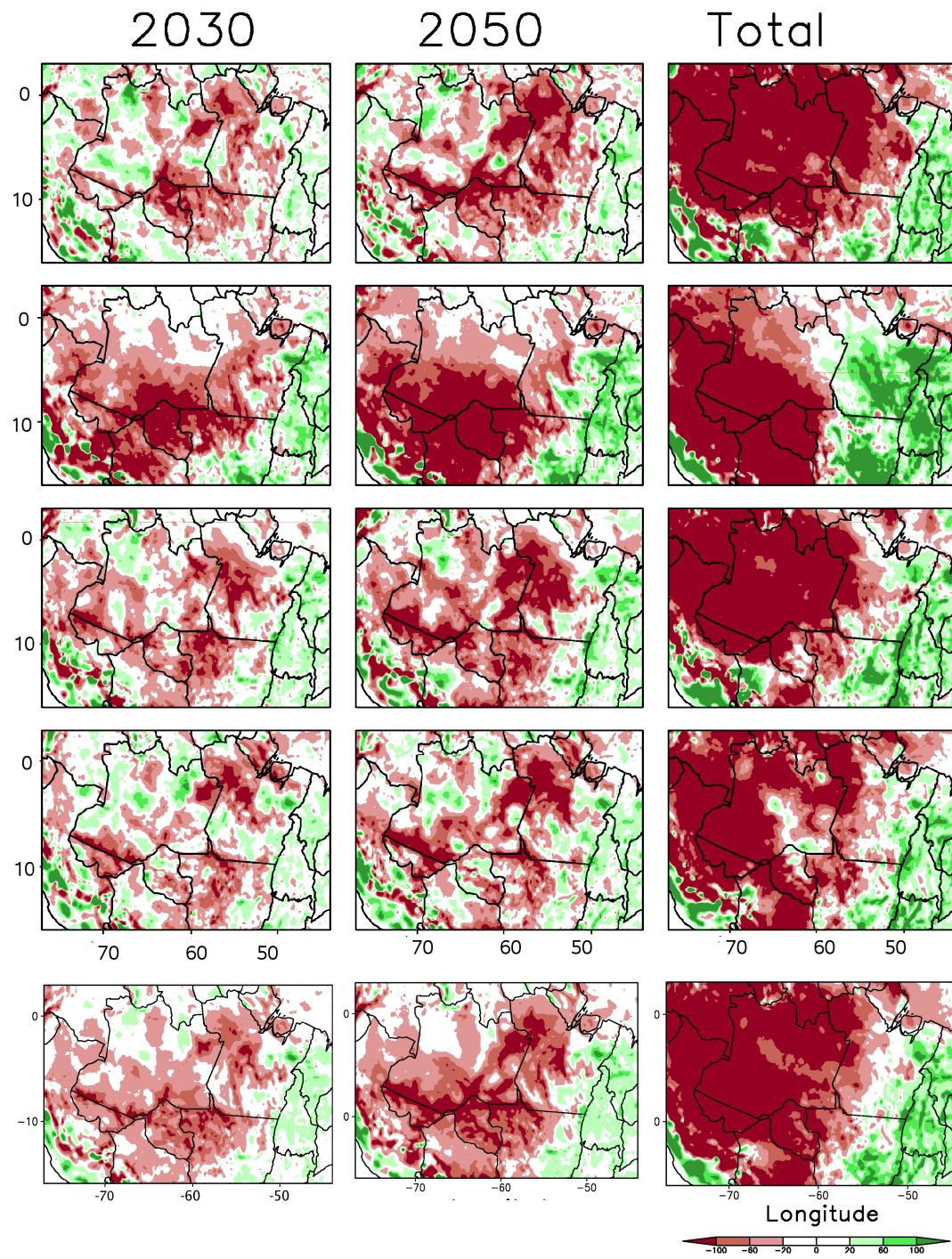
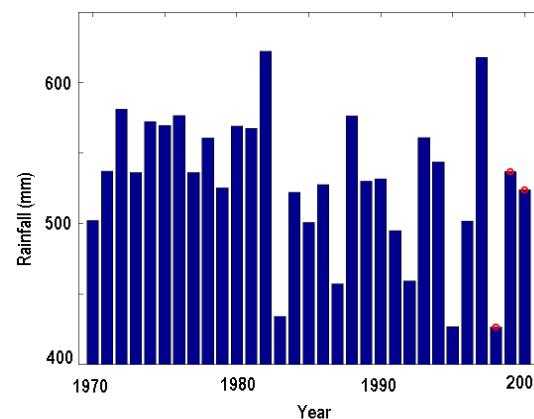
September 26, 2007

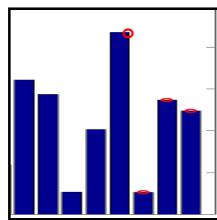
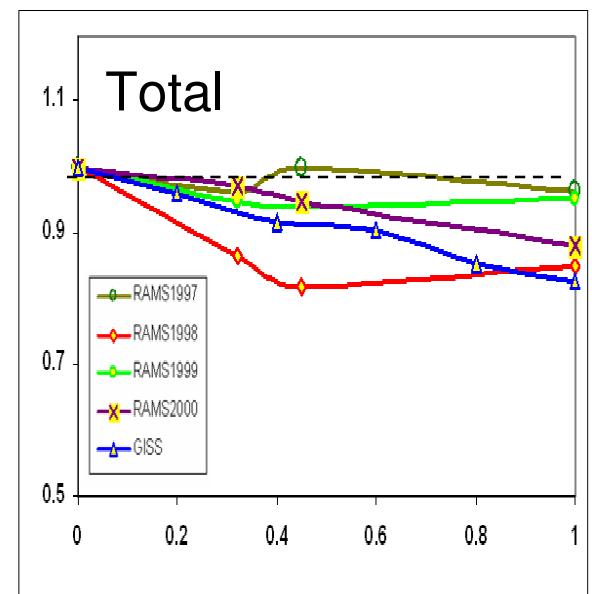
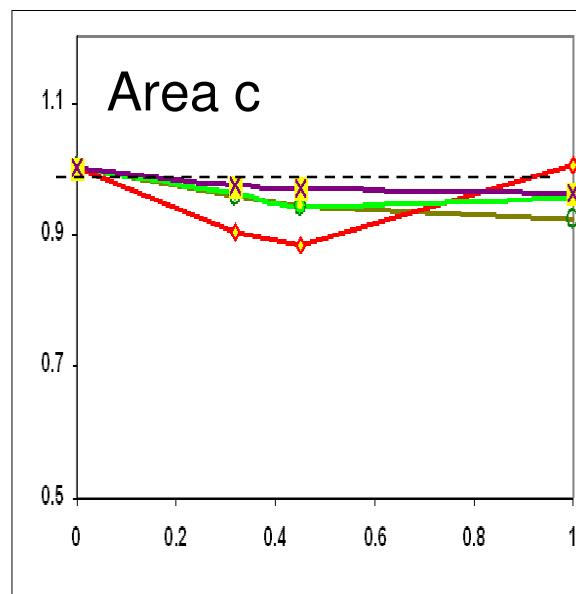
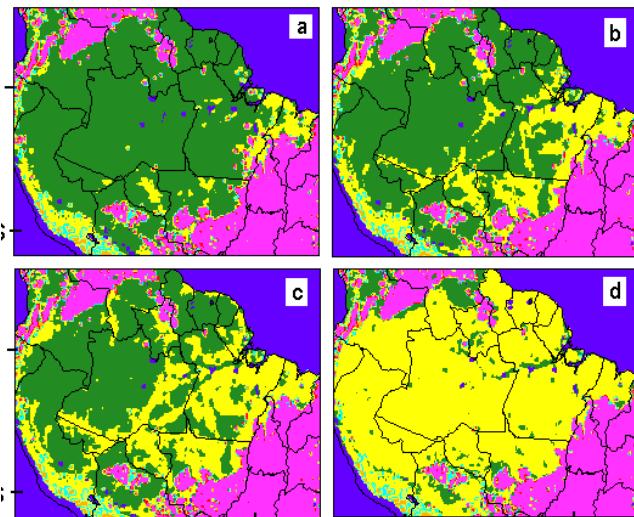
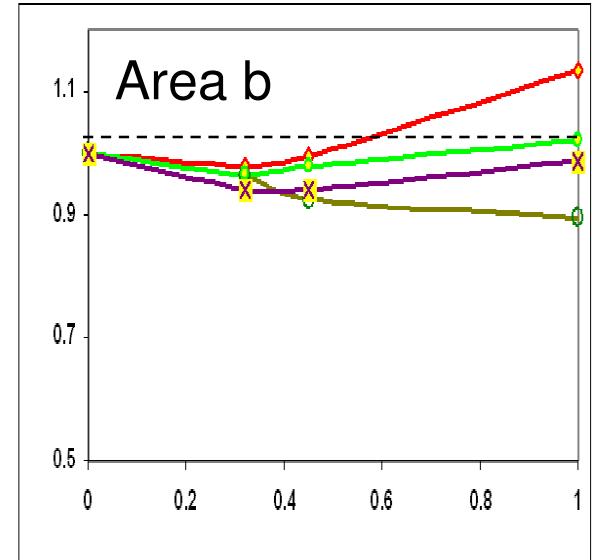
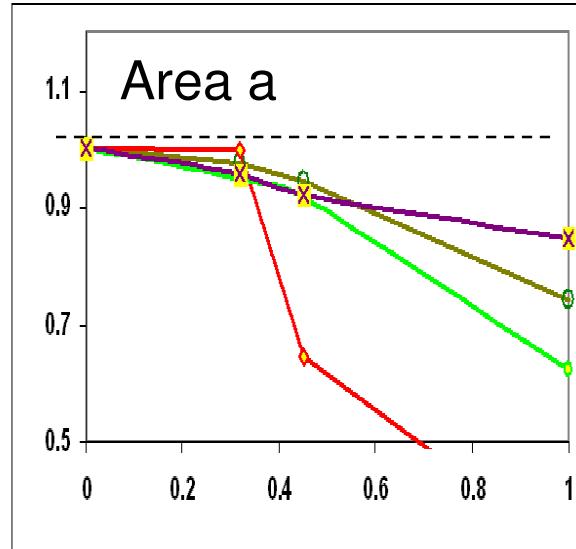
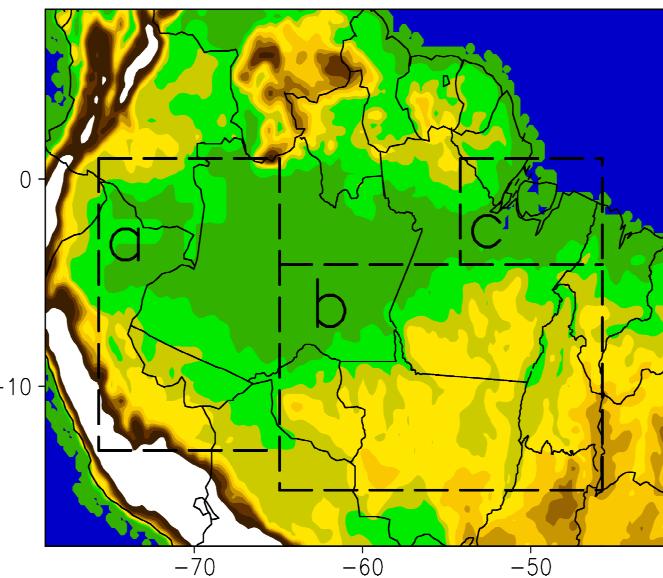


**Soares Filho et al. 2004**

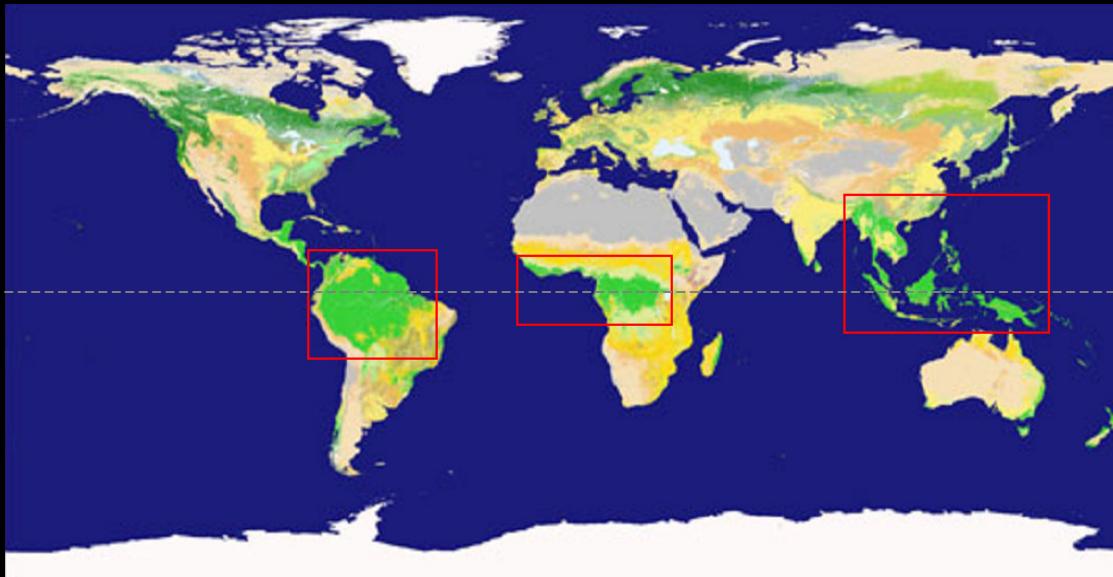
## Amazon Basin Landscape Scenarios



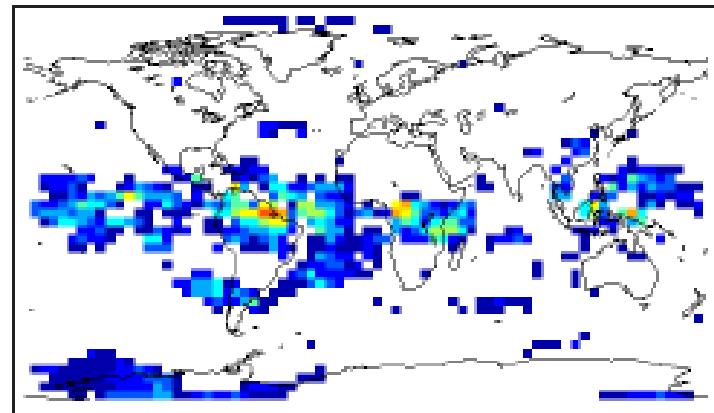
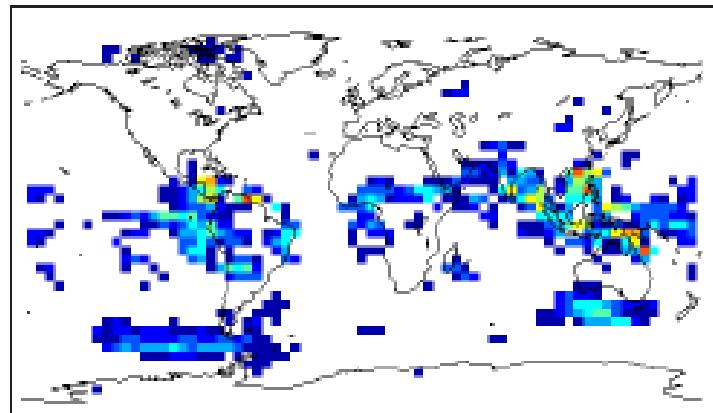
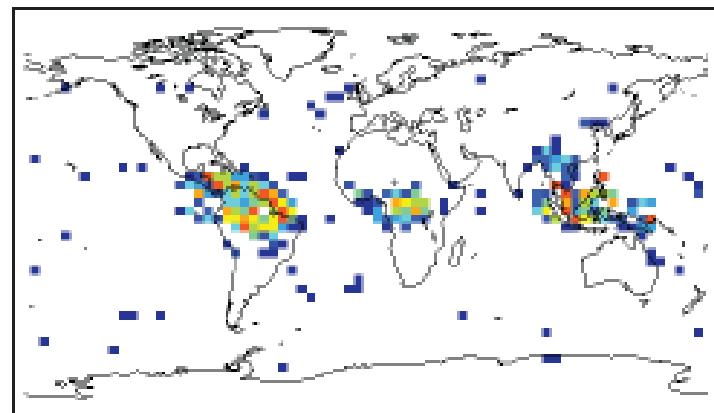
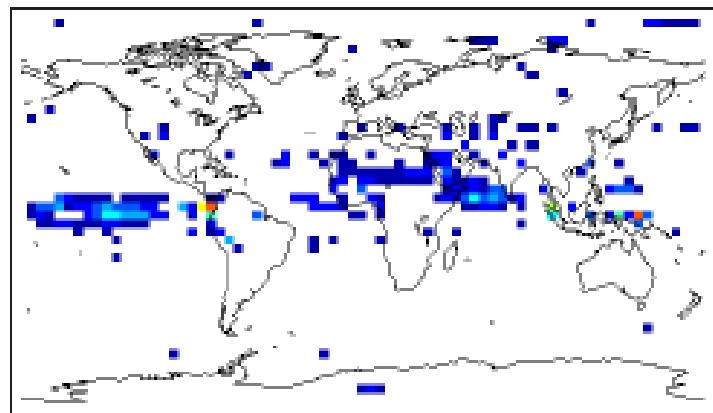
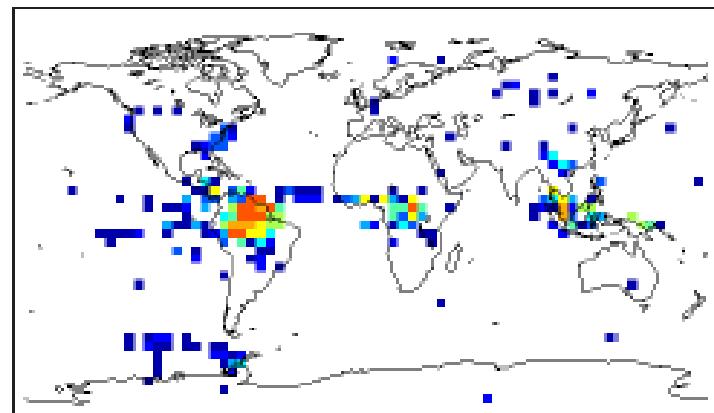
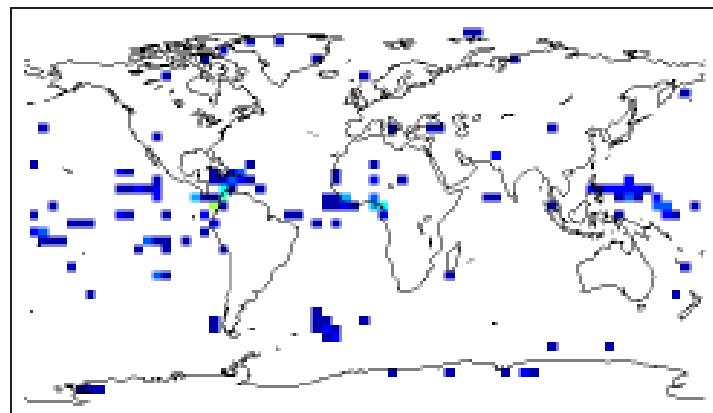




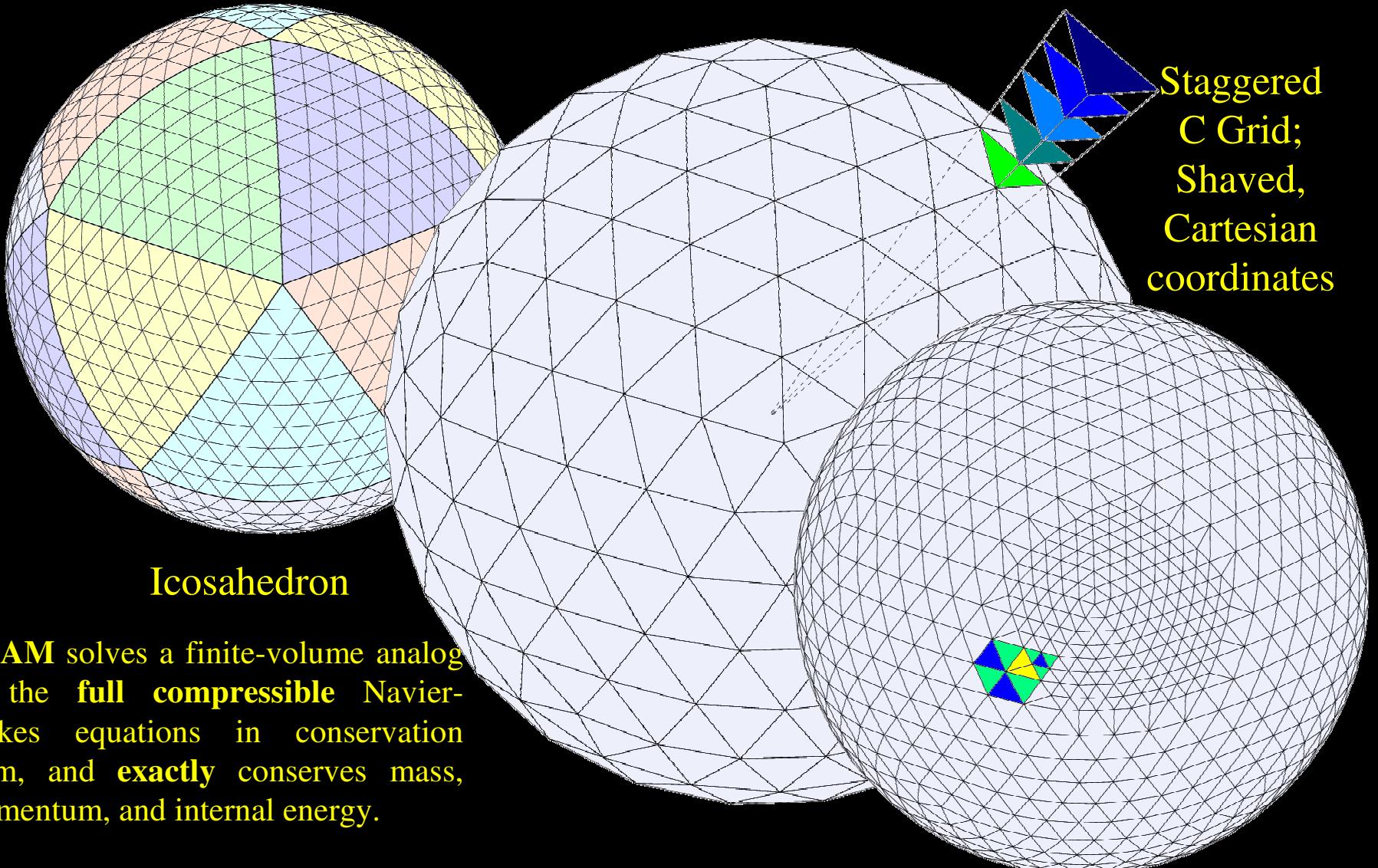
Ramos da Silva, Werth and Avissar,  
*J. Climate*, accepted for publication



- Five “super-ensembles” of three GCMs (GISS, AM and CCM3), each used to produce six, 12-year realizations (with imposed monthly mean sea-surface temperatures):
  1. Control - land-cover in early 70's, before intensive deforestation started (Matthews, 1983);
  2. Amazonian deforestation;
  3. Central African deforestation;
  4. South-Eastern Asian deforestation;
  5. All three tropical regions deforested simultaneously (i.e., “total” deforestation).
- Control case is compared to Cases (2) - (5). Each grid point is tested for monthly, ensemble mean, statistically significant difference in precipitation.

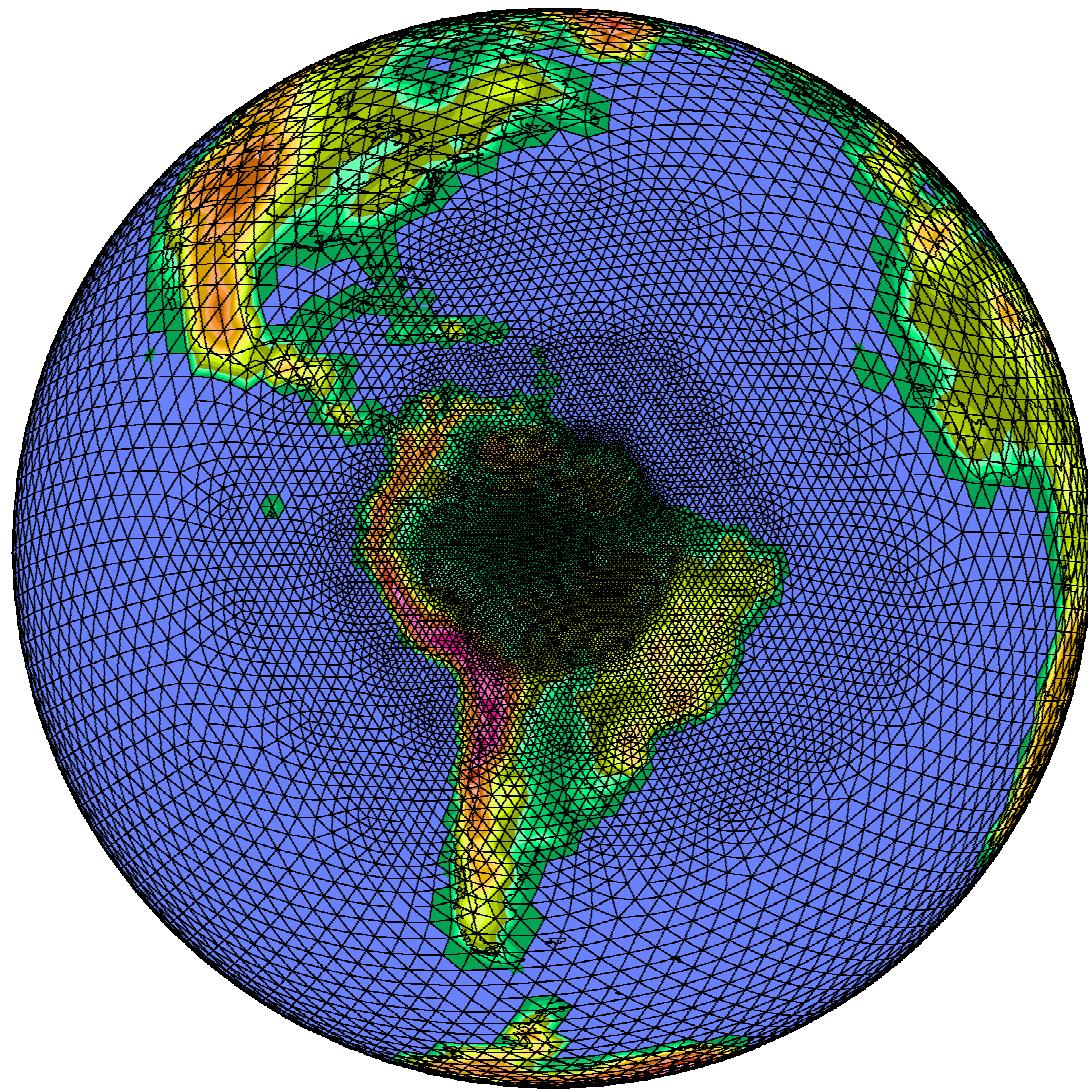


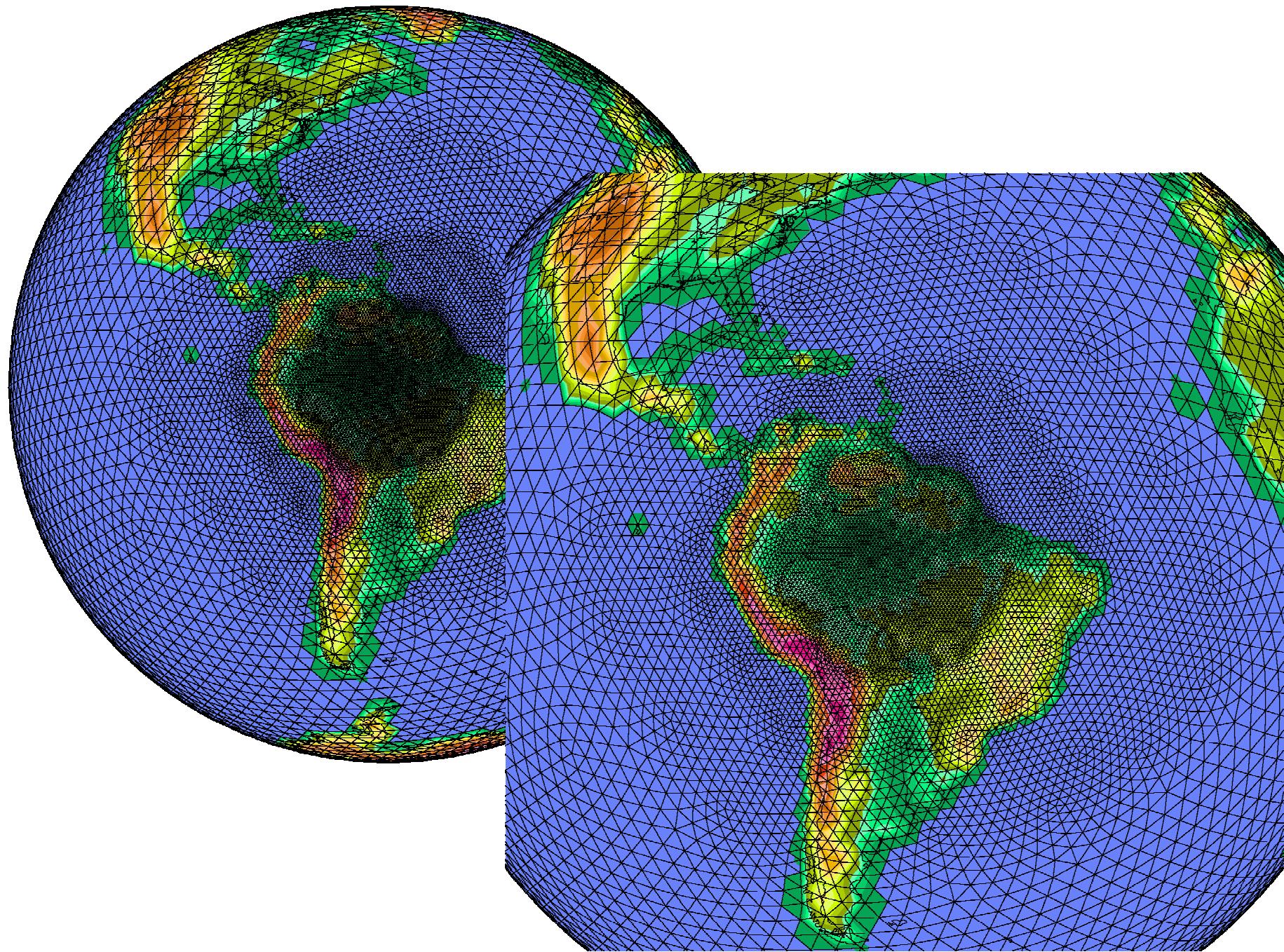
# The Ocean-Land-Atmosphere Model (OLAM): An expansion of RAMS into an Earth System Model

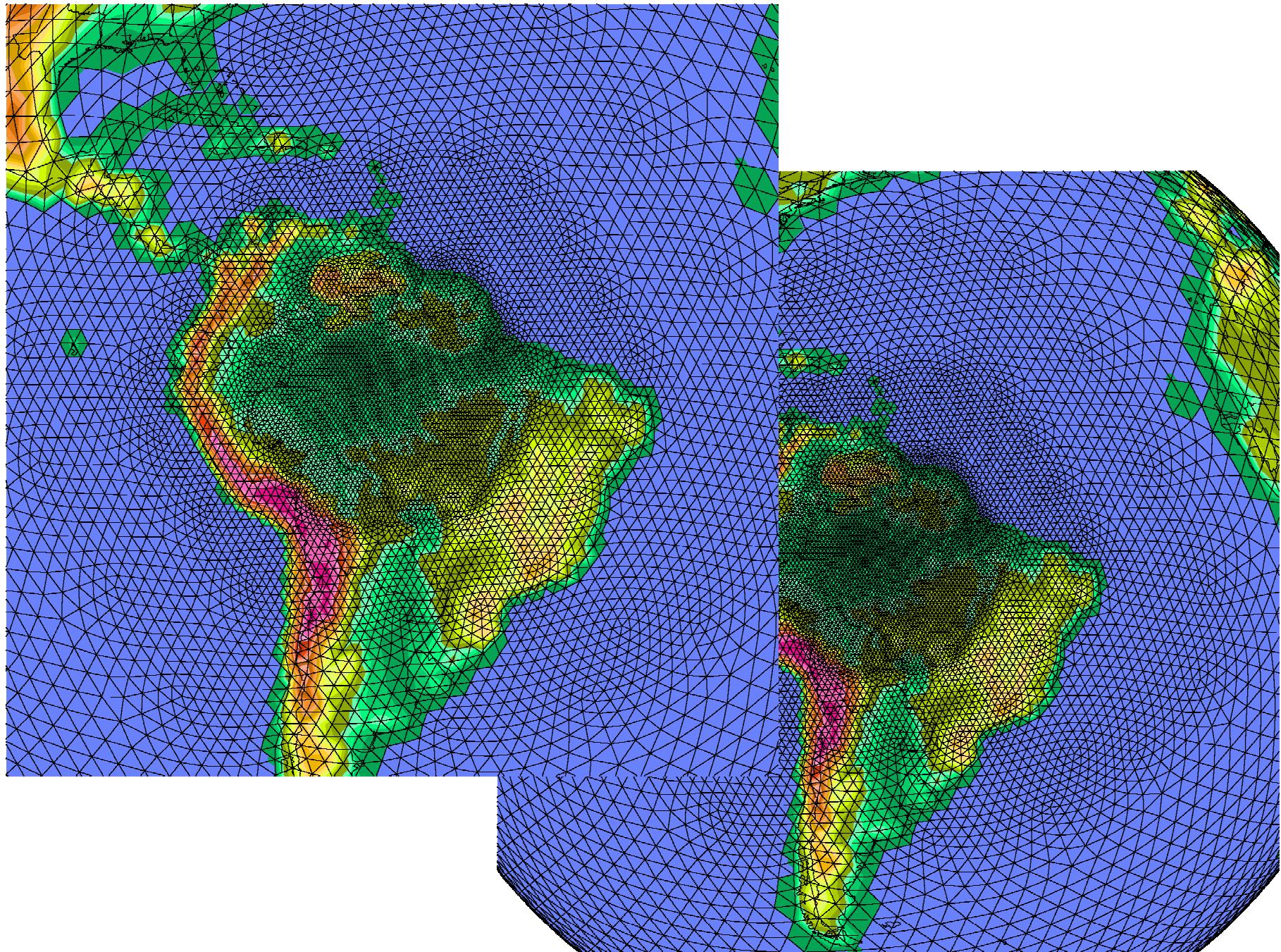


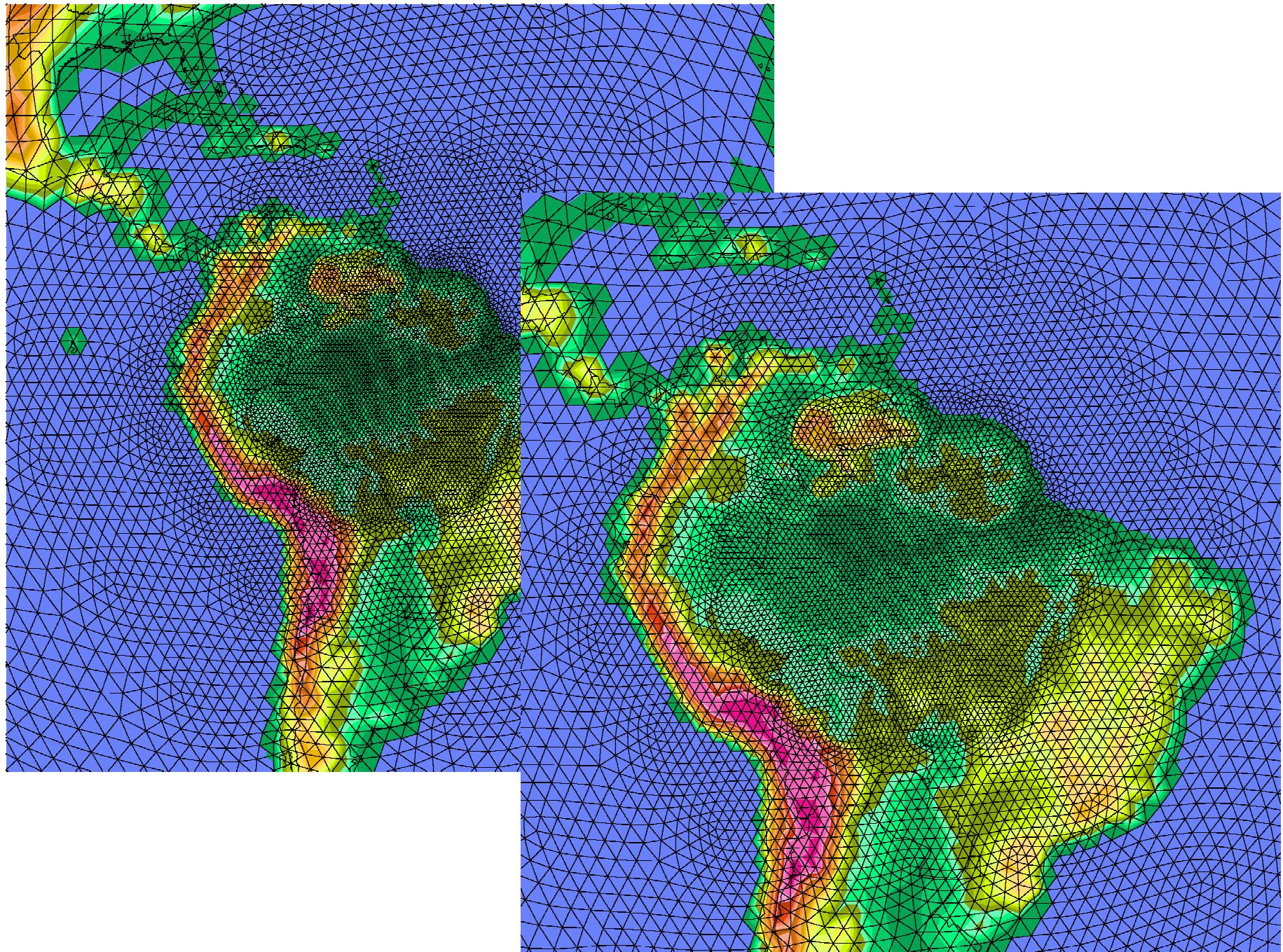
**OLAM** solves a finite-volume analog of the **full compressible** Navier-Stokes equations in conservation form, and **exactly** conserves mass, momentum, and internal energy.

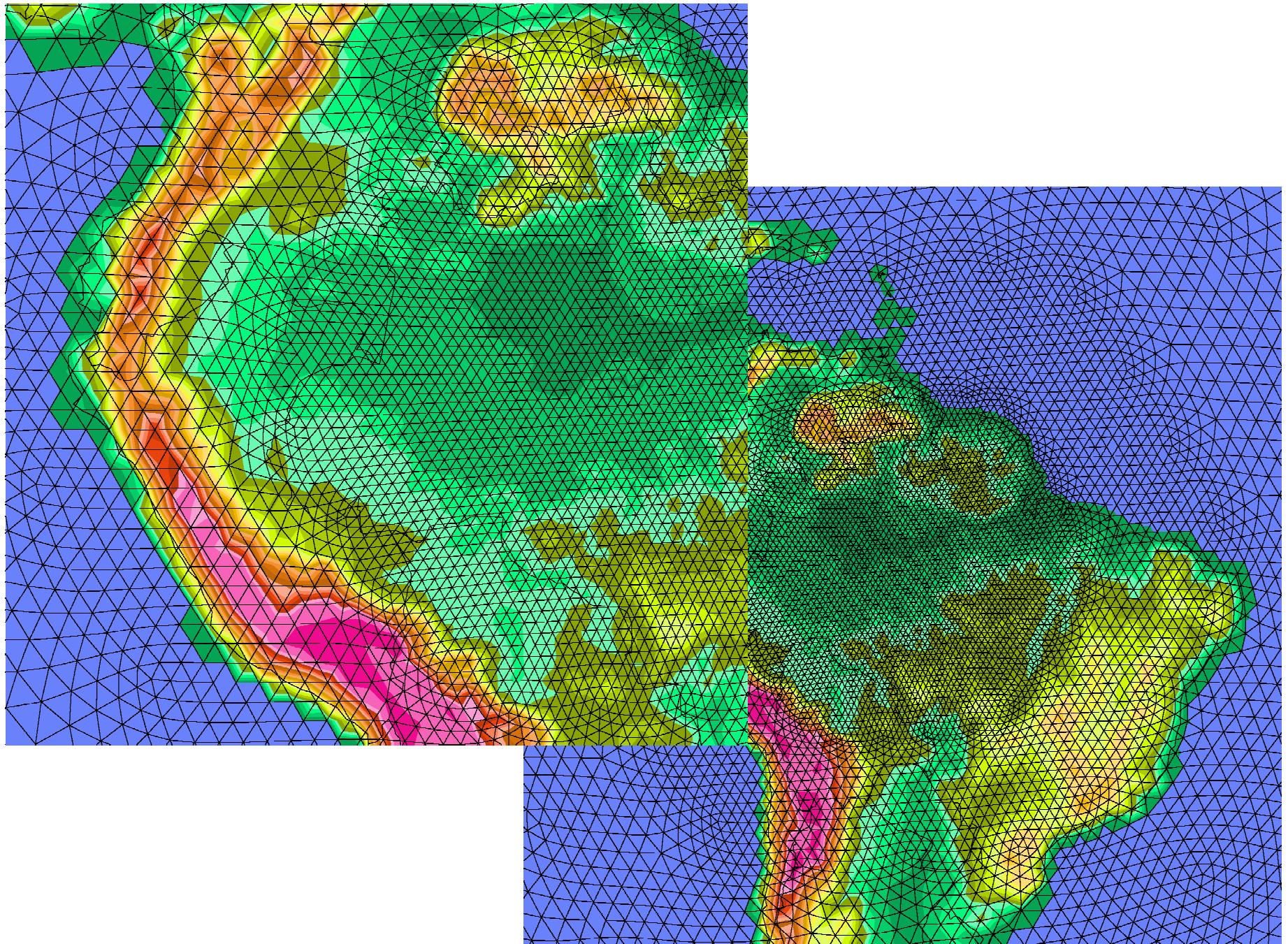
**Unstructured Grid;** No overlapping grid cell; No special nest communication; Each cell communicates directly with its neighbor independently of resolution

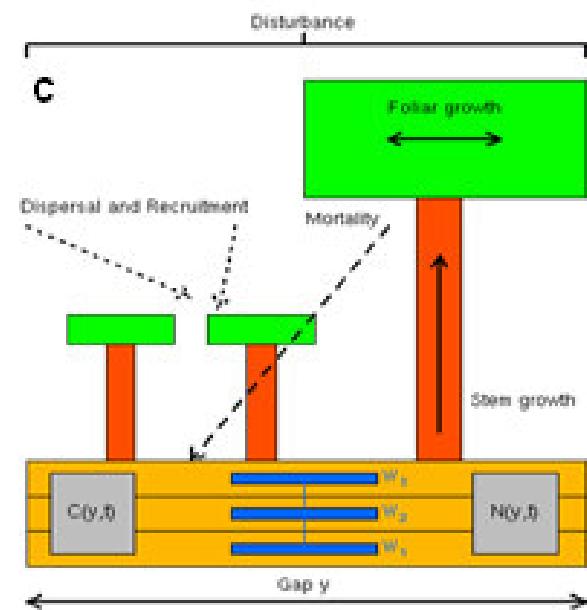
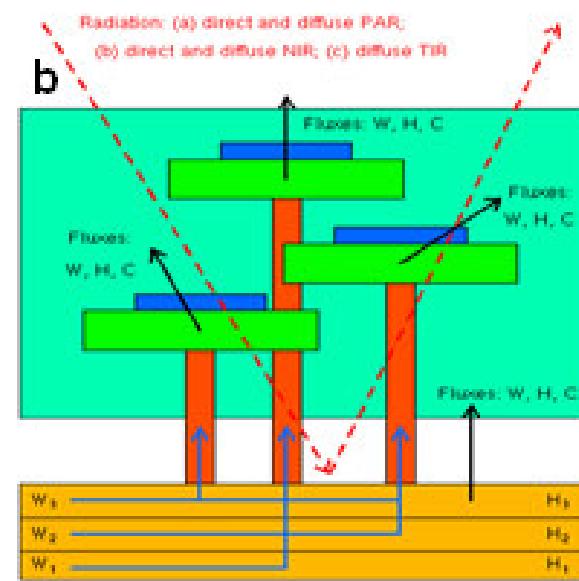
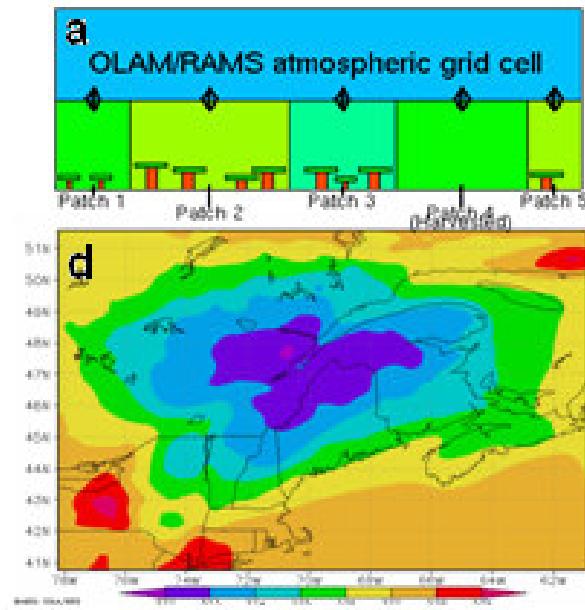












## **So what's next... (concluding remarks)**

### **OLAM Version 2.2 (released October 1, 2007)**

- New nesting scheme
- ED2 included
- Independent land and ocean surface grids and grid resolution, i.e., no need to match the atmospheric grid
- All RAMS schemes “physics” included (microphysics, cloud, radiation, land surface, turbulence, etc.)
- New parameterizations: “Emmanuel” cloud combined with partial cloudiness scheme; Radiation (based on Harrington)
- Optimization Scheme for parameter selection (LDAS and other observation datasets, e.g., Pinker’s radiation dataset, used)

### **OLAM Version 2.3 (in advanced development phase)**

- Hi-SVATS
- Deep-soil hydrology coupled to land system
- Aerosols

## **Current Research**

- Use OLAM in fully coupled mode (ED2 and aerosols) to check regional and global consequences of deforestation under increased CO<sub>2</sub>, when controlling fires and various other hydro-eco-climate processes
- Hurricane (atmosphere and hydrology) forecasting

## Most Relevant Publications

- Avissar, R. and D. Werth, 2005. Global Hydroclimatological Teleconnections Resulting from Tropical Deforestation. *J. Hydromet.*, 6, 134-145.
- Ramos da Silva, R., D. Werth, and R. Avissar. Regional Impacts of Future Land-Cover Changes on the Amazon Basin Wet-Season Climate. *J. Climate*. Accepted for publication.
- Hasler, N. D. Werth and R. Avissar. Tropical Deforestation Impact on Global Hydroclimate: a Model Superensemble Analysis. *J. Climate*, submitted.
- Medvige D., M. Otte, R.L. Walko and R. Avissar, 2007. The Ocean-Land-Atmosphere Model: An expansion of RAMS into an Earth System Model. *Mon. Wea. Rev.*, in revision.
- Walko R.L. and R. Avissar, 2007a. The Ocean-Land-Atmosphere Model (OLAM): Description and test of the dynamic core. *Mon. Wea. Rev.*, revision submitted.
- Walko R.L. and R. Avissar, 2007b. The Ocean-Land-Atmosphere Model (OLAM): Two-way grid nesting from macroscale to microscale. *Mon. Wea. Rev.*, in revision.