# Plenária II
(*Plenary II*)

**1.1: Interações entre Clima e Vegetação na Amazonia: Do Último Período Glacial até o Clima do Futuro**
(*Overview of Climate-Vegetation Interactions in Amazonia: From the Last Glacial Maximum to the Climates of the Future*)

**Carlos Afonso Nobre**, CPTEC-INPE, nobre@cptec.inpe.br (Apresentador / Presenting)

LBA research on Physical Climate aspects of Amazonia is uncovering novel features of the interaction of vegetation and the atmosphere in many spatial and temporal scales. The question of the importance of the Amazonian heat source for the global circulation of the atmosphere will be reviewed to establish likely remote climate changes due to Amazonian deforestation via atmospheric teleconnection patterns. Regionally, the question of the heterogeneity of deforestation patterns will be discussed. High resolution model simulations tend to indicate an increase of rainfall over the intensely deforested areas of Rondonia through the so-called "forest breeze" effect. However, a review of raingauge and satellite-derived observations of cloudiness and rainfall over Rondonia do not show, as yet, an increase of rainfall in either the dry of the wet season. The dynamics of the main circulation features associated with the heat source, namely the continental tropical convection in Amazonia, the South Atlantic Convergence Zone (SACZ) and the Inter-Tropical Convergence Zone (ITCZ), and their association to remote forcing from the Tropical Pacific and Atlantic Oceans, will be addressed and alterations of these large scale features due to land use change will be summarized. Next, a discussion of paleoclimate vegetation reconstructions from the Last Glacial Maximum (LGM) 20 kaBP to the present will be assessed in light of our current knowledge of biome-climate stability. Finally, a consideration will be given to likely scenarios of ecosystems changes in Amazonia due to scenarios of future climate change.

**1.2: Desmatamento e Queimadas como os forçantes da Mudança Regional Climática na Amazônia** (*Deforestation and Biomass Burning as Drivers of Regional Climate Change in Amazônia*)

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Deforestation and biomass burning represent potential drivers of significant regional climate change in the Amazon Basin. The horizontal and temporal scales over which these drivers are affecting the atmosphere varies for the different part of the Amazon but a few common features arise from the research carried out in LBA.
Deforestation is associated to a change in land cover, from forest to grassland or agriculture, or even a substitution by secondary growth forest. The change in land cover has direct impact on the energy input, through the change in surface albedo, and on the energy output through availability of soil moisture at root depth defining the partioning of sensible and latent heat fluxes. This is basically a boundary forcing for the atmospheric boundary layer and the effect on the atmosphere is a function of the scale where it is happening. One key result is an increase in surface temperature locally and impacts on cloudiness and rainfall depending on the scale of the deforested area.
Biomass burning also has an impact on the surface forcing through a change in surface albedo, but the main impact is in the change of atmospheric composition, in particular with respect to number concentration of aerosol. The internal forcing represented by biomass burning alters the thermodynamic structure of the lower layers and the cloud microphysical structure with both effects combined changing the rainfall occurrence and amounts.
The two effects, deforestation and biomass burning, combine in nature and the suggested effect is seen as a delay on the start of the rainy season, and a tendency to produce more thunderstorms in the end of the dry season.

**1.3: Fumaça, Aerossóis, Nuvens, Chuva e Clima na Amazonia** (*Smoke Aerosols, Clouds, Rain and Climate*)

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Research over the past decade has confirmed and highlighted the importance of a number of aerosol effects on climate, both through direct interaction of the aerosol with solar and terrestrial radiation, and via perturbations of cloud properties and convective dynamics. In this presentation, I will highlight recent results from a study of the effect of biomass smoke on tropical clouds and the consequences for regional and global climate. We investigated the emission of smoke from biomass burning, its regional distribution, and its effects on cloud microphysics during the LBA-SMOCC experiment in Amazonia, September-October 2002. The campaign consisted of airborne, ground-based, remote-sensing, and modeling

components. Two instrumented aircraft investigated trace gases, aerosol properties and cloud microphysics across a large region that comprised highly polluted and essentially pristine airmasses. At a ground site, we made continuous measurements of trace gases and a large suite of aerosol properties, and collected samples for laboratory analysis. Measurements spanned from the peak of the burning season, with high smoke concentrations, to fairly clean conditions in the early rainy season.

We found high loadings of smoke particles and pyrogenic trace gases in the boundary layer over vast reaches of Amazonia, and evidence for efficient vertical transport of smoke into the free troposphere. Smoke aerosols had pronounced effects on the radiation budget, cloud microphysics and precipitation formation over Amazonia, as show by in-situ measurements and remote sensing data. These effects are likely to perturb convective dynamics, radiative flux, and atmospheric composition on regional to global scales.