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Global Opportunities Fund – Climate Change and Energy Programme

Newsletter of the project

Using Regional Climate Change Scenarios for Studies on Vulnerability and Adaptation in Brazil and South America (GOF-UK-CPTEC)

Year 2 - #3 - October 2006 - Semestral Distribution

Editorial

The path which links the scientific knowledge to the police makings, its implementation and divulgation, it is not very weel consolidate in Latin-America. It is important to look for and to implement mechanisms of divulgation, so the society can be aware of what climate change is and how is affecting the natural environment and the daily life.

The *GOF-UK-CPTEC* project has a purpose of building a net of scientifics and police makers in the way of having permanent cooperation among the results of the scientific researches and the decision making process. For the next year, the project is planning different activities, which is included a meeting for the diffusion of the information about the elaborated climate change scenarios. We hope to have the participation of the whole scientific community, communities of usuaries and all the ones who are interested on the appliance of the models and strategies using climate change scenarios.

On this third Newsletter of the project, we describe the Ibero-American Climate Change Offices Network -RIOCC- and some of the conclusions of the III Meeting, realized few days ago in Bolivia. Doctor Luiz Guilherme Ferreira Guilhon, from the Hydrology Management of the Brazilian Electric System National Operator ONS-, it manifests the importance of the use of climate change scenarios in the long term energetic planning. They also discuss some preliminary results from the possible climate change effects of the South America biomes distribution, using IPCC/AR4 scenarios and the CPTEC-PVM potential vegetation model. Finally, is made a presentation of the educative campaign for children that GOF-UK-CPTEC project will realize in the climate change topic and the openning of the brochure called "Litlle Planet and his Troop".

José A. Marengo, Scientific Editor and General Coordinator
Diana Raigoza, Technical Editor and Researcher

Ibero-American Network of Climate Change Offices -RIOCC-

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The Ibero-American Network of Climate Change Offices -RIOCC- perhaps is one initiative of the largest political hit in the region. This network has been created and proposed by Spain, in the meeting of the representatives of the climate change workshops which has happened in Cartagena de Indias - Colombia, in September 2004 and lately formalized in COP10 of UNFCCC, which took place in Buenos Aires - Argentina, in December 2004.

The climate change offices of the 21 countries of the Ibero-American Nation Communities belong to RIOCC: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Equator, El Salvador, Spain, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Portugal, Dominican Republic, Uruguay and Venezuela. This network works under custody of the Ibero-American Ministers of the Environment, which present the most relevant conclusions to the Ibero-American Meeting.

Its work program it is focused in different topics related to Climate Change. One of the main areas is the adaptation to climate change and intends to consolidate as a sample of the identity through the Ibero-American Program of Evaluation Impacts, Vulnerability and Adaptation to Climate Change, a program that has been supported in December 2005, during the COP11 celebrated in Montreal, by the Ibero-American Ministers of the Environment.

Through October 4th, 5th and 6th 2006, it has been celebrated in Santa Cruz de la Sierra, Bolivia, the Ibero-American Third Annual Meeting of the Climate Change Offices Follow some conclusions of the meeting:

- The reiteration of the climate change is an important matter for Latin-American region and a thread for the environment, the sustainable development and the vulnerable populations.

- A necessity to keep moving forward in politics and climate change programs and promotion of clean energies in regional and national circuits.

- The importance of helping the RIOCC countries for the access to the available founds to support the projects of adaptation to climate change.

- They recognize the magnitude of the emissions caused by deforestation in the developed countries and they are aware of the necessity of moving forward in the construction of tools that reduce the deforestation level, allowing the developing countries to participate in the climate change mitigation process.

- They highlight the activities that happen in matter of climate scenarios in the Region, and agree as a first step to develop in the mark of PIACC (Ibero-American Program of Climate Change Adaptation) the purpose of Brazil related to the "training for the use of the regional model Eta/CPTEC". Spain and Brazil will collaborate for determining the most suitable option to support this activity.

- They agree with the elaboration of divulgation brochures of RIOCC and PIACC of the topics discussed in the meeting and highlight the importance of strengthen the communication strategy RIOCC and PIACC, as a key element for the success of RIOCC.

Related to the presented work by CPTEC/INPE, there were two parts: A summary of the regionalized climate change scenarios by ETA Model and generated through PROBIO and GOF-UK-CPTEC projects. In the PROBIO project, two other models were used. The three models presented differences in some regions and agreements in others. Annual and seasonal average values of precipitation anomalies and air temperature have been presented. All the models agree in the warming surface. However, the fields of precipitation anomaly projected by the models have a disagreement. The second part of the presentation was a purpose of practical training using the ETA Model to realize long run projections of the climate change scenarios, including programs and methodologies of studies of vulnerability and statistics of extreme values. This training will be offered for the countries that are participants

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Climate Change Scenarios as Support in the Electric Sector

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The Electric Sector has a power planning with different temporal horizons and discretization breaks. The Energy National Plan is a long term planning instrument, on which are stablish growth levels for the offers e demands of electric energy, for the subsystems that are part of the National Interlinked System.

The future scenarios of energy offer, in that it is all about hydroelectric generation, could consider results deriving from models that take regional climate changes, aiming the study of the energy offer expansion possibilities from water origens associated to future generated precipitation/runoff scenarios from these tools. The result of these analyses will probably be of most important for the considerations of the potential use of Amazon, for Northeast and South regions, where once in a while there is a reduction of the water availability, and also for the installation of new enterprises in Southern and Central Western regions.

Moreover, it is also important to emphasize that the study of the future scenarios of electrical energy demand should not consider only the economic, political and technological of each class of consume, however could also consider the climate variability from the models that consider regional climate changes, propitiating elevations or reductions of the temperature in such regions that could somewhat intervene on the demand projections.

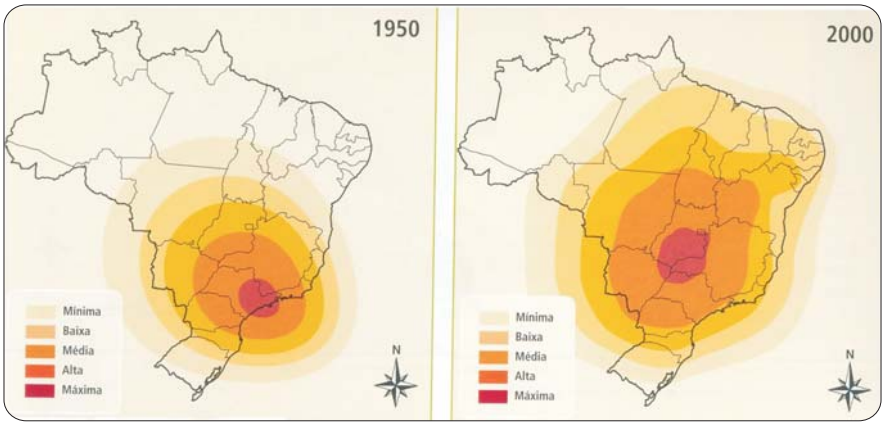

Figure. Evolution of the concentration of the hidroeletric plants in Brazil (1950-2000). Source: Electric National Agency - ANEEL. Supervision of Studies and Hidrologica Information. 2001.

(*) "The electric energy market dynamic is a due, not only the gowth of economy, as also the evolution of the structure of the national income and a number of many other factors, such as, population, domiciles, huge industrial projects, ***climate conditions,*** *etc., some of them also linked, direct or indirectly, to the economy growth".*

(*) Decennial Plan 2006-2015.

Climate Change Consequences on the Biomes in South America

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1. Introduction

The geographical distribution of the vegetation communities and their relationship with the climate has been examined with biogeographical models or biome models. These models use as central paradigm the supposition that climate has dominant control over the distribution of the vegetation. The biogeographical models can simulate the potential vegetation based in some climate parameters as temperature and precipitation. Due to the simplicity of these models and to the existence of empirical global rules between the natural vegetation and the climate, these models are used in climate studies (Claussen e Esch, 1994; Nobre et al., 2004; Nobre et al., 2006). Oyama e Nobre (2004) have developed a model of potential vegetation CPTEC-PVM which shows a good skill in reproducing the current natural vegetation distribution pattern in global scale, and in regional scale, the South America biomes, where other models widely used as BIOME (Prentice et al., 1992) and BIOME3 (Haxeltine e Prentice, 1996) show some deficiencies.

Field observations (Gash e Nobre, 1997) and numerical studies (p.e. Nobre et al., 1991), have shown that large scale deforestation in Amazonia could alter the regional climate. The effect might lead to a savannization of partions of the tropical forest domain. However, there have been fewer studies on the impact of global climate change on the South America, particulary on its biomes such as Cox et al. (2000) and Nobre et al. (2004).

Then, it will be addresses this question examinate, with a CPTEC-PVM model (Oyama e Nobre, 2004), how natural biomes could change in response to various scenarios of climate change prepared for the Intergovernmental Panel on climate change-Fourth Assessment report (IPCC/AR4).

2. Data and Methodology

This study uses standard output from nine Coupled Ocean-Atmosphere GCMs for the IPCC/AR4 (CNRM-CM3, INM-CM3.0, ECHO-G, ECHAM5/MPI-OM, GFDL-CM2.0, GFDL-CM2.1, GISS-ER, IPSL-CM4.0 and UKMO-HadCM3), with typical model horizontal resolutions between 2° to 3°. These models simulate the climate in the 21st century according to the changes in climate forcing, including increase of atmospheric carbon dioxide. We have examined the biome distribution in the 21st century under the emission scenarios A2 and B1, which represents possible pathways of future greenhouse gas emissions.

The potential vegetation model used is CPTEC-PVM (Oyama e Nobre, 2004). Given a set of environmental variables derived from climatological values of monthly mean surface temperatura and precipitation, namely growing degree-days, temperature of the coldest month and two moiture indexes (one to distinguish between wet and dry climates and the other to represent the soil moisture seasonality) CPTEC-PVM outputs a biome belonging to the vegetation classification of Dorman and Sellers (1989).

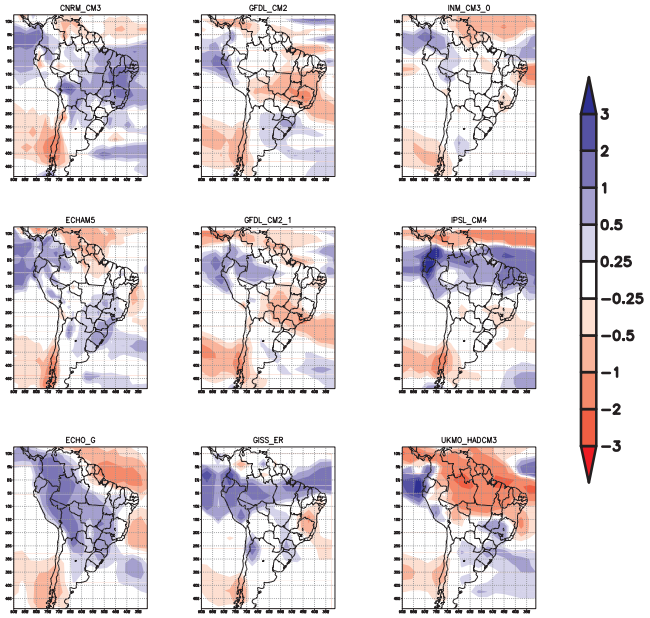

Figure 1. Climate change projections for 2070-2099 of rainfall anomalies (mm/day), for the 9 models and the A2 scenario (with respect to each model´s average rainfall for the base period of 1961-1990).

3. Results

Figures 1 and 2 show average precipitation and temperature anomalies derived from the 9 coupled Ocean-Atmosphere models, for the period 2070-2099, with respect to the base period 1961-1990, on the scenario A2. Analyses of these figures reveal larger differences among the different models. For the rainfall, there are divergencies in the value and sign of the anomaly (Figure 1).

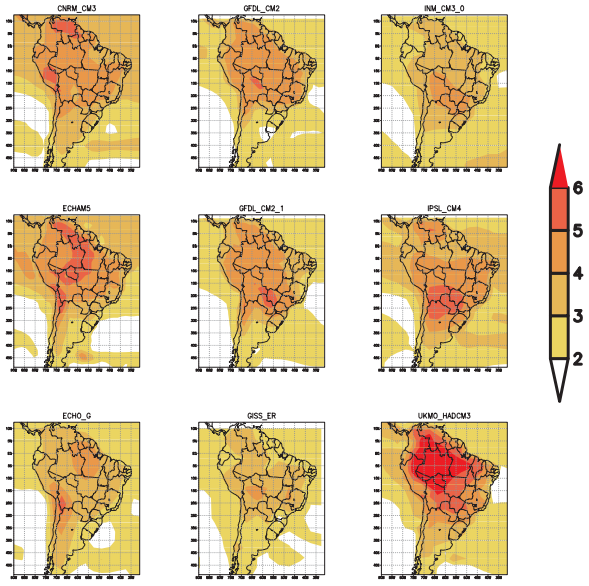

Figure 2. Climate Change Projections for 2070-2099 of surface temperature (C), for the 9 models and the A2 scenario (with respect to each model´s average rainfall for the base period of 1961-1990).

While the models CNRM_CM3, IPSL_CM4, ECHO_G, GISS_ER show a positive anomaly over Tropical South America, other models present reduction (UKMO_HADCM3) or little alteration. The projected temperature warming for south america range from 2° to 4°C for emissions scenario B2 (Figure not show) and 2° to 6° for the emissions scenario A2 (Figure 2). These differences among the models increase the uncertainties to the changes in the hydrological cycle in regional scales.

The figure 3 shows the actual potential vegetation and the projected biome distribution for South America for scenario A2.

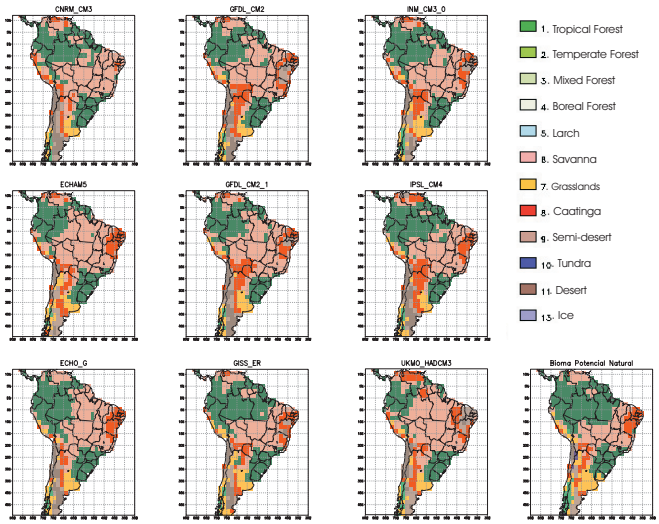

Figure 3. Projected distribution of natural biomes in South America for 2070-2099 for the scenario A2, based on the climate scenarios of Figures 1 and 2. Natural potential biomes (Down .Right).

Figures 4 and 5 show the grid points where more than 75% of the models coincide with a future condition (permanence, disappearing or appearing) of the forest and savanna, respectively (the analisys is done for the "time-slice" of "2080" of the scenarios A2 and B1). For South America tropical, the results indicate that for scenario A2, more than 75% of the models present regions of reduction of the tropical forest (Figure 4a) that are replaced by savanna (Figure 5a).

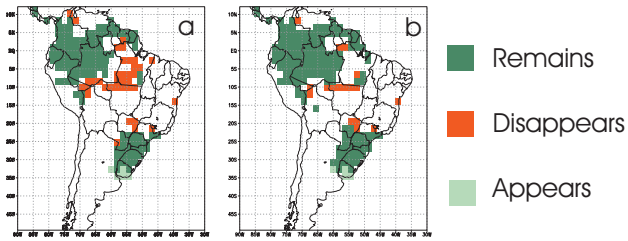

Figure 4. Condition of the Forest fn the period 2070-2099 for more than 75% of the models for scenario (a) A2 and (b) B1, comparing to the actual natural potential vegetation.

Still for the scenario B1, between 50 to 75% of the models indicate a valuable area of loss of the tropical forest that would be replaced by savanna (Figure not shown). From this analisys of the scenario B1 for the forest, it can be concluded that there is also an area (East of Amazonia), where more than 75% of the models do not present permanence or disappearing, what indicates that there is not a conclusive consense (>75%) of what would happen with the biomes on this region (Figures 4b and 5b). Impact on extratropical South America is somewhat smaller.

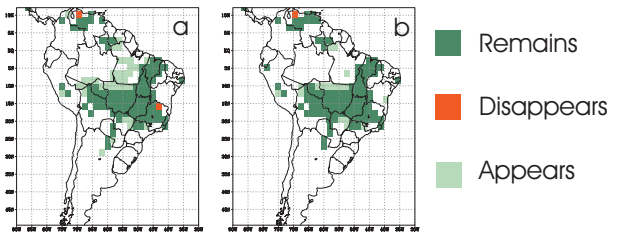

Figure 5. Condition of the savanna for the period 2070-2099 for more than 75% of the models for the scenario (a) A2 and (b) B1, comparing to the actual natural potential vegetation.

Conclusions

The global climate models from IPCC/AR4 and climate change regional models point for the future climate scenarios of superficial temperature increasing of 2 to 4°C in South America. However, the uncertain is greater for rainfall changes, mainly for the Amazonia and Brazilian Northeast (Figure 1). Evidently, these climate changes have an impact on the natural ecossystems and specifically in the biome distribution, what consequently have impacts on biodiversity, agriculture, water resources, etc. The future of biome distribution in tropical South America, that will probably be affected by the combination of impacts due to both land cover and climate change, points out to savannization of portions of tropical forest in Amazonia and desertification of parts of Northeast Brazil (second vegetation-climate equilibrium state founded by Oyama and Nobre, 2003). The combination of warming and rainfall changes indicates less water availability for large portions of tropical South America, which a strong impact on the agriculture and water resources.

For a large scale, there is a reasonable corresponde between the global distribution ot potencial and natural vegetation (native vegetation, without antropogenic land cover changes). How In regional scale the climate is not the only factor that determines the vegetation type (others factors, such as topography, soil type, fire ocurrence, etc.), there are differences between the spatial distribution of potential and natural vegetation. Thus, the potential vegetation model CPTEC-PVM is been adapted to be used on regional scale. The regional climate scenarios that will be product of "Using Regional Climate Change Scenarios for Studies on Vulnerability and Adaptation in Brazil and South America (GOF-UK-CPTEC)" project (Marengo, 2004; Marengo and Ambrizzi, 2006) will lead to study, with regional potential vegetation models, the consequences of climate change in South America and will allow the comparison with the results found in the large scale.

Acknowledgments

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Education for Kids Concerning Climate Change

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Considering the importance of the care with environment and kids education in this point of view, the National Institute of Spatial Research INPE and the Climate Studies and Whether Prediction Centre CPTEC through the "The Use of Climate Change Regional Scenarios in Studies of Vulnerability and Adaptation in Brazil and south America (**GOF-UK-CPTEC**)", suggest itself the realization of an education campaign aiming the children in basic school level, though that is considered a very good space to begin with the learning concerning the environment that we live, and also through the kids to establish a learning web to reach the closest adults around them.

Related to the climate change topic, there are very few educative campaigns being done. However, the topic is calling the attention of the authorities, because everyday our natural and urban environments are being affected by the constant climate changes.

The educative proposal considers that School is not a unity apart of the community life; it is an important part of the society, which frames true mutual values. Besides, children with their creativity can find solutions for real problems, working with educative purposes that allow them to express their reality.

Stratégy

To reach the objective of the educative campaign, a character has been created to protect Earth, called **Little Planet**. This character is the start point for the elaboration of a brochure titled "*Little Planet and His Troop*".

The brochure will be published initially in Portuguese language in the schools of Vale do Paraíba region, Sao Paulo state, Brazil.

As the objective of the research project **GOF-UK-CPTEC** attends other regions from South America, CPTEC-INPE is developing a website on the internet, where it will be available on interactive way the "*Little Planet and His Troop*". The website also will be available in Spanish and English.

Socialization

For the socialization of the educative campaign, it will happen the casting of the first number of the "Little Planet and His Troop" brochure in several schools. There are also been planned other cultural activities for the children, such as painting and tale concourses.

The Brochure

There are 14 very colorful pages in total, with the following contents:

* ABC of the climate change - Through the letters of the alphabet, they are presented different meanings about the climate change topic.

* Curious facts - Related to the environment, recycle importance and other cares that we must have with the environment.

* Games - It is a place where the children can color the pictures, play memory games, crosswords, word search among others.

The first 2500 copies of the brochure will be printed with the support of the Ministry of Science and Technology from Brazil. Contacts are been done with educative public and private institutions, as well as with public and private companies that have shown some interest in support the educative campaign.

Project "Using Regional Climate Change Scenarios for Studies on Vulnerability and Adaptation in Brazil and South America (GOF-UK-CPTEC)"

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Who is "Little Planet"?

He is a character created with a mission of saving the Earth. His function is to teach children what climate change is and how can affects the daily routine of the society. The character has been created by Giuliano Guerra Mendonça Marcelino, a Brazilian eleven years old boy.

The brochure has been idealized by Josiane Cristina Mendonça de Oliveira, who works for the GOF-UK-CPTEC project, and she is convinced that with the children's help, a better future for the climate of the planet can be reached.

One more person has had an importance in the creative process: Leandro Guarino. He is the web designer that digitalized all Giuliano's drawings and also created the web site on the internet, that this being implemented for the CPTEC-INPE.