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Diagnostic of change in energetics for a 2xCO2.

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Many studies have investigated the climatic effects induced by the expected increase of atmospheric greenhouse gases, such as carbon dioxide and methane. Experiments with AOCGCM have suggested that the response to the climate change will be an overall increase in global tropospheric and surface temperature in the range 2 to 5 K at the time of CO2 doubling.

Besides these studies of changes on the basic components of the climate system, such as temperature, precipitation and wind components, some papers have examined the changes on medidional energy transport, frequency of blocking or storm-tracks activity. The aim was to determine the response of regional atmospheric circulations and local extreme weather events to the global climate change. This requires accurate simulation of regional patterns and resolution of AOCGCM as low as 20-50$\sim$km, in order to allow the detection of realistic local events.

Differently, the aim of this study is to use results computed for the winter season by a coarse resolution GCM (Arpege, T63) and to analyze the change in atmospheric energetics predicted by this model, in terms of zonally average and eddy available energies, of baroclinic and barotropic conversions, of generation of energies by differential heating, etc...

The motivation for this approach is to consider that eddy kinetic energy and the baroclinic conversions are indicators of the baroclinic instability, the key process that initiate or amplify most of the storm in mid-latitudes. A clear signal in amplifying (or reducing) these processes could be interpreted as (un)favorable conditions for producing more (or less) baroclinic mid-latitudes extreme weather events.

Like in other papers dealing with the global impact of 2xCO2 on the global energetics of the atmosphere, it is expected that the available parts of energies must be reduced on the global scale. Indeed, the simulated changes in temperature are more important

in the polar region than in the tropics. There are also a maximum over land and a minimum (locally negative) over the oceans. These differential patterns should act such as to reduce the temperature horizontal gradients in the troposphere and, as a consequence, to reduce the horizontal available energy components. But no indication can be inferred for the real baroclinic conversions, represented by quadratic terms like $<$u'2+v'2$>$/2, or by correlation terms like (R/p)$<\omega$'T'$>$.

Other more local results will be presented, by using an exact energetic package defined for limted area domain with open lateral and upper boundaries. The predicted change on energetics will be analyzed for the Northern Atlantic domain and for separate vertical layers (boundary layer, middle troposphere, Jet, lower troposphere).