## The climate sensitivity to changes in oceanic heat transport

<u>Marcelo Barreiro</u><sup>†</sup>; Annalisa Cherchi; Simona Masina <sup>†</sup>Universidad de la Republica, Uruguay, Uruguay Leading author: <u>barreiro@fisica.edu.uy</u>

Several studies have shown using atmospheric models coupled to fixed oceans that ocean heat transport (OHT) warms the climate by decreasing the albedo due to reduced sea-ice extent and marine stratus cloud cover and by increasing the greenhouse effect through a moistening of the atmosphere. These results have been used extensively to explain past climate changes as result of changed OHT. However, the above studies usually compare an experiment with present day OHT versus an experiment with zero heat transport. In this study we perform a systematic exploration of the sensitivity of climate for various values of OHT, starting from the absence of OHT to two times the present-day values. To do so we use an atmospheric general circulation model coupled to a slab ocean and test the results with two cloud parameterizations. In agreement with previous studies an increase in OHT from zero to present-day conditions warms the climate. However, when the OHT is further increased the solution becomes highly dependent on a positive radiative feedback between tropical low clouds and sea surface temperature (SST). We found that the strength of the low clouds-SST feedback combined with the model design may produce solutions that are globally colder than the Control experiment mainly due to an unrealistically strong equatorial cooling. Besides those cases, results indicate that the climate warms only if the OHT increase does not exceed more than 10% of the present-day value in the case of a strong cloud-SST feedback and more than 25% when this feedback is weak. These values are given by the limit when the difference between equatorial and subtropical SST vanishes, that is when the tropical region is widest. Larger OHT increases lead to a cold state where low clouds cover most of the deep tropics increasing the tropical albedo and drying the atmosphere. This suggests that the present-day climate is close to a state where the OHT maximizes its warming effect on climate and pose doubts about the possibility that greater OHT in the past may have induced significantly warmer climates than that of today.