Geophysical Research Abstracts,
Vol. 10, EGU2008-A-02023, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-02023
EGU General Assembly 2008

Winter synoptic-scale variability over Mediterranean basin under future climate utilizing ECHAM5

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Changes of the winter climate in the Mediterranean Basin (MB) for future A2 conditions are investigated for the period 2071-2100 A.D. and compared with the control period 1961-1990 A.D., using time-slice simulations of ECHAM5. The main focus is on synoptic and large-scale features and their variability. The control simulation is evaluated with reanalysis data, which could be seen as best estimate of observations. The model is found to be capable of reproducing the main synoptic and large-scale features of the MB in winter, except tropical plumes, which are overestimated in the control simulation. To investigate the impact of possible future Greenhouse gas forcing on these features the A2 simulation is compared with the control simulation, revealing important changes of winter climate. The low-level temperature is projected to rise by 3°C. The upper-level trough, extending from East Europe to the central Mediterranean with a northeast-southwest orientation, shifts to the eastern coast of the MB and is rotated to a north-south orientation in the A2 simulation. The mean low pressure pattern of the MB shrinks and only remains in the eastern part, whereas a high pressure system dominates the western part. This is also evident regarding cyclones, which are individually detected and tracked, decreasing by 10% in the Western Mediterranean (WM), but no significant change in the Eastern Mediterranean (EM). The cyclone intensity is slightly reduced in the entire region. To understand these reductions, underlying processes are analyzed showing that changes in baroclinicity, static stability, and the transformation of eddy kinetic energy to kinetic energy of the mean flow are impor-

tant in particular in WM and the coastline of North Africa. The reduction of cyclonic activity has a severe impact on precipitation, mainly at the southern half of the WM and in the adjacent North African coast. One reason that EM is less affected is the change in polar intrusions, which are expressed by extreme negative anomalies in the 500-hPa geopotential height and become more intense in the A2 scenario. Thus the region, which is expected to suffer most in winter, is the southern part of the WM and the western part of the North African coasts.