



Impact of southern and central European land surface heating induced by greenhouse warming on the atmospheric circulation

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A robust result of greenhouse warming runs with global climate models is the depletion of soil moisture in southern and central Europe in summer. This leads to a strong increase in surface temperatures as a result of the accompanying reduction of the surface cooling by evaporation. In a series of sensitivity experiments with the EC-EARTH climate model we investigate the effect of this enhanced warming on the atmospheric circulation. EC-EARTH is a coupled climate model jointly developed by the EC-EARTH consortium and is based on the integrated forecast model of the ECMWF. The sensitivity experiments are designed to test the hypothesis that the enhanced summer surface easterlies over central Europe that are found in many recent climate scenario simulations are mainly due to the development of a heat low over the Mediterranean region in response to the enhanced warming of North Africa and Southern Europe. In the experiments with EC-EARTH the land surface temperature is artificially enhanced by increasing the downward surface solar radiation. This is done in order to enable the soil moisture to respond in a dynamically consistent way to the increase in surface land temperature. A similar approach has been successfully used in a previous study (Haarsma et al., *Geophys. Res. Lett.*, 2005, doi:10.1029/2005GL023232) to show that an enhanced Sahara heating results in a deepening of the Sahara low with consequences for the Sahel rainfall.