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The role of large scale circulation changes in the global warming increase of extreme heatwaves

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The Summer 2003 Extreme Heatwave over Europe was linked with a characteristic Large Scale Circulation ({\bf LSC}) pattern advecting very warm tropospheric air masses from Maghreb and Sahara, also providing anticyclonic subsidence over western Europe and Mediterranean as well. With the Global Warming, Extreme Heatwaves will certainly worsen; however several mechanisms may play a role and {\bf LSC} changes may, {\it a priori}, as well reinforce the consequences of Global Warming over western Europe, or reduce them. \vskip 0.15cm Temperatures at the 850 hPa geopotential level ({\bf T850}) actually appear to provide quite relevant prognosis fields for {\bf TX} extremes. The actual level of {\bf T850} extreme values warming for a given Summer will actually depend on the leading Low Frequency Circulation patterns during this particuliar Summer. \vskip 0.15cm Using several Control and Scenario run outputs together with Reanalysed {\bf LSC} fields, we first determine the preferred observed {\bf LSC} patterns, the so-called "Weather Regimes" ({\bf WR}). Like the 2003 Summer {\bf LSC} leading patterns, {\bf WR} are fundamentally Low Frequency objects and tend to persist and (or) recur through long periods. The link between extreme heatwaves and particular {\bf WR} occurence is then investigated within the present climate framework. In the next step, we classify the Control and Scenario {\bf LSC} daily patterns into these observed {\bf WR} and look for any change in the {\bf WR} frequencies in response to Global Warming forcing. \vskip 0.15cm Using as an Extreme Index {\bf TXQ90} or {\bf TXQ95}, the 90^{th} or 95^{th} percentiles of {\bf T850} for individual summers of the end of the 21^{st} century Scenario runs, we apply to assess the role played by the changes of individual {\bf WR} occurence frequencies in the changes of Extreme Heatwave Indices. Conclusions attained with two different models are compared.