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Radiative forcings explain recent rapid temperature increase in Europe

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Over the past two decades temperature in Europe increased considerably faster than in the northern hemisphere. Detailed analyses now reveal similar in-phase monthly temperature changes over all Europe, but showing large differences in magnitude with annual means decreasing by -0.2(0.4) ˚C over western and increasing by +1.4 (0.5) ˚C over eastern longitudinal zones from 1995 to 2002. In-phase monthly changes indicate, that large-scale weather patterns uniformly influence temperature over greater Europe. The large differences on magnitude of temperature changes however, seem to be related to regional surface conditions and radiative forcings. We show strong evidence from monthly evolutions of surface radiation budget, temperature and humidity, that increasing greenhouse gases - primarily water vapour - cause the non-uniform rapid temperature rise in Europe. Solar shortwave radiation rather decreases and changing cloud amounts show small annual net radiative forcings. However, high annual correlation of increasing cloud-free longwave downward radiation with temperature (r =0.99) and absolute humidity (r =0.89), and high correlation between ERA-40 reanalysis integrated water vapour and surface temperature (r =0.84), clearly manifests non-uniform strong ‘water vapour feedback’ greenhouse forcing.