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Global scale energy budget contrast between warm and cold years

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This contribution analyses changes to the energy budget of the troposphere associated to global warm anomalies of the Earth surface temperature. This is important for understanding the dynamics of climate change. A phenomenological approach is adopted, comparing coldest and warmest years over the last century. Data are provided by the results of 10 simulations carried out within the ERA-20CM experiment and covering the period 1900-2010. This ensemble is forced by 10 perturbed realizations of SST fields and greenhouse gases concentration time series. Analysis considers the annual mean meridional distribution of zonal mean tropospheric and surface temperature, net downward solar radiation at top of atmosphere and Earth surface, surface heat flux (SHF), consisting of net longwave upward radiation, latent heat and sensible heat vertical fluxes, and outgoing longwave radiation at top of atmosphere (OLR). Differences of these variables between the warmest and coldest years are computed, in order to analyze how the energy budget of the atmosphere is associated to the warming the Earth surface. During warm years, it is observed that tropospheric warming occurs at all latitudes, decreasing at its top, being rather uniform but larger/smaller around the North/South Pole than at the tropics. This is consistent with the overall increase of OLR at all latitudes. Shortwave absorption in the troposphere increases, with a peak around 30 degrees north, as a result of increased net downward solar radiation at the top. The warming of the surface is associated with reduced SHF almost everywhere, particularly at higher latitudes. This combined effect might be interpreted as a reduction of solar reflection by cloud cover and an increased moisture in the lower troposphere, inhibiting evaporation and heat fluxes from the surface, and increasing downward flow of longwave radiation to the surface. Finally, the meridional distribution of residual net energy budget in the troposphere suggests an increased meridional transport toward high latitudes, as well as a more intense energy loss to the surface and to outer space