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The two faces of the Global Warming in the ERA-20CM experiment

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In the 20th century global mean surface temperature increase has occurred throughout two distinct phases, which are characterized by an evidently different behavior. In the first period anomalies over continents and oceans are indeed very similar, while in the last few decades continents have warmed faster than oceans.
ERA-20CM is an ensemble of 10 members atmospheric model integrations for the 1900-2009 period, adopting different sea-surface temperature and sea-ice cover conditions to sample uncertainty of the HadISST2 dataset. Radiative forcing is based on CMIP5 recommendations.
Meridional sections are retrieved for the ERA-20CM experiment ensemble mean of individual components of the energy budget, separately considered at the surface, at the Top of Atmosphere (TOA), and for the atmosphere. Model outputs are analyzed in order to assess how and to what extent the nature of the warming is different between the two periods. This analysis considers the atmospheric energy budget difference between the coldest and warmest decades of the two warming periods.
Results show a net positive budget at the TOA in the second period (radiative imbalance), while it is close to zero in the first. This is a consequence of a drastic change in the Outgoing Longwave Radiation (OLR), less efficiently compensating the SW radiation input. The atmosphere in turn is seen to be less transparent to SW radiation, increasing its absorption mostly in the Northern Hemisphere. For both periods an increase in the surface absorbed radiation is found, particularly in the LW band, which in the second period is less efficiently compensated by an increase in vertical heat fluxes toward the atmosphere. The meridional section approach emphasizes the global importance of sea-ice melting in the Arctic regions, and how budget variations affect the latitudinal energy budget gradient, necessary condition for the onset of the mean meridional circulation.