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On Future European Cold Spells

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Many studies exist that show that in a warming future climate, European winter cold spells will become less frequent, less intense, and less persistent. Indeed, many metrics like, the annual number of frost days, the number of ice days, and winter heating degree days (known from the energy sector) do show significant negative trends. Yet the anomalous circulations that lead to the cold spells appear not to show such strong negative trends. With advection being the most important source for temperature variability at mid-latitudes, and especially for Western Europe, this brings forward the idea that the non-uniform pattern of global warming itself, and the modification of the mean (westerly) circulation must be the key-factors to explain the changes in cold-spell statistics. These two factors mainly affect the mean and variance of the winter probability density function. It is shown that many of the future changes in cold-spell statistics are indeed readily explained by taking into account only changes of the (increased) mean and (reduced) variance of the daily winter temperature probability density function.