Can we predict weather and climate extremes using machine learning techniques?

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Recurrent neural networks have been recently introduced to predict the behavior of chaotic systems. Surprisingly, they provide reliable forecasts up to the predictability limit without knowing the underlying equations of the systems. Here we focus on the predictability of rare trajectories leading to extreme events. We focus on different chaotic systems, ranging from toy models of the atmospheric dynamics, up to the re-forecast of sea-level pressure and temperature fields issued by ERA Interim and NCEP reanalysis datasets. Our results show that: i) the machine learning techniques can make reliable weather forecasts of global atmospheric fields up to 48-72h with a time step of 3-6h ii) long time forecasts do not diverge, they produce reliable climatology of the sea-level pressure and temperature fields iii) we can evaluate the coherence of extreme events generated via the machine learning with respect to the observed ones.