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Springtime surface wind speed trend in France

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Observations of surface wind speed over the last decades show a negative trend over the continents in the Northern Hemisphere, leading to concerns in the wind energy community. In China, a large negative trend has been observed and several studies attribute it to human-induced modifications in temperatures and aerosols affecting the monsoon circulation patterns. Regarding other regions, the link between negative wind trend and large-scale atmospheric circulation is more speculative. Indeed the most frequently suggested cause is changes in surface roughness due to an increase of vegetation cover and urbanization. Though some correlations were found between vegetation index and wind trends, this hypothesis cannot explain the whole trend, and it is not clear how local changes could lead to a global and regular trend over decades.
In Europe, studies analyzing annual averaged wind speed show a small trend with respect to other parts of the globe. Over the last three decades, the trend found in the observations is lower than -0.1 m/s/decade in average, but with a large spatial variability, and the trend in the reanalysis is even lower. This trend is small compared to the high inter-annual variability, making it difficult to quantify and attribute.
The present study brings new elements by studying seasonal variations of wind speed, mainly over France. Both observations and reanalysis show a strong negative springtime wind speed trend (about -0.25 m/s/decade in observations and -0.15 m/s/decade in reanalysis, over March-April). The wind variability is analyzed and divided according to different time scales and the long-scale trend explains at least a third of the observed spring-time decrease. This trend is linked to changes in the seasons lengths : longer summer conditions and shorter winter conditions. Spring is the transition from winter pressure conditions, when wind speed is higher in average, towards summer conditions, when the wind is lower in average. There is evidence that, since 1960, this transition has been happening sooner, shortening the winter, decreasing the average wind.
Finally, another result is reached regarding the local effects on wind speed. The comparison between observations and reanalysis enables to extract the trends due to the modifications in the surroundings of the observation stations. Those local-scale trends are negative in average and show no seasonal but a large spatial variability.