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Lightning over Italy: analyses of data and impact of their assimilation on lightning and precipitation forecast

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Lightning can influence many human activities, being a threat also for human lives. The Mediterranean area is prone to thunderstorms and lightning. In this context, lightning forecast plays a fundamental role. We studied the impact of lightning data assimilation (LDA) on lightning and precipitation forecast over Italy and over part of the Central Mediterranean Basin. First, we highlight some characteristics of strokes over Italy and the Central Mediterranean [1], considering data over 13 years recorded by LINET (LIghtning NETwork). The analyses of the records show that lightning activity occurs mainly in summer and fall; moreover, a substantial change of convection characteristics between the two season is apparent. In summer, convection occurs over the land, in fall it is mainly over the sea.

Then, we consider a two-seasons data assimilation experiment [2] running the Weather Research and Forecasting (WRF) model coupled with the Dynamic Lightning Scheme (DLS) at 3km horizontal resolution for summer 2020 and fall 2021. Each simulation produced the forecast for the following 6h. Therefore, the representation of a whole day needs four different simulations. Verification is done over two sub-periods, 0-3h and 3-6h after assimilation. Results for the 0-3h phase show a positive impact of LDA on strokes forecast, both improving correct forecasts and reducing false alarms. Depending on the case, LDA can trigger convection missed by control forecast and can correct strokes' patterns, leading to predictions more in agreement with observations. An improvement compared to the previous day forecast, without LDA, is also obtained. Therefore, the forecast over the 0-3h phase with LDA is applicable to issue warnings and alerts as the storm is approaching. LDA forces convection where lightning is observed. Consequently, lightning forecast improvement given by LDA, is more evident over the land in summer and over the sea in fall. The 3-6h phase show a negligible impact of LDA on strokes forecast.

References

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