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# Study and forecast of convection phenomena over the territory of the south of Russia using lightning location data network

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Introduction
In recent years, the number of lightning detection networks deploy worldwide. They provide information of coordinates, time, type of discharge, and physical characteristics of a lightning. For instance, there is Worldwide Lightning Location Network (WWLLN). Gathering lightning data is necessary for storm climatology, forecast validation , finding solutions of lightning protection problems and improving the prediction of convection using data assimilation technique. The main goals of this study are storm climatology and simulation of severe storms using data assimilation technique over southern part of Russia during the convective season of 2017. WWLLN data, WRF-ARW and LTNGDA are used for the research [1,2].

Methodology
Well-known that the south is “the most lightning” region of Russia. This research is devoted to the statistical analysis of thunderstorm data in 2017. It includes identifying the number of days with thunderstorms, determining the total duration of every thunderstorm events, identification of areas with the highest thunderstorm activity and study of the spatial distribution of the density of lightning discharges.
Also, this work presents simulation results of 8 case studies of the most destructive convective storms observed in 2017 over Krasnodar region of Russia. In current research are computed BASE experiment (without lightning assimilation) and LTNGDA experiment (with assimilated lightning data gathered from WWLLN [1,2]. Both experiments are computed using WRF-ARW v. 3.9.1 with 2 km resolution and 30 vertical levels. The advance time is 48 hours. The domain of interest is (45.5-46.4 N; 37-41 E). Some used parameterizations: cu convection – Kain-Fritsch, microphysics - NSSL 2–moment Scheme with CCN Prediction. Then the difference in vertical profiles of the air temperature and cloud water content in points with observed lightning for both experiments is analyzed. The convection thunderstorm evolution is studied.The main goal of the research is the accuracy of the surface air temperature, relative humidity, pressure and rains evaluated for BASE and LTNGDA experiments. Bias, abias and rmse are obtained.
Conclusions
According to the preliminary results it was found that lightning assimilation helps to improve the short-term forecast of air temperature, pressure, relative humidity and rain. It concerns not only its forecast estimations. The LTNGDA technique makes the cumulus precipitation localization more accurate.

References:
1. Lay E.H. (2008), PhD thesis, 142.
2. Height et al. (2016), J. Adv. Model. Earth Syst., 8, 1806–1824.