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Nonlinear Processes in Geophysics
Discussions
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Interactive comment on "Diagnosing non-Gaussianity of forecast and analysis errors in a convective scale model" *by* R. Legrand et al.

Anonymous Referee #2

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Review of the Manuscript: 'Diagnosing non-Gaussianity of forecast and analysis errors in a convective scale model' by R. Legrand, Y. Michel, and T. Montmerle.

The present work presents a valuable diagnosis study of the non-Gaussianity (NG) of the analysis, background and short-term forecast errors of the humidity and temperature fields (among others), derived from ensembles of assimilations on the AROME model. The impact of convection and radar observation density is also studied. The paper is quite clear in most sections and well written and therefore it is worth to be published on NPG.

The paper may be improved after some minor revisions.

1 – The transformed estimator f4(G4) for kurtosis was originally presented by

Anscombe and Glynn(1983), after that of d'Agostini (1970) test for skewness. The omnibus test (4) in pg. 1068 was presented by D'Agostino et al. (1990). See references bellow and add to manuscript.

Anscombe, F.J.; Glynn, William J. (1983). "Distribution of the kurtosis statistic b2 for normal statistics". Biometrika 70 (1): 227–234. doi:10.1093/biomet/70.1.227. JSTOR 2335960

D'Agostino, Ralph B.; Albert Belanger; Ralph B. D'Agostino, Jr (1990). "A suggestion for using powerful and informative tests of normality" (PDF). The American Statistician 44 (4): 316–321.doi:10.2307/2684359. JSTOR 2684359.

2 – Beyond K2 (Eq. 4), other diagnostics of NG have been used on assimilation error and innovation diagnostics, like those relying cumulant-based expansions of the negentropy or the Kullback-Leibler divergence with respect to the fitting Gaussian pdf (Pires et al. 2010). Add the reference:

Pires, C.A., O. Talagrand, M. Bocquet, 2010. Diagnosis and Impacts of non-Gaussianity of Innovations in Data Assimilation. Physica D. Nonlinear Phenomena, Vol. 239, (17), 1701-1717. doi:10.1016/j.physd.2010.05.006 .

3- Fig 3b and 3c present profiles of the horizontal averages of f3 and f4 for humidity. However local values of f3 and f4 may exhibit quite larger and extreme values (see Figs 4b and 4c) than their horizontal averages. Figs 3b and 3c do not give an idea of the NG range over the area. A figure with profiles showing the range interval (e.g. 5-95%) of f3 and f4 would be useful. It would be more consistent with Fig 3a presenting spatial averages of the local K2 values.

4 - Pg 1071, line 15. Please be more rigorous not using the 'inversely proportional' attribute. For instance: larger values of k2 generally occur for small values of q.

5 - Pg 1072, line 1. Negative skewness - left-tailed distributions. Please correct.

6 - Pg. 1073. Relationships between NG and physical processes must be analysed

with care. Which makes you to link diabatic processes to NG? NG can come from nonlinear processes acting on Gaussian pdfs; linear processes acting on NG pdfs or both. Add a short justification.

7 - Sec. 4.1 highlights the drastic reduction of NG of the analysis compared to that of background (Fig8a,b), specially over regions of dense radar observations. This can only be due to the hypothesis of Gaussianity of observation errors (e.g. radar) which is for the moment the better hypothesis to use. Comment that.

8 - Pg 1075. Despite the fact that vorticity and divergenge are linear operators of the quasi Gaussian zonal and meridional wind fields, mostly of the NG comes from heteroscedasticidy (spatial variability of the wind variance). Refer this aspect.

Interactive comment on Nonlin. Processes Geophys. Discuss., 2, 1061, 2015.