

Interactive comment on “Air quality forecasts at kilometer scale grid over Spanish complex terrains” by M. T. Pay et al.

Anonymous Referee #1

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The paper entitled “Air quality forecasts at kilometer scale grid over Spanish complex terrains” submitted by Pay et al. to GMD presents an evaluation of a country-scale air quality forecasting system for Spain, including focuses on specific major urban areas (Madrid, Barcelona, Andalucía). Such models have been used for a decade or more and are now well established as relevant tools to support public information and design mitigation strategies. With the increase in knowledge and computing power, their complexity and spatial refinement has gradually increased. And the amount and quality of detailed data available for their validation has increased accordingly. It is therefore relevant to revisit their evaluation as proposed in the present paper.

My impression is that the paper is well organised and clearly written, thorough and rigorous as well as being relevant, insightful and useful for the community of users,

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therefore I would support its publication provided that the following comments can be addressed.

Major Comment

My only major concern regards the comparison of very high resolution model output to point stations for high-frequency scores, including exceedances. When the model reach such high resolutions, it becomes impossible to ignore the issue of spatial representativity of the observations. Depending on their environment and meteorological conditions, various stations sample different airsheds. An air parcel advected within a gentle wind of 1 m/s over flat terrain would drift 3.6km away over an hour. At 4km model resolution, this displacement can be ignored. But reaching the kilometre scale raises unprecedented issue. In particular I would need to know if model outputs and stations observations are instantaneous every hour, or if they are integrated in time in some way. If an inconsistency exist in the temporal sampling, one could argue that 4km is a more sensible horizontal scale than 1km, therefore the 1km model outputs should be degraded somehow to reach the spatial and temporal representativity of the station. On a similar topic, the discussion in Section 3 on spatial representativeness is interesting overall, but the reader keeps wondering what support the statements on how realistic are 1km and 4km maps given that we do not have such high resolution data to compare with.

General Comment

It is not clear why the evaluation period is so short. If the forecasting system is operational since 2009 for two of the selected areas, one could have expected a more comprehensive validation.

Minor Comments

P2295 L21: The author may consider relevant to add a couple of sentences on the need to reach high resolution in order to improve covariance between population and pollu-

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tion for health impact assessment, e.g. as done in Thompson, T. M., Saari, R. K., and Selin, N. E.: Air quality resolution for health impacts assessment: influence of regional characteristics, Atmos. Chem. Phys. Discuss., 13, 14141-14161, doi:10.5194/acpd-13-14141-2013, 2013.

P2299 L12&14 : the use of "in" such as "by" in this context is surprising.

P2303 L 3-6 : in an evaluation paper, it is acceptable and relevant to spend a few lines to introduce the evaluation metrics rather than using references.

P2304 L16 : "desert"

P2308 L12: PM10 composition data is probably not available over the domains of interest. A reference to other studies having validated the CALIOPE system for individual PM compounds would be interesting. In particular, the abundance of SOA seems small, does it comply with the average load in Spain?

P2308 L 17&18: replace "in" for "by".

P2308 L26: a word is missing between "wind speed" and "relative humidity"

P2308 L27 "not shown"

P2309 L 3: what is the reason for the change in primary PM load with resolution? One can expect increases in horizontal gradients reported later in the same paragraph but the change in total abundance is more surprising.

P2309 L 15 : "increase on daily cycles"

P2309 L19: please clarify what is referred to as "lamination" of the PBL.

P2310 L8: what is the dynamical process leading to a lower PBL in the high resolution simulation?

P2310 L 19-24: which additional measurement or modelling experiment could lead to a better understanding of the reason for this diurnal cycle in the model bias?

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Interactive comment on Geosci. Model Dev. Discuss., 7, 2293, 2014.

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