Anonymous Referee #2

Please revision the english language

Please review the conclusions. They are confused. Conclusions should be done in short setences and with the main conclusions each by each (in paragraph)

The authors would like to thank Reviewer for constructive comment that improved the quality of our paper. We made a modification of conclusions. With these corrections, we are also attaching Proofreading confirmation. Please find corrected part of Summary and conclusions below (in purple colour):

Numerical modelling of $(\overline{PM_{10}})_d$ with different AQMs is still challenging (Baró et al., 2015; Prank et al., 2016; Laurent et al., 2016). It is therefore important to further analyse the different performances of regional models that have been widely used in practical applications. The main task of the current work was to investigate one of the weakest model capabilities, i.e., the simulations of AQMs under statically stable boundary conditions (e.g., Gašparac et al., 2016; Grisogono and Belušić, 2008) focusing on dynamic model aspects during episodes of elevated $(\overline{PM_{10}})_d$ concentrations over Central and Eastern Europe. Here, two different regional AQMs, namely, EMEP and WRF-Chem, were applied to evaluate their individual state-of-the-art performance and to investigate the processes that contributed to a high $(\overline{PM_{10}})_d$ concentration during pollution episodes that occurred in Europe. Other model intercomparison research studies over Europe and North America were done within the AQMEII project (e.g., Im et al., 2015; Solazzo et al., 2012; Rao et al., 2011). However, with respect to those large exercises with harmonised input data (same meteorology, emissions, boundary and initial conditions), the focus of this research was on the specific meteorological situations when statically stable atmospheric conditions prevail accompanied by the occurrence of high $(\overline{PM_{10}})_d$ concentrations. The offline EMEP and online WRF-Chem modelling systems were used with the available input data that are usually implemented in practical applications (e.g., environmental assessment studies). The added value here is in the individual statistical evaluation of such modelling systems using data from the large number of meteorological and air quality stations in Eastern Europe that have been less represented in other similar exercises. The analysed and modelled meteorological parameters were validated using surface measurements from 920 synoptic stations, soundings within the Pannonian region and mast-mounted instrument measurements. The $\left(\overline{PM_{10}}\right)_d$ concentrations were validated against surface measurements from 310 rural background stations.

During the colder part of the year, when usually higher PM concentrations are observed, following model features are established:

- According to the low systematic errors a very good model performance is found in simulating $\left(\overline{mslp}\right)_d$ over sea-level and elevated stations,while high positive BIAS for both models was obtained over mountain stations.
- Good performance in modelling $(\overline{ws})_d$in EMEP and $\left(\overline{t_{2m}}\right)_d$ in the WRF-Chem model are found while on contrary EMEP model highly overestimated $\left(\overline{t_{2m}}\right)_d$, and WRF-Chem overestimated $(\overline{ws})_d$.
- The differences in boundary layer dynamics were found in models through the analysis of vertical wind profiles.
- Based on calculated values of Ri_B, the evaluation of modelled $\left(\overline{pblh}\right)_d$ agreed well with the measurements for both models. However, according to the spatial $\left(\overline{pblh}\right)_d$fields, the WRF-Chem model generally tends to estimate lower $\left(\overline{pblh}\right)_d$with respect to the EMEP model over areas affected by high pollution (*DF*> 100%).
- From the results of the simulation of a one-month period that encompassed various meteorological conditions and different terrain types, we found:
  - Strong influence of meteorological conditions on increased background $\left(\overline{PM_{10}}\right)_d$ is found and correct estimation of the $(\overline{ws})_d$ is recognised as one of the main factors in the dispersion of $\left(\overline{PM_{10}}\right)_d$.
  - General underestimation of background $\left(\overline{PM_{10}}\right)_d$concentrations with both models, except with EMEP for mountain stations (slight overestimation).,
  - Statistical analysis with respect to the terrain type shows the best modelling performance of $\left(\overline{PM_{10}}\right)_d$ and meteorology over sea-level stations (flat terrain). Both models tend to agree

in decrease in performance with height, indicating problems in regional model simulations over complex terrain.

- From the analysis of the high pollution episodes, we can conclude following:
  - During the first high pollution episode, a high $(\overline{ws})_d$ in the WRF-Chem model resulted in a decrease in surface $(\overline{PM_{10}})_d$ while favourable conditions prevailed for the build-up of concentration in Central Europe over hotspot areas with a decrease in surface $(\overline{ws})_d$.
  - Low wind speed conditions during the entire second episode, followed by high $(\overline{mslp})_d$ and low $(\overline{pblh})_d$, prevailed over the affected area (*DF* > 100%).
  - Statically stable conditions were recognised as the main mechanism for the build-up of concentrations during the second episode. Both models produced low values of $(\overline{pblh})_d$, (<100m in WRF-Chem and 100 – 200m in EMEP) over areas where stations recorded $(\overline{PM_{10}})_d$ concentrations > 200% (*DF*) with respect to the annual mean (Figs 3 – 4, *SI* Figs S8, S12).
- Underestimation of background $(\overline{PM_{10}})_d$ concentrations with regional models is in accordance with other modelling studies (Gauss et al., 2016; Forkel et al., 2015).
- Reasons for for the underestimation of modelled $(\overline{PM_{10}})_d$ concentrations were attributed to the uncertainty of associated and inadequate treatments of formation processes that usually omit some components of atmospheric aerosols (e.g., SOA, SIA) and thus fail to estimate the total PM budget properly.

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