

**Evaluation of Doppler radar and GTS data Assimilation for NWP Rainfall Prediction of an Extreme Summer Storm in Northern China: from the Hydrological Perspective**

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**Technical Corrections**

**Point 1:** P4 L23-24: ‘...always performed well’ is this really the case or should it be limited to the area you studied?

**Reply:** The sentence is revised as follows in P4 L23-24 and a reference is also added:

*‘...the horizontal grid spacing of the WRF inner domain (Domain 2) was set to 3 km, and the downscaling ratio was set to 1:3, which was commonly used and always performed well in the Beijing-Tianjin-Hebei region of northern China (Liu et al, 2012; Chambon et al, 2014; Tian et al, 2017b).’*

Reference:

Tian, J., Liu, J., Yan, D., Li, C., Chu, Z., and Yu, F.: An assimilation test of Doppler radar reflectivity and radial velocity from different height layers in improving the WRF rainfall forecasts, Atmos. Res., 198, 132-144, doi: 10.1016/j.atmosres.2017.08.004, 2017b.

**Point 2:** P4 L24-25 ‘The large scale topography and ... can be covered by the nested domain...’ I think it’s better to say your settings have been shown to be effective in previous studies in terms of representing ...

**Reply:** The sentence is revised accordingly in P4 L24-26:

*‘The settings of the nested domains have been shown to be effective in previous studies in terms of representing the large scale topography and the main climate characteristics in the study area (Wang et al, 2013; Tian et al, 2017b).’*

**Point 3:** P5 L17 ‘The total water mixing ratio ...’ You seem to try to highlight your choice of using qt but don’t give a proper reason for doing this. Is such choice better/more effective or just a random choice?

**Reply:** The use of the total water mixing ratio is not a random choice, but a fixed setting in WRF-3DVar for the assimilation of the radar reflectivity data. The total water mixing ratio has a more direct relation with the radar reflectivity compared to the pseudo-relative humidity, and has been proven to be effective in WRF-3DVar (Sun and Crook, 1997).

The reason for using the total water mixing ratio as the control variable is restated in P5 L19-23 to

avoid misunderstanding:

*'In the WRF-3DVar system, the total water mixing ratio  $q_t$  was used as the moisture control variable instead of the pseudo-relative humidity when assimilating the radar reflectivity data (Dudhia, 1989). The water mixing ratio has a more direct relation with the radar reflectivity, as described by Eq. (2), which has been proven to be effective in WRF-3DVar as an observation operator to calculate the model-derived radar reflectivity  $Z$  from the rainwater mixing ratio  $q_r$  (Sun and Crook, 1997).'*

$$Z = 43.1 + 17.5 \log(\rho q_r) \quad (2)$$

**Point 4:** P24 Table 1 Column 'Number of the data', please use a more proper/accurate expression. The word 'data' itself is plural and we don't say one data or two data.

**Reply:** The expression is replaced with 'number of observations'.