Dear editor and reviewers,

Please find bellow the main modifications of our manuscript. We would like to thank you again for the time and effort taken to review our manuscript.

Sincerely

Nan YU

Page 1000 Line 14-15

The observed precipitation, air temperature and wind get good agreements with these simulated features.

The observed precipitation, air temperature and wind confirm the cold pool feature in simulation.

Page 1000 Line 16-17

Our study highlights the important role of air mixing with microphysical processes at 1 km scale in simulating such intense precipitations.

The numerical experiment highlights the important role of evaporation process at 1 km scale to create cold pool in simulating such intense precipitation.

Page 1000 Line 23

at kilometric scale

at kilometer scale

Page 1000 Line 25

Past experiences in hydrological modeling have emphasized the need for precise precipitation data (Kobold and Suselj, 2005) in hydrological models.

Past experiences in hydrological modeling have emphasized the need for precise precipitation data in hydrological models (Kobold and Suselj, 2005).

Replacing the sentence on Page 1013 lines 13-14 to Page 1001 Line 27 with modification:

Zhang and Zhang (2012) simulated a MCS along a stationary front with an extension up to 1000 km. (This sentence is replaced to the introduction)

Page 1002 Line 21-22

from 4 km to 500 m, will be used to

from 4 km to 500 m, was used to

Page 1002 Line 24- Page 1003 Line 2

The final objective is to better understand the model behavior at different resolutions and to determine an optimal model configuration to simulate such strong convective precipitations.

The final objective is to investigate the model behavior at different resolutions and to understand the impact of resolution on physical processes in simulations.

Page 1004 Line 17 – line 22

Vertical level spacings near the surface were 50 m to resolve properly turbulence in the boundary layer. Four horizontal grid definitions were tested in this study. The first two simulations at 4 and 2 km grid spacing were carried out within a large domain (D1: 360 km × 360 km, see red rectangle in Fig. 1). With the D1 as the father domain, a nested domain (D2) with finer resolution was then implemented for the 1 km and 500 m runs.

The first vertical grid point was 20m above the ground and the vertical grid length was defined by a logarithmic function. Four horizontal grid definitions (4km, 2km, 1km and 500m) were investigated in this study. First, several configurations of domain size and location were tested. Based on the results and our modeling experience, we selected four configurations to present the impacts of model resolution. The first two simulations at 4 and 2 km grid spacing were carried out within a large domain (D1: 360 km × 360 km, see red rectangle in Fig. 1). With the D1 as father domain, a nested domain (D2: 80 km × 72 km) with finer resolutions ( 1 km or 500 m) was then implemented.

Page 1004 Line 24 – line 26

They were initialized by Aladin-Réunion operational analyses and coupled with them every six hours. The two-way nesting technique was applied for the nested runs (1 km and 500 m).

The Aladin-Réunion operational analyses at 8 km resolution were used to initialize the simulations and update the boundary conditions every six hours. The two- way nesting technique (Stein et al., 2000) was applied for the nested runs (1 km and 500 m).

Page 1005 Line 10 adding

Detailed studies about the turbulence and kinetic energy spectra as a function of resolution were carried out by Honnert et al. (2011) and Ricard et al. (2013).

Page 1008 Line 8 – line 11

The statistical criteria which reflect the inherent variability of rainfall exhibit the similar behavior as numerical simulations. Growth of temporal resolution of rain field degrades rapidly the correlations of persistence model and increases the CVRMSD.

The reference scores reflecting the inherent variability of rainfall exhibit the similar behaviors as numerical simulations. High CVRMSD value and low correlation coefficient for the 6 h precipitation suggest the large spatial and temporal variability in such observed rainfall.

Page 1008 Line 25- line 28

The previous evaluation was based on the bulk information of rain spatial distribution. Observations at all raingauge stations were used together to yield a global performance score for the entire rain field.

The previous evaluation was mainly based on the information of the space-averaged rain intensity. Observations at all raingauge stations were used together to yield a global performance score for the entire rain field.

Page 1009 line 8

The 20 % of gauge stations record a daily rainfall greater than 200 mm day,

20 % of the stations records are greater than 200 mm day,

Page 1009 line 14

for the 2 km and 1 km simulations

for the 4 km and 2 km simulations

Page 1009 Line 19 – Line 21

Figure 9 shows the ratios of 4 day rain simulation to observation at each raingauge station, as a function of its altitude and affiliated zone (see the definition of these areas in Fig. 2b).

The simulated and measured precipitation during the 4 days for each raingauge is calculated. The ratio of simulation to observation is showed, in Figure 9, as a function of the altitude and affiliated zone of raingauge (see the definition of these zones in Fig. 2b).

Page 1011 Line 4-7

Regarding the local circulation, the 10 m wind in the 1 km run exhibits a land breeze behavior after 12:00 UTC and it is in good agreement with the observations (Fig. 12b), even if the direction of the wind in the morning is still difficult to be accurately simulated by the models.

Regarding the local circulation, the 10 m wind in the 1 km run exhibits a land breeze behavior after 12:00 UTC, which close to the observations (Fig. 12b), even if the direction of the wind in the morning is difficult to capture by the models.

Page 1011 Line 17-19

Interestingly, decreasing the grid spacing to 1 km without evaporation process misses all the features of the cool pool.

It is remarkable that the simulation at 1 km resolution without evaporation process misses the cold pool phenomenon.

Page 1011 Line 20-22

These results suggest that the air mixing at 1 km scale is essential to well simulate the cooling process caused by evaporation.

These results suggest that the microphysical process at 1 km scale is important to well simulate the cooling process caused by evaporation.

Page 1011 line 26-28

The deep convection triggered by the cold pool through thermal lifting and convergence seems to enforce the cloud formation so as to reduce again the short wave radiation over the coastal area. Figure 14 shows the simulated short-wave radiation arriving on surface 5 at 12:00 UTC on 30 January for the 2 km, 1 km and 1 km without evaporation runs.

The deep convection triggered by the cold pool through thermal lifting and convergence enforces the cloud formation near the coast. The short wave radiation during daytime is further reduced by the cloud. Figure 14 shows the simulated short-wave radiation arriving on surface at 12:00 UTC on 30 January for the 2 km, 1 km and 1 km without evaporation runs.

Page 1012 line 23-26

This may be due to the density of the raingauge network that is not enough to distinguish fine difference. The improved radar rainfall estimation, with advanced statistical method, such as the near-neighbors approach (Roberts and Lean, 2008), or a wavelet decomposition approach (Casati et al., 2004; Bousquet et al., 2006), will be needed for the assessment in the future.

Rainfall observation at higher resolution is necessary to evaluate these simulations. The radar quantitative precipitation estimation using advanced statistical method, such as the near-neighbors approach (Roberts and Lean, 2008), or a wavelet decomposition approach (Casati et al., 2004; Bousquet et al., 2006), will be needed for the assessment in the future.

Page 1012 lines 27-28

The physical mechanism reproduced in the 1 km and 500 m simulations has been investigated.

The physical mechanism represented by the higher but not with the lower resolutions has been investigated.

Page 1013 lines 6-9

The coarse resolution simulations (4 km and 2 km) can not simulate correctly this mechanism: the moist air from the ocean enters the island and convection is triggered by orographic lifting. As a result, their simulation of extreme rain position is totally failed.

However, with the coarse resolution simulations (4 km and 2 km), the moist air from ocean reach the interior of island and convection is only triggered by orographic lifting. As a result, their simulation of extreme rain position failed.

Page 1013 lines 15-16

The impact of 1 km grid spacing under other weather systems (such as tropical cyclones) on precipitation for such tropical island should be investigated in the future.

The high-resolution model behaviors under other weather regimes (such as tropical cyclone) at La Rénion island will be studied in the future.

Page 1014 adding

Honnert R., Masson V., and Couvreux F.: A Diagnostic for Evaluating the Representation of Turbulence in Atmospheric Models at the Kilometric Scale. J. Atmos. Sci., 68, 3112–3131, 2011.

Ricard, D., Lac, C., Riette, S., Legrand, R. and Mary, A.: Kinetic energy spectra characteristics of two convection-permitting limited-area models AROME and Meso-NH. Q.J.R. Meteorol. Soc., 139: 1327–1341, 2013.

Page 1018 Table 1

We added the configurations of the turbulences in the table

Page 1019 Figure 1

We completed the units for wind and pressure.