(I) Major comments:

1) There is some mention of a finer scale model producing less rain, so is the authors' goal to understand why that fine-scale run delivered far less rain than was observed? If so then they need to tell us more about the prior run and defend why a 10 km horizontal scale should be viewed as a more accurate depiction of the event. Are there differences in the boundary conditions/ initialization procedure that mattered?

R: The goal of our paper is to understand why this typhoon can dump such a high rainfall amount over southern Taiwan that has never seen before. The purpose of other studies (e.g. Ge. et al. 2010) such as why delivered far less rain than observation is not the concern of this paper. It may due to the difference in simulation strategies and initial conditions between our study and the model of Ge et al. (2010).

In this revision, we dropped the simulation result of 10 km resolution and further conducted a fine-scale simulation and explore the reason why the mesoscale processes leading to this continuous heavy rainfall in detail in section 4.(Page 13-23)

2) At horizontal scales of 10 km the model cannot resolve convective scale motions. This is a dangerous scale to choose because it falls in a region where most cumulus parameterizations were not designed for, and the scale also fails miserably for the typical updrafts and downdrafts associated with convective clouds. I note that the authors do not present any views of the typhoon. I wonder if the model produces realistic rainbands, an eyewall and reasonable vertical structure.

R: We couldn't agree the reviewer's comments more, so we have conducted a fine-scale numerical simulation in this revision. Allow me to stress that major focus of our paper are on the detail mesoscale processes. From the fine-scale numerical simulation, we have found that not only did the convergence itself provided the cause of the heavy rainfall when it interacted with the topography, but also there is an existence of the convective cells within the Typhoon's main rainband. The convective cells were in the form of small rainbands perpendicular to the main one, and propagated as vortex Rossby waves downwind. As the main rainband moved northward and reached the southern Central Mountain Range, convective cells inside the narrow convergence zone to the south and those to the north as a part of the vortex Rossby waves, both rained heavily as they were lifted by the west-facing

3) Seems like an important part of the story is the role of the large scale and specifically the SW monsoon flow, but there is only Fig. 3c that shows the large scale evolving flow. This is for only one level and does not show the earlier set-up for the heavy rains. There are no figures showing the environmental water vapor conditions. Are there no soundings available to show evolving moisture conditions? The phrase "high moisture content" isn't really that useful (the SW monsoon generally has high moisture content)

R: To present the environmental water vapor condition, we further provided the environmental water vapor conditions in this revision as below. As one might see that this Sounding at 00 Z 06 August showed the high moisture content in the low troposphere . At this time, the center of typhoon Morakot is still far away (about 800 km) from Taiwan (Figure 1)
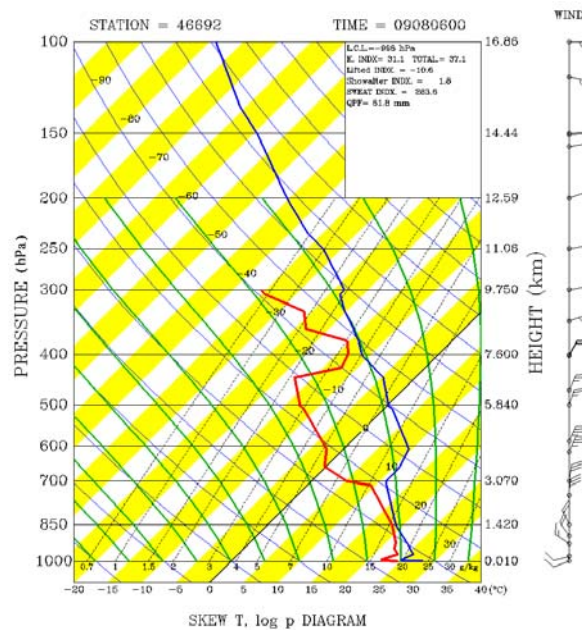
4) The authors seem to stress the rain at one point too much. Comparing a point value for two numerical simulations is not a good test. This single point measurement focus is continued in Table 1. I suspect that the maximum value is controlled by the fi ne-scale topography (A-Li Shan sets most of the records) and I'll bet neither model really captures that very well. A good comparison would include rain rates over the period of interest and region of interest. If the fine-scale model simply produced a stronger convective cell in a different location then one could imagine that large

differences would arise.

R: **We agree the reviewer's comment that topography plays an important role for location of the maximum rainfall occurrence. As replied in Q2, our purpose is to understand the mesoscale processes of the unprecedented heavy rainfall occurred over western plain. We agree that the coarse resolution of this study (10 km) might not reproduce well for the peak rainfall over the mountain. As response in Q1, we have dropped the 10 km simulation and replaced with the fine-resolution to response the gaps.**

More importantly, we would like to emphasis that the heavy rainfall start earlier from southern Taiwan (less than 22 N) (Fig 1c and Figs. 4c-e) and then occurred in the center Taiwan (which near A-Li Shan mountain station, 23.5 N, 120.8 E). Even the elevation of the mountain less than 1000 meters also can dump more than 2000 m and destroy the Xiaolin villiage. This is not an un-usual path but there are significant different mechanisms between the previous typhoons and Morakot which is the major purpose of this paper.

5) Model discussion is a little too brief. The authors do not mention exactly when the model was started, its domain, if the typhoon structure was bogussed in and how if it was. There is no discussion of the initial typhoon structure (rainbands and eyewall, typhoon size, wind field) that would be highly relevant to the issues at hand. The ice physics of the model, surface fluxes and tuning parameters such as horizontal diffusion are not mentioned. I wouldn't be a bit surprised to see that the model got some approximate answers simply by dumb luck, or by tuning to the desired results. Were there any sensitivity tests conducted? Can the model be used to isolate rain from the monsoon-typhoon convergence from the orographic lifting? What does the terrain in the model look like compared to the actual terrain?

R: **Actually, we have presented the model configure in original paper (ACPD, page 13499) Our control simulation started from 0000 UTC 06 Aug. and run for 96 hrs (ACPD paper, Page 13504, line18-19). We have also provided the model domains and the parameters we used for the boundary layer scheme (YSU scheme), microphysics scheme (WSM-5 class scheme), in the control run simulation (ACPD paper, Page 13499, line 12-21). To ensure that this event was well simulated, the four-dimensional data assimilation (FDDA) scheme was activated based on the NCEP-GFS analysis data.**

Boguess is a common scheme to simulate typhoon in order to improve the intensity and path (Kwon and Cheong, 2009). However, the FDDA method, we used, already can capture the large scale weather patterns, typhoon path (as

below, Red: best track, Green: simulation) and intensity well. Therefore, we do not think it is necessary for us to consider bogus scheme in our simulation study. Our sensitivity tests prove that the FDDA scheme could improve the simulation typhoon track. We will discuss a series sensitivity test in the separate paper. Here we provide 3 km resolution of the terrain in the model (right) and the actual terrain by USGS 1 km resolution (left).
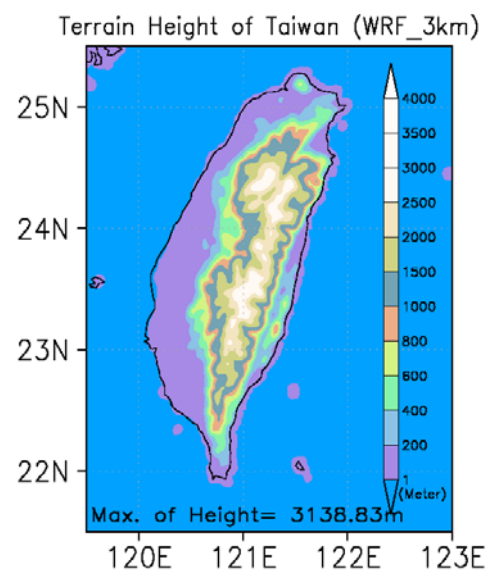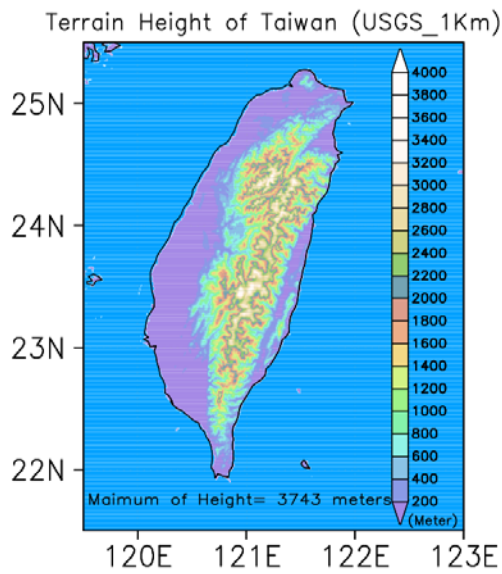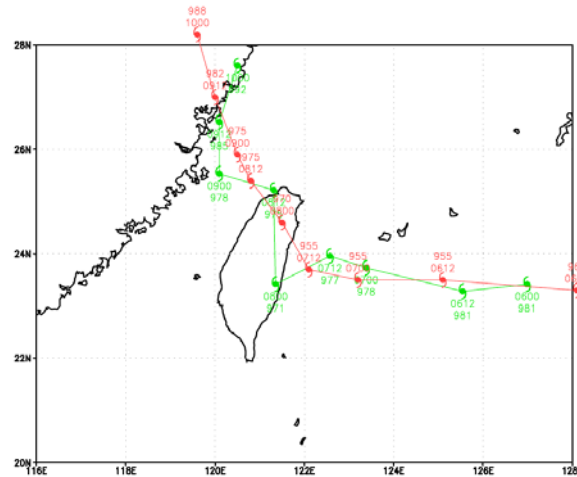
(II) Minor comments:
1. **page 13496,**
   line 8: delete highly moist and tell us the specific humidity or mixing ratio for a layer or layers " line 15: don't start a sentence with a number not written out, line 17: change…the 5-day period …to ….over 5 days

   R: Text has been amended (Page1 Line 6-7 and Page2, Line 2 and 4)

2. Page 13497, 2: ...with a strong southwesterly.... ", 3: generates to generated ", 9:

terrain (no s) ", 19 and 20: damage (no s), though the use of the plural is now more of an editorial call ", 28: circulation (no s)

   R: Text has been amended (Page 3, L 8-9, L16)

3. **page 13498,** 3: In addition....this sentence repeats claim on prior page, collect references and state once ", 17: delete more ", 19: ....the most important and direct process.... Change....to the most important factor.... ", 23: ...joined the system... reword ",

   R: Text has been amended (Page 4, L7-13)

   line 18: did the runs by Ge et al. have the same initial conditions? Are you using a cumulus parameterization scheme that he didn't need? "

   R: There are couple different initial conditions usedbetween our study and Ge. First, our model started from 0000 UTC 06 Aug while Ge's study started from 1200UTC 05 Aug. Second,we do not use cumulus parameterization scheme (Page 5, L16) but Ge applied cumulus parameterization at coarse domain. Third, we use FDDA to include the large scale information while Ge with bogus in the model simulation.

Page 13499: line 6: ...at a 6 h interval. ", 9: dynamically consistent ",

   R: Text has been amended.(Page 5 L5 and 7)

   line 20: The event might not be well simulated simply because of model inadequacies, which has nothing to do with the use of the NCEP-GFS input.

   R: The four-dimensional data assimilation scheme was activated to make sure the large scale information has been included. For example, the track would not well simulate if FDDA excludedn the 10 km simulation. (Red: best track, Green: FDDA not turn on)
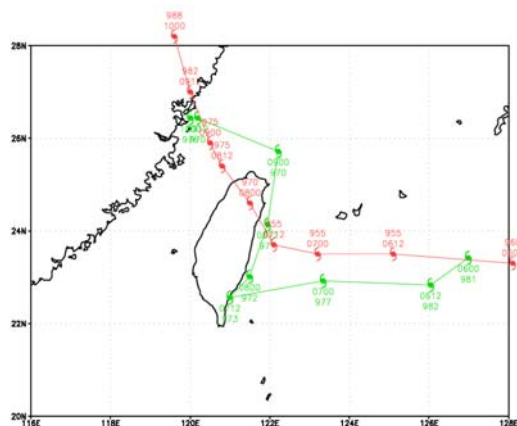
Page 13500,

Line:3: ...it quickly was downgraded (people grade storms) ", 4: incoherent structure? The following sentence you describe structure that is coherent ",line8: comment in parentheses is unclear, then following phrase needs a rewrite, too. 13: ...was limited to... ", 14:...the South China .... ", 18: ...the extent south? Rewrite please ", 25: northerlies....while southerlies dominated the southern half of the island. (or CMR?) ", 29:...pouring down in a narrow N-S belt (about 50 km x 25 km) over the mountains

R: Text has been amended. (Page 6,L10- 16)

Line12:   impinged? Does this mean the eye made landfall? Clarify please. ",

R: Text has been amended. ➔ before Morakot's circulation first impinged upon (Page 7, L1)

Page 13501,

Line 6: high moisture content would be better described using specific values of mixing ratio or specific humidity over a given layer or layers "
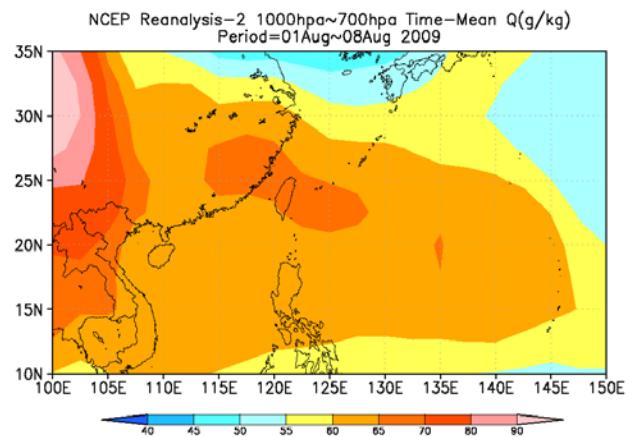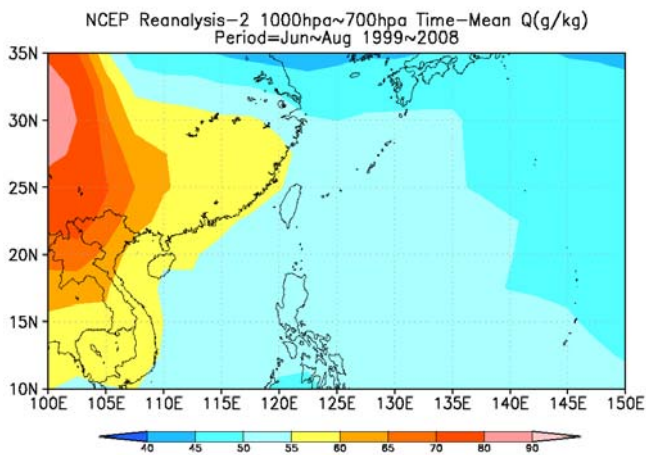
R: Text has been amended (Page 8, L4-5).

Line 11: why does the zonal flux include the meridional wind component? "

R: In our original article is " Zonal mean" not " Zonal flux".   (ACPD, Page 13501, line 11)

Line 23: Total vapor flux would simply be reported as Kg s-1 for vapor flux through the surface of interest. The authors could report the total vapor flux for their approximately 200,000 m x 3000 m surface, and I suspect they would have values of   2. 0x108kg s-1 (for about 20 m/s flow with a mean q of 15 -18 g/kg). The units they use appear to be in the kinematic form by dividing by the density of moist air but they expressed it in units that aren't quite mks. Suggest a sentence or two of clarification here. They might mention what is a typical vapor flux for monsoon flow which would place the Morokat values in a context. It might be on the order of .4 x 108 kg s-1. Now what is the change in the mean q through the 3000 m depth of interest for Morokat versus the typical SW monsoon flow?

R: Here we compared horizontal distribution of the mean q which deduced from NCEP reanalysis-2 data set between the long-term average (from 1999 to 2008) and the early August of 2009. Form the sum of the mean q in the three levels (1000, 850, and 700 hPa) clearly indicated that the mean q in the early August 2009 significant greater than the climatology value during the summer monsoon.

NCEP Reanalysis-2 1000hpa~700hpa Time-Mean Q(g/kg) Period=Jun~Aug 1999~2008 / NCEP Reanalysis-2 1000hpa~700hpa Time-Mean Q(g/kg) Period=01Aug~08Aug 2009

Page 13502, **line** 2: ...accumulation....delete amount (redundancy) ", 13: so is the convergence of the flows crucial or is the lifting along the CMR? Seems like you could express this more clearly. In the early stages the convergence between the typhoon's flow from the north and the SW monsoon yielded heavy rain; later the rain was produced more from the convergence along the CMR?

R: Text has been amended. Page (Page 10, L3-6)

Page 13503, **line :** 6: farther instead of further ", 15: The red...the color codes for the fig. belong in the caption, and the sentence needs editing ", 21: deeper instead of higher? ", 25: directly averaged means what?The red...the color codes for the fig. belong in the caption, and the sentence needs editing

R: Text has been amended (Page11, L4,L16,)

Page 13504, **Line** 10: ....gradual increase.....delete toward ", 15: ...are presented next. ", 25: resolution (no s)25: resolution (no s). What is the actual observation resolution of the NCEP GFS?

R: Text has been amended (Page 12). The resolution of NCEP GFS data set is 0.5 degree.   Here is the detail actual observation resolution by NCEP GFS web site. http://nomads.ncep.noaa.gov/

Figure captions:

Fig. 1b. reword caption to 426 rain gage stations... also topographic height...black dashed rectangle convert area means what? Fig. 1e: delete amount ..... rewrite as.... simulation of the accumulated rainfall

R: Text has been amended in this figure caption.

Fig. 3: cannot read the upper right yellow print, presumably the radars that are used for the composite. Is radar a composite of a single time? Vertical maximum radar

reflectivity means what? Radar shows that location of rainbands would be important in the simulation. Fig. 3b. Authors do not use the satellite picture to make any point – consider deleting. Fig. 3c. Moisture flux derived from the GFS – how is this field produced given that there are few obs in the typhoon? GFS view of Typhoon Morakot seems unrealistic with the eyewall too far from center or not resolved at all. This is horizontal moisture flux and should be stated as such. Where it rapidly decreases is where the rain should be...well, is it? Based on the three pictures it doesn't look like it.

R: (a) (b) This figure is the composite of the maximum radar reflectivity in a volume. (c) .Moisture flux is the result of q*V, and is different from the rainfall only. (d) The satellite images (Figure 3b) are the other way to show the variation of the typhoon structure to response the other reviewer's concern

Fig. 4. Repeated the wind scale and color scale three times! Fig. 4a isn't depicting just the zonal mean, looks like the total horizontal flux. Fig. 4d,e: delete – they add nothing to the story. Fig. 5. Could shorten the caption considerably by reorganizing it. Convergence itself is ok without wind. Not surprised that the model is close to the GFS given that the GFS is used as an initial condition. Units should be 10-6.

R: Our intention is to qualitatively describe the different moisture flux transport between northern and southern Taiwan in the figures 4d and e. It clearly showed the moisture flux blocking by the mountain in the southern Taiwan. Text has been amended in Figure caption 4 and 5.