Review of

Idealized Simulations of Mei-Yu Rainfall in Taiwan under uniform Southwesterly Flow Using a Cloud-Resolving Model

By Wang et al.

The authors used a cloud-resolving model to investigate the role of the complex topography in Taiwan on rainfall characteristics during the Mei-Yu season without the influence of fronts or disturbances. They initialize the model using horizontally uniform flow without vertical shear with different wind speeds and directions. They characterized their rainfall regimes based on the wet Froude number (*Frw*). For the low-*Frw* regime, rainfall production is dominated by thermal forcing from the surface, whereas for the high *Frw* regime, the mechanical uplift of unstable air becomes important. Between these two regimes, the mixed regime exists for intermediate *Frw* number. They also compare their model results with real cases in Section 5. The manuscript is fairly well written. However, there are significant major concerns the authors will need to address before this work can be accepted for publication.

1. This study is lacking well-defined scientific objectives. It is well-known that under weak wind conditions, thermally driven diurnal circulations are important, whereas under strong wind conditions with a large impinging angle, mechanical uplift becomes significant. What is new?

2. The Froude number has been used to classify flow regimes (flow over vs blocked flow regimes) for airflow over an isolated mountain by many authors. Compared with classical theoretical studies, that use a bell-shaped mountain, this study uses the real-terrain of Taiwan. However, the results from a series of numerical experiments in this study simply confirm this well known fact.

3. The authors fail to state the theoretical basis or hypothesis to invoke Froude number theory for the rainfall regimes.

4. In Section 5, the authors attempt to compare their model simulations initialized by a single upstream sounding to real cases of heavy rainfall events during the Mei-Yu season over Taiwan. This is simple minded. Heavy rainfall events in many different parts of the world are related to synoptic and mesoscale processes in addition to orographic effects (G. Chen 1983, JMSJ; Doswell, 1987, WAF; Doswell et al., 1996, WAF; Maddox et al., 1979, BAMS; and many others). Without including these processes in the models, it is unlikely that numerical simulations initialized by a single sounding will be able to simulate these events.

5. The authors state that the wet *Fr* number is very close to the *Fr* number. Thus, in terms of flow regimes, the moisture is not important. However, for heavy rainfall events, moisture availability is a significant parameter for rainfall production and may be more important than the variations in the Froude number for $Fr < 1$.

6. The upstream sounding used is horizontally uniform with very little vertical wind shear below the 500-hPa level. Is this a typical sounding for heavy rainfall events over Taiwan? Do soundings in the warm sector of Mei-Yu systems exhibit clockwise turning with respect to height due to warm advection?

7. Except in the lowest levels, the thermodynamic profiles used seem rather dry. Is this typical for the heavy rainfall soundings during the Mei-Yu season over Taiwan?

8. The authors use observed SST as the lower boundary condition over the open ocean. The reviewer presumes there are spatial variations in SST in this region. How would the spatial variations in SST affect the horizontal distributions of thermodynamic fields in the mixed layer and the depth of the mixed layer? Are those being considered in the model initial conditions?

9. Each simulation was run for 50 hours and the first two hours are considered as the model spin up period. How is the initial spin up period determined?

10. To address the effects of thermal forcing from the land surface, it is imperative to describe the lower boundary conditions over land used in the model. The authors should also compare the simulated diurnal variations in temperature, winds and rainfall with observations very carefully. Fig. 4 shows simulated rainfall on the eastern leeside in the afternoon hours which is odd. It fails to show the effects of orographic uplift on rainfall production.

11. Areal averaged rainfall shown in Fig. 6 is inadequate. There must be large spatial variations in rainfall throughout the diurnal cycle. What are the days used for observations (gray curve) in Fig. 6? How often do you observe southwesterly winds > 20 m s^{-1}?

Minor points:

1. The figure caption for Fig. 2b is very confusion.

2. Figure 4: Should provide information on local time. The authors should also adjust the color table.