Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2017-332-RC2, 2017

Atmospheric Chemistry and Physics Discussions

ACPD

Interactive comment

Interactive comment on "The influence of sea- and land-breeze circulations on the diurnal variability of precipitation over a tropical island" *by* Lei Zhu et al.

Anonymous Referee #2

Received and published: 5 June 2017

The present study investigates the diurnal variation of precipitation over Hainan, an island in South China Sea. The authors document the rainfall climatology over Hainan using long-time observational records from gauge and satellite (CMORPH), and manage to show convincingly that dynamical and physical processes on the diurnal time scale are the primarily contributor to rain climatology. Mechanisms of diurnal rainfall are examined using a set of well-designed cloud-permitting numerical simulations driven by the ERA-interim reanalysis data. Results from these numerical experiments indicate that precipitation diurnal cycle is mostly due to land-sea breeze, whereas the island orography is of secondary importance. These diagnosis and modeling results are new and deserved to be published. The manuscript is overall well structured and

Printer-friendly version

Discussion paper

presented. I recommend minor revision for publication in ACP.

Major comments:

1. A numerical sensitivity experiment (FakeDry) is used to demonstrate the impact of cold pool on the sea breeze. In this FakeDry run, all latent heating and cooling is turned off. This prevents both diabatic feedback from the latent heat of condensation in the whole troposphere and cold pool due to rain reevaporation in the lowest 1-2 km. Both can be responsible for the difference between FackDry and the control run. So, conclusions (e.g., line 28-29, Line 446-449) from this FakeDry experiment regarding the role of cold pool may be revised. Otherwise, another experiment turning off rain re-evaporation in the lowest 1-2 km may be conducted to further clarify the exclusive roles of cold pool versus diabatic heating throughout the troposphere.

Specific comments:

Line 45: it is stated that “precipitation is usually due to convection”. What else could rain come from other than convection?

Line 101: “full” records?

Lines 112-113: What are the surface boundary conditions? Is surface temperature predicted over both land and sea, or just predicted over land? What is the scheme for land processes?

Lines 178-179: it is stated that “The precipitation is extremely light in March and somewhat heavy in September”. This statement needs some corroborating evidence, as none of the figures shows diagnostics of precipitation intensity.

Line 208: as -> at?

Lines 245-246, 328-330: Here surface temperature decrease is attributed to precipitation and cold pool. From the surface energy budget point of view, surface temperature is controlled by a range of processes: surface heat fluxes, both shortwave and longwave radiative processes, diffusion in the soil, etc. It is at least equally likely that decrease of surface temperature may be attributed to decreases of incoming solar heating and persistent longwave cooling.

Lines 393-394: Here the discussion of cold pool may be revised since the role of diabatic heating in the whole troposphere may also be important.

Lines 398-399: It is stated that the land sea breeze circulations “are confined to lower levels owing to weaker vertical motion”. Any evidence to support this statement of causality?

Lines 425: Some discussion may be needed to justify using cyclic boundary conditions since none of the flow or surface boundary condition (SST) are cyclic in the horizontal.

Lines 450-455: Model resolution may be a convenient culprit responsible for the 1-hour delay of the rainfall (which in my opinion should be not a concern). On the other hand, there can be many other factors causing this delay, for example, biases in ECMWF reanalysis data used for boundary conditions to drive the numerical simulations, biases in physical processes (microphysics, surface processes, radiative process, etc.). It is difficult to rule out these possibilities.

Figures 14,15,18, and 19: It makes more sense to label the horizontal axis with kilometers instead of grid points.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2017-332, 2017.