







Shamekh et al (2019)

## The impact of ocean temperature anomalies on the aggregation of deep convective clouds

S. Shamekh, C. Muller, J-P. Duvel, F. D'Andrea

LMD, ENS

• Convective clouds can sometimes spontaneously aggregate and form large clusters in high-resolution cloud-resolving simulations (Wing et al 2017). The aggregation of convective clouds significantly changes the water vapor profile, precipitation pattern and the mean radiative cooling of the domain.

• The interaction between convective clouds and sea surface temperature (SST) potentially impacts the formation and evolution of aggregation of convective clouds. Here we investigate the impact of long lasting ocean warm anomalies (such ocean warm eddies, islands) that we refer to as hot-spot and the impact of an interactive SST on the (self-)aggregation.

• We use the System for Atmospheric Modeling (SAM, Khairoutdinov and randall 2003) to perform 3D RCE simulations. A hot-spot is represented by a circular area with temporally and spatially fixed SST anomaly at the center of the domain. An interactive SST is produced by a slab ocean with a fixed mean SST.



- Self-aggregation proceeds by appearance and expansion of dry regions
- long wave radiative cooling at surface (LWNS)
- At its early stage, dryness leads to a warm SST anomaly. • With further dryness, surface latent heat flux (LHF) and increases.
- With enhanced LHF and LWNS the center of dry region cools.
- With cooling at the center, a ring of warm water forms around the cold center that enhances the up-gradient transport of moisture.
- The enhanced up-gradient transport of moisture accelerates the aggregation.

## Shallow Circulation and the speed of aggregation • Shallow circulation is stronger for faster aggregating simulations.

- The interactive SST opposes at first, and then favors, the formation of shallow circulation.
- The radiative cooling of the boundary layer outside convective region also impacts the shallow circulation, (consistent with the theoretical prediction of Naumann et al, 2017)



## The impact of slab depth on the aggregation speed • An interactive SST delays the self-aggregation. • The self-aggregation is slower with shallower slab (.consistent with Hohenegger&Stevens,2016, and with Coppin&Bony,2017) • The delay is longer at lower SST.

## The impact of dryness