Overview of the JPL SCM

Team: **Mikael Witte**, Kay Suselj*, Marcin Kurowski, Mark Smalley, Maria Chinita, Ian Glenn, Rachel Storer, Marcin Witek

Group lead: Joao Teixeira

* = lead developer

Summary

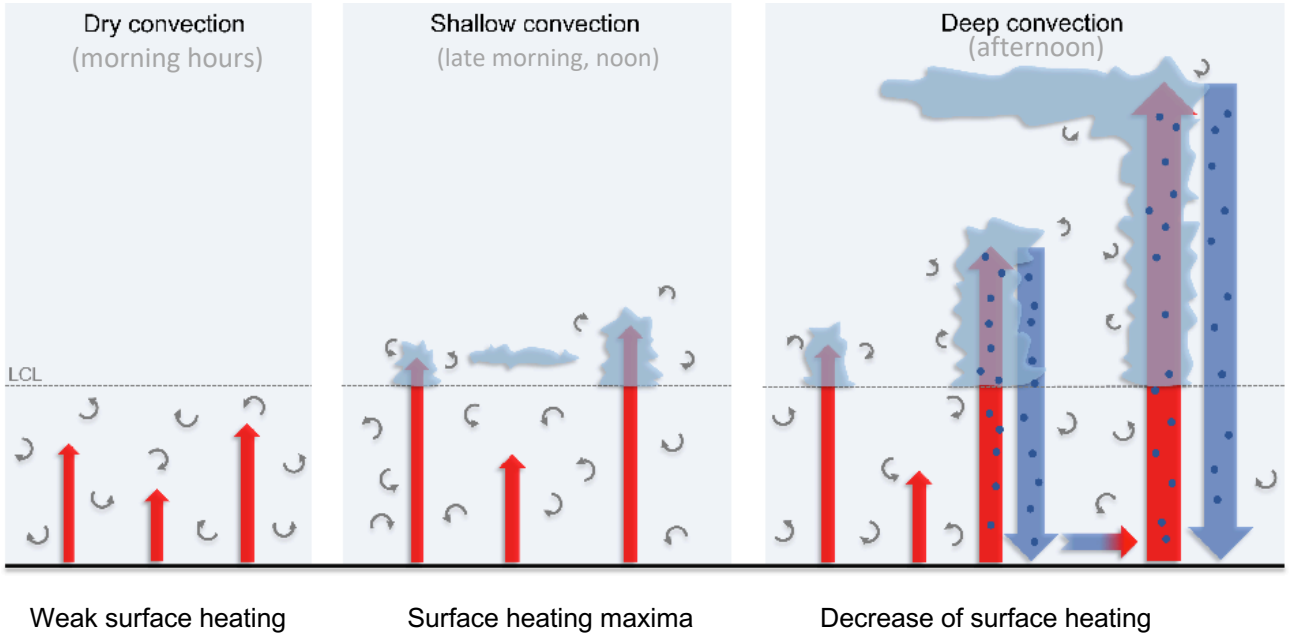
- Primary use of JPL SCM: development and evaluation of JPL eddy-diffusivity/mass-flux (EDMF) unified convection parameterization

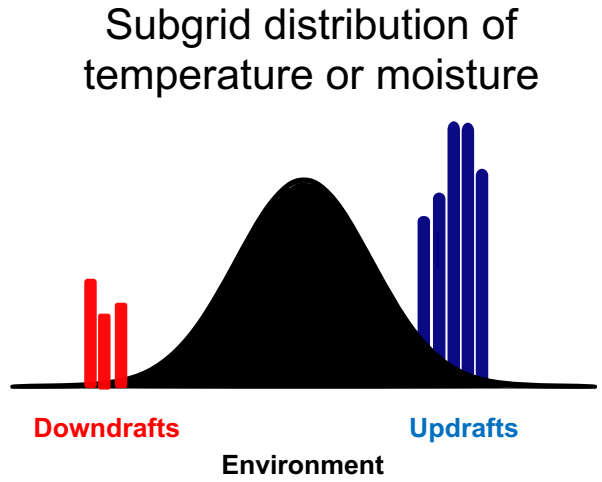
- Implemented in MATLAB; **NOT** associated with any specific 3D model
  - I/O in .mat format by default, but can easily interface with netCDF (i.e. already done for reanalysis forcing)
  - We also work on multiple Fortran-based implementations in external AGCMs (DOE, NCAR, GFDL, NASA GMAO, etc.) and associated SCMs

- Increasing focus on “routine simulation” paradigm for model development using reanalysis to force SCM

JPL EDMF parameterization

Representation of diurnal cycle of continental convection



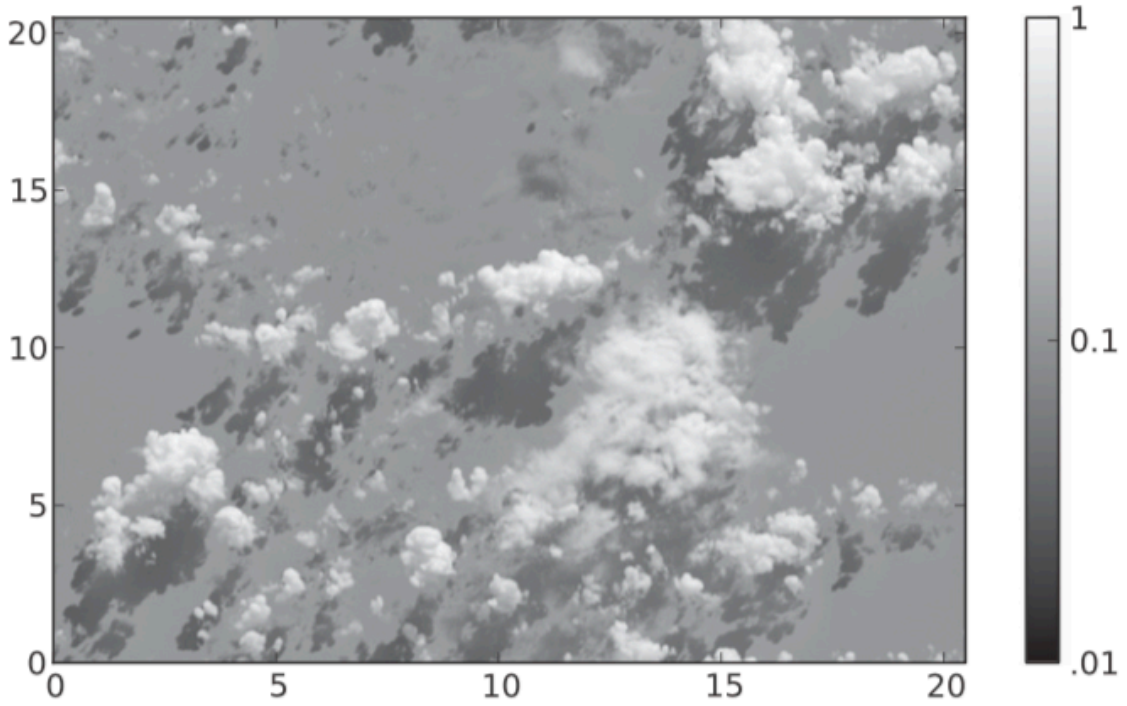


- All parameterized processes use common assumptions for subgrid-scale variability
- Different types of convection coexist in the same vertical column via multiple plumes
- Enables a continuous transition between convective regimes (across spatial and temporal dimensions)

Details: Suselj et al., (2012,2013,2019a,2019b,2020)

Example cloud fields from JPL/UConn LES

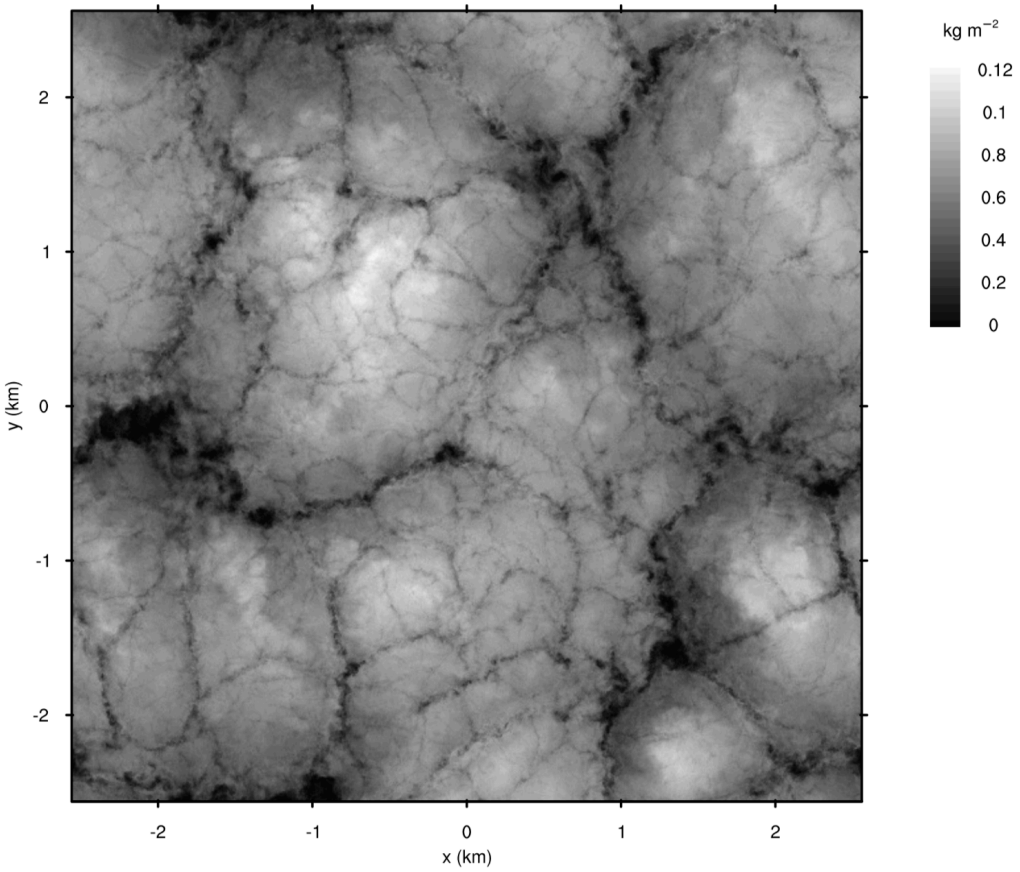
Grid convergence with stretched vortex SGS model



RICO

Matheou et al. (2014)

Ultra-high res output: dx=1.25 m



DYCOMS-II RF01

Matheou and Teixeira (2018)

LES cases simulated at JPL (all available in SCM):

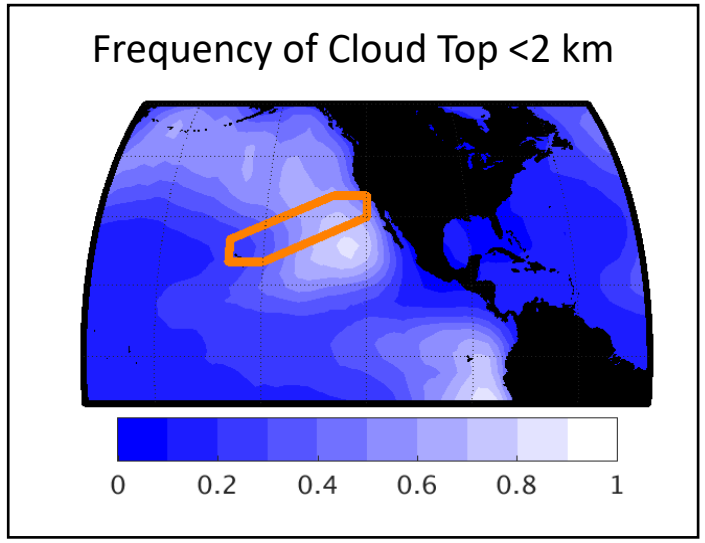
Experiment	Type	References
ASTEX	Sc to Cu transition	Chung et al. (2012)
GABLS1	Stable boundary layer	Matheou et al. (2014)
BOMEX	Shallow non-precip Cu	Matheou et al. (2014), Suselj et al. (2014), Chinita et al. (2018), Suselj et al. (2019)
RICO	Shallow precipitating Cu	Matheou et al. (2014), Suselj et al. (2019)
DYCOMS-II	Stratocumulus (both RF01 & RF02)	Matheou et al. (2014), Chinita et al. (2018) – both RF01
DRY	Free convection	Matheou et al. (2014), Suselj et al. (2014), Chinita et al. (2018)
ARMCU	Diurnal cycle of shallow Cu	Suselj et al. (2012), Kurowski et al. (2019)
LBA	Shallow-to-deep convection transition	Kurowski et al. (2019), Suselj et al. (2019)
GATE	Convective-radiative equilibrium	

Global Reanalyses Force JPL SCM with Evaluation from Co-located Satellites

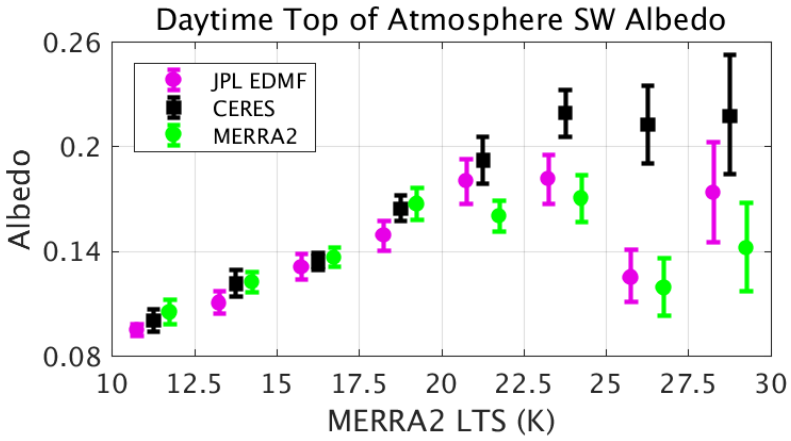
Mark Smalley[1,2], Kay Suselj[2], Matthew Lebsock[2], Joao Teixeira[2]

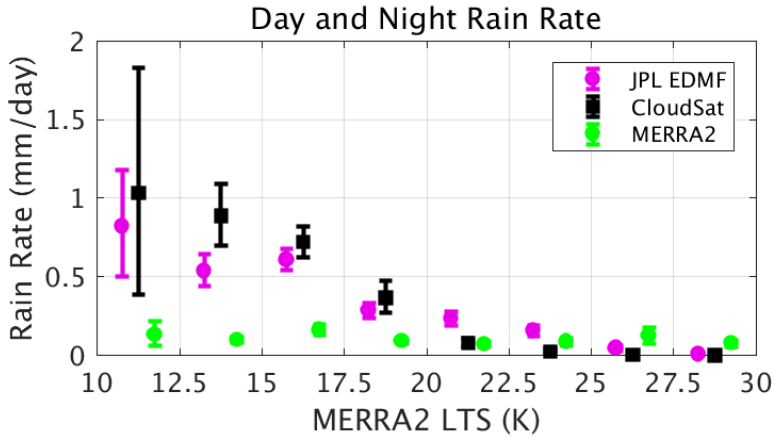
[1]UCLA JIFRESSE, [2]NASA JPL

- Simulation cases chosen such that NASA A-train satellite constellation passes over at the end of each simulation
- Flexibility in location/time reduces issues of selection bias and lack of representativeness that plague studies using traditional idealized/smoothed case study profiles
- This framework encourages detailed model evaluation along a continuum of realizable meteorological conditions



e.g. Simulations of ~2000 unique cases in cloud transition region (orange) between Los Angeles and Honolulu





Smalley et al. (2019; *MWR* DOI: 10.1175/MWR-D-18-0394.1)