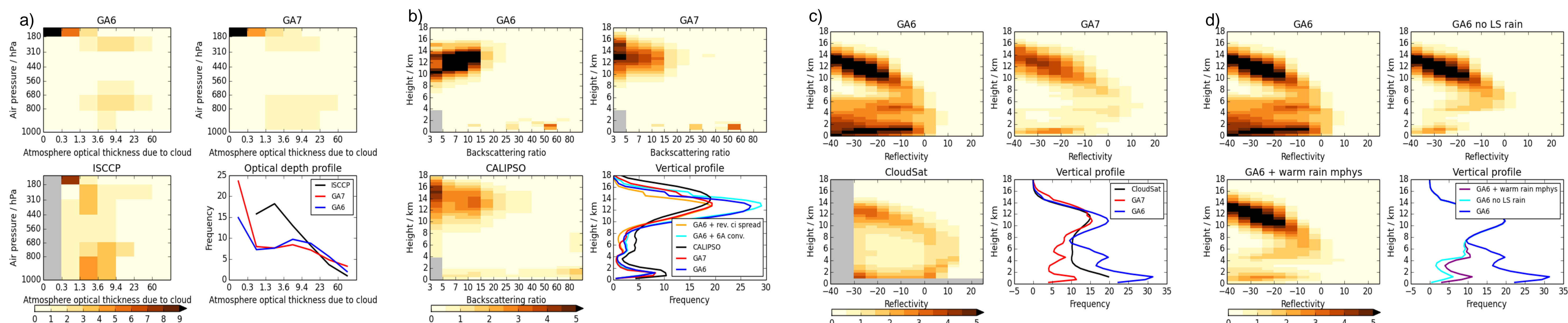


Met Office

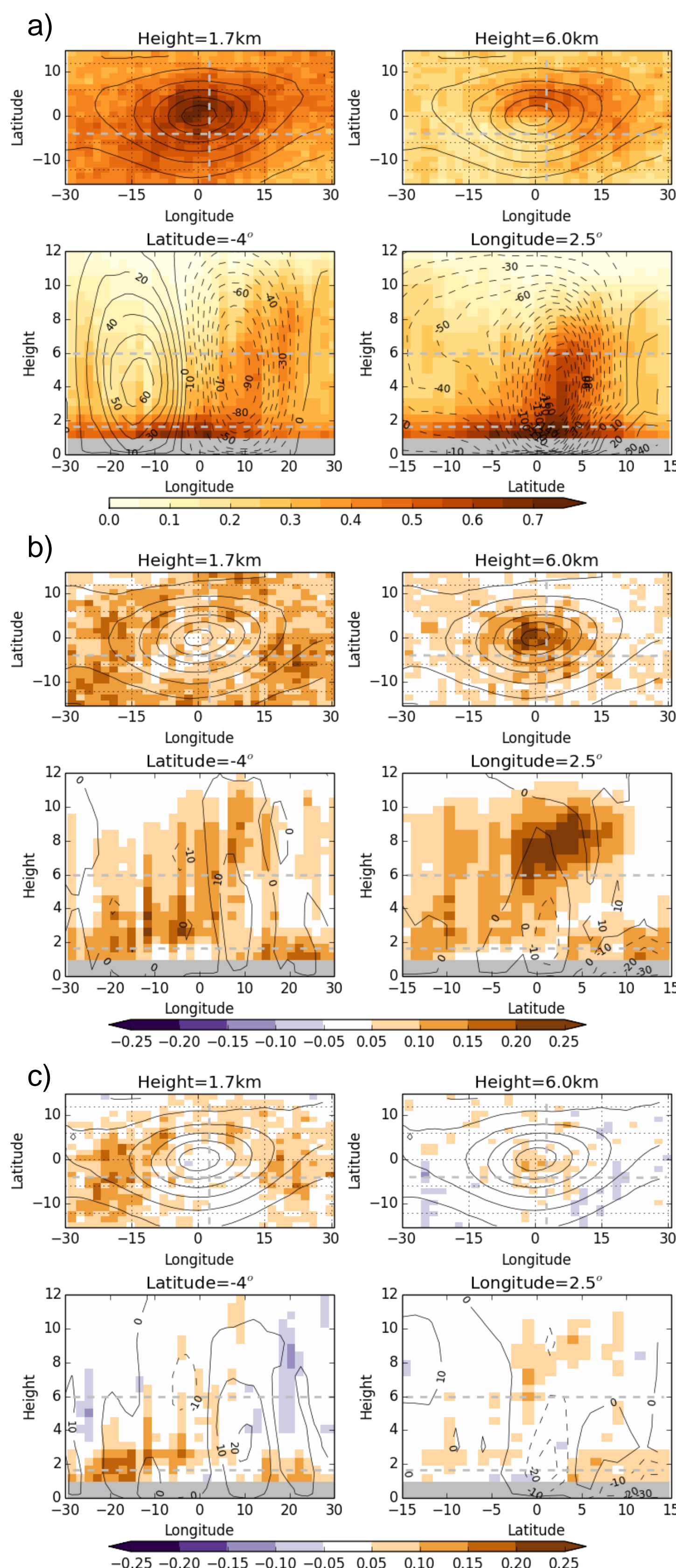
A multi-diagnostic approach to cloud evaluation

Keith Williams and Alejandro Bodas-Salcedo

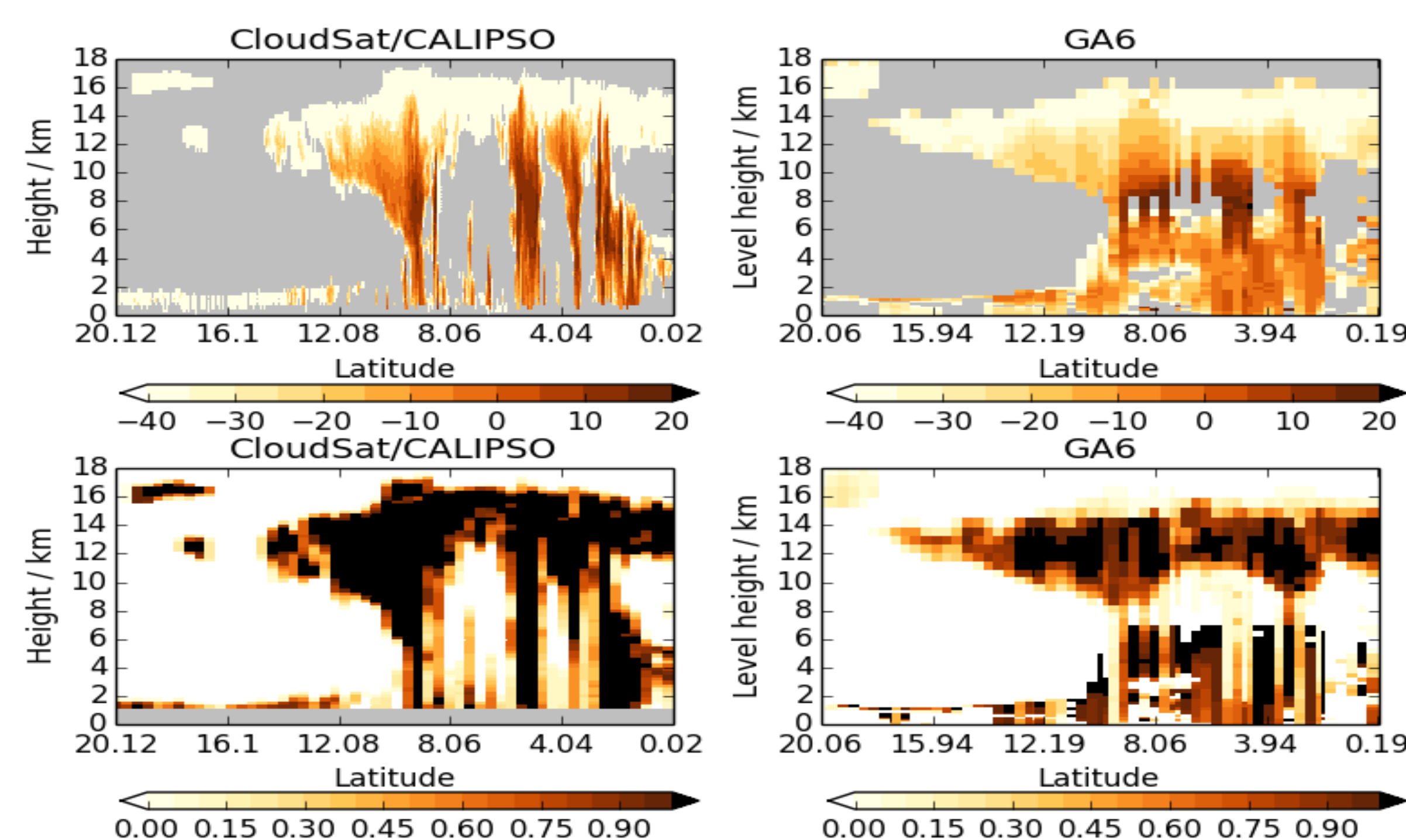
- A variety of diagnostic techniques and observational datasets applied across forecast timescales are used to provide a thorough evaluation of cloud.
- This has been applied in a model development process (from GA6 to GA7 configurations) to show model changes are improving the cloud simulation.
- The multi diagnostic/dataset/timescale approach minimises the risk of achieving apparently good performance through compensating errors.



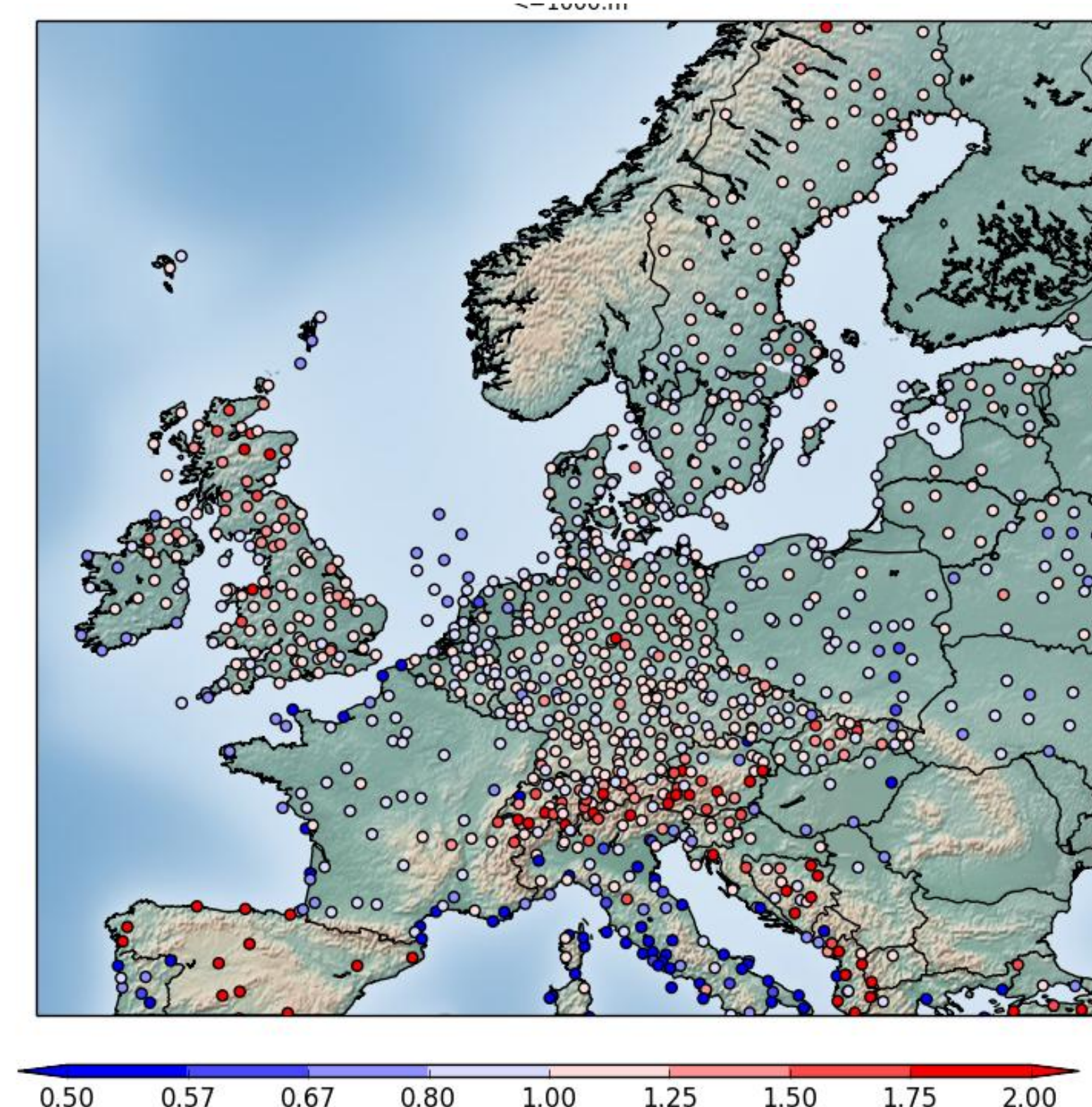
Tropical satellite cloud summaries using the CFMIP Observational Simulator Package (COSP). Satellite datasets are a) ISCCP, b) CALIPSO, c) CloudSat. GA6 and GA7 model configurations are shown in each. Tests of individual model changes are also shown in b & d. Improvements have been made to excess cirrus (through reduced cirrus spreading) and spurious drizzle (through revised microphysics).



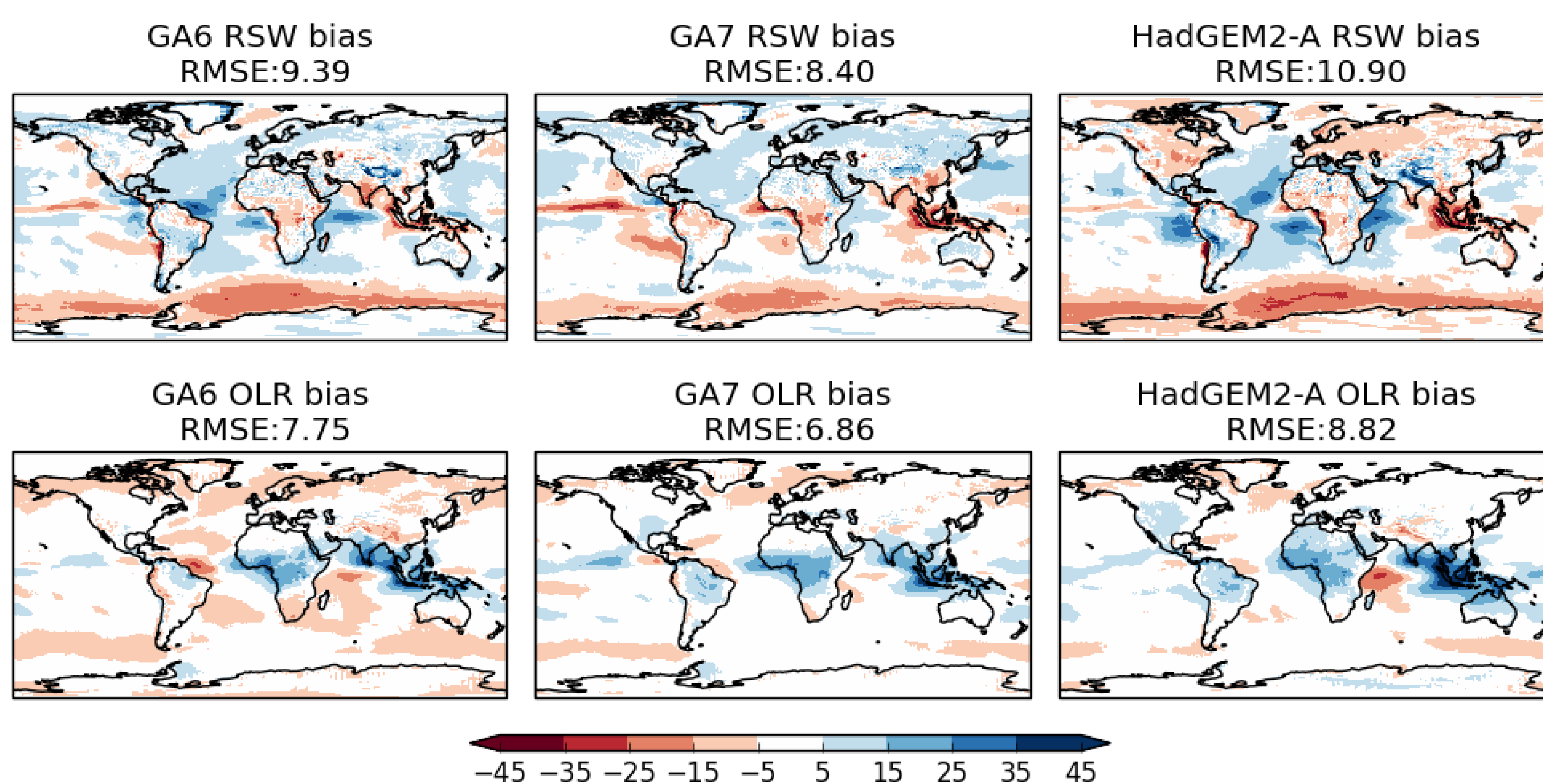
Distribution of hydrometeor (cloud plus precipitation) fraction around a composite cyclone (northern hemisphere DJF shown). a) Observed (RL-GEOPROF dataset), b) error in GA6, c) error in GA7. In each case, top panels are horizontal slices with PMSL contoured. Lower are vertical slices with a) omega b,c) error in omega contoured. The large amount of excess cirrus in GA6 has been corrected in GA7.



NWP case study of a CloudSat/CALIPSO pass across a convective system over the South China sea (left) and as simulated by the model (right). Radar reflectivities are shown top and cloud fractions on the model grid shown bottom. Model biases for convective cloud tops to be too low and cirrus fractions of 0% and 100% too infrequent can be seen.



Frequency bias of cloud base height <1km in GA6 against surface station data. There tends to be excess low cloud over high orography and too little around coasts.



Top of atmosphere mean reflected SW and outgoing LW error against CERES-EBAF for GA6, GA7 and HadGEM2-A (an older model submitted to CMIP5). These have improved through the model versions and the other diagnostics presented on the poster help ensure it's for the right reasons.

Williams and Bodas-Salcedo (2017)
GMD, doi:10.5194/gmd-2016-295