MC3E + CStAT: A Simple Mode of Multi-PI Collaboration ... to Evaluate and Improve Models

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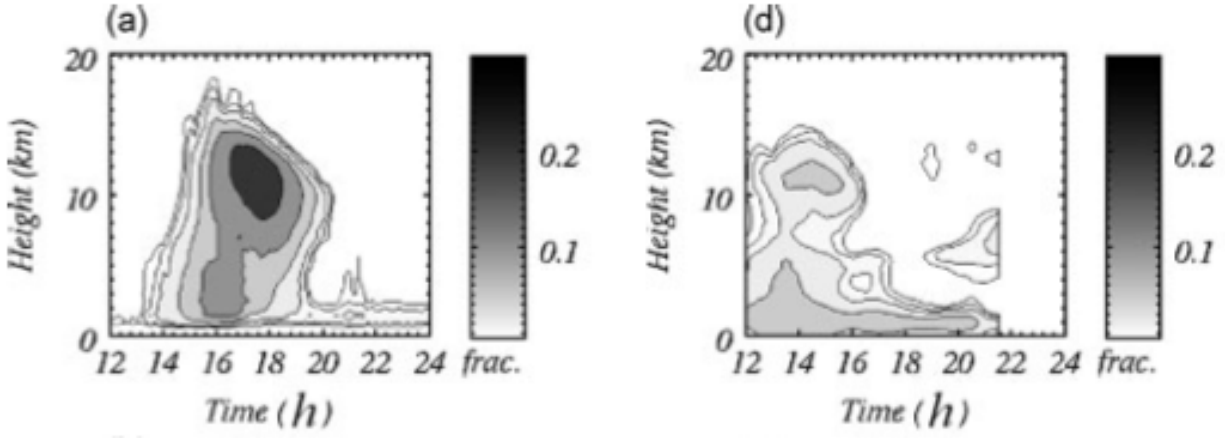
Some propositions motivating CStAT

- science is propelled by new observations and innovative use of existing observations
- ice hydrometeor fields vary widely across all atmospheric model types, including under deep convection conditions
- a first-order structural feature of deep convection is the presence of ice-containing convective and stratiform rain and anvil regions with unique dynamical and microphysical properties that play an important role in atmospheric circulation
- worthy goal to rigorously characterize the state of convective, stratiform and anvil ice-containing clouds, including their radiative and microphysical properties, and understand how they are shaped by environmental conditions (thermodynamic, aerosol, electrical...)
- worthy goal to establish to what degree atmospheric models reproduce such properties and improve them

Model intercomparison collaboration

- IOP observations provide ICs and BCs
- a fixed case set-up is adopted for all models in an intercomparison (sensitivity test or few)
- simulations compared with survey of observations
- end up comparing simulations more to one another than to observations
  - modelers go home with an idea of their model vs others
  - but which simulations are "better"?



Zhu et al., 2012

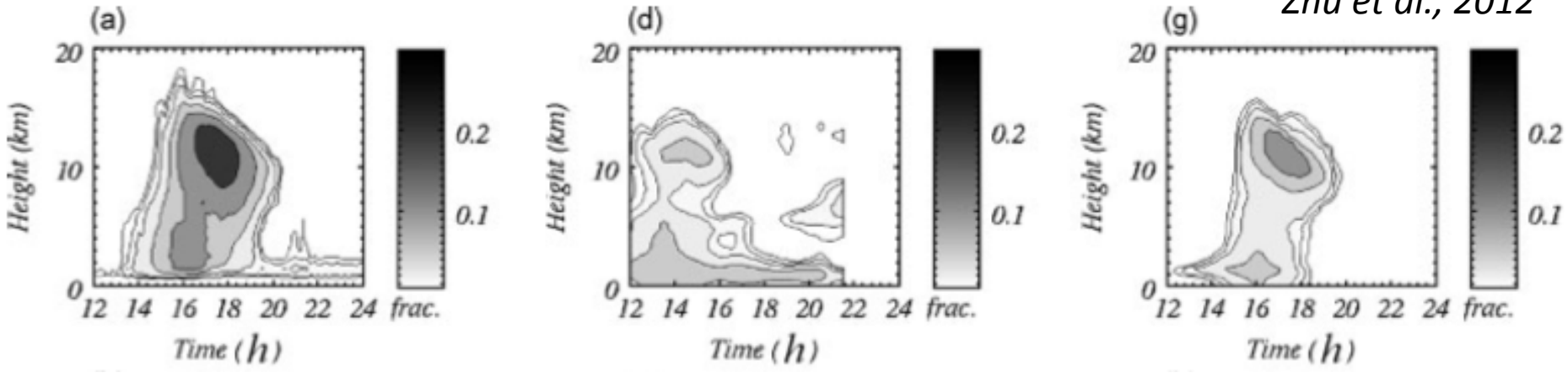
Some experiences

- about the TWP-ICE simulations
  - it was good rather than bad to have models run in different ways, as in Adam Varble and Ping Zhu's analyses of CRM and LAM simulations (different reanalysis forcings, etc.)
  - especially when our primary CRM goal was to compare all models with the observations rather than to one another
- about the TWP-ICE observational data sets
  - as Adam has said, "not all data sets are equally good for constraining models"
  - better data sets: excellent coverage (high-frequency and domain-wide, spatial patterns: C-POL, VISST), richness (multiple spatiotemporally collocated variables: S-band/VHF), relevance (offer some degree of constraint in a critical zone: C-POL)
  - better data sets may be most difficult to use without close involvement of an expert (new instruments or retrievals, uncertainty poorly characterized, documentation difficult)
  - would have learned more by focusing directly on such data sets?

CStAT mode of multi-PI collaboration?

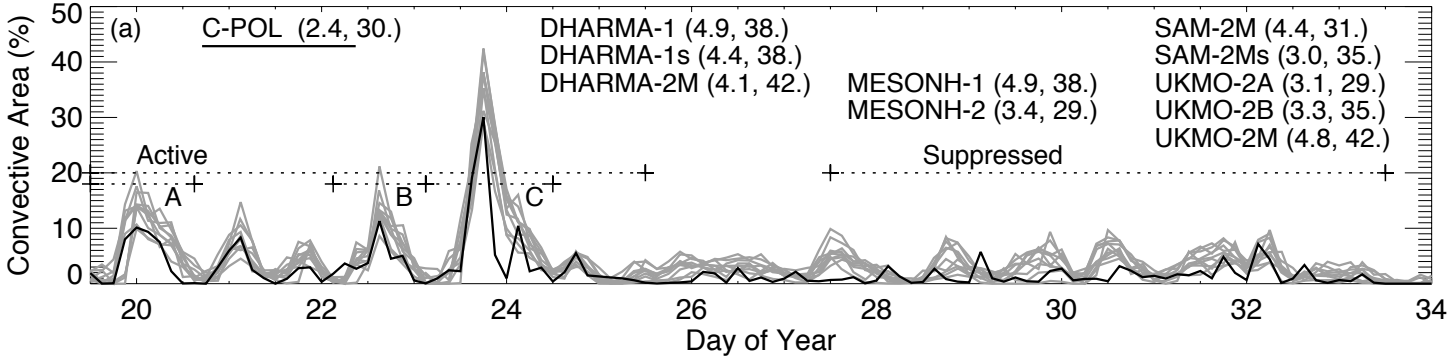
- not a model intercomparison but a model challenge (run your model as you see fit)
- focus on penetrating analyses of specific data sets in parallel (fingerprints rather than survey of domain means)
- models not necessarily even reporting lists of domain-wide quantities, but more specialized subsets of results, such as statistics of structural features (e.g., mean Doppler velocity/dBZ profiles in objectively identified dense stratiform regions) or 2D maps (e.g., dBZ/rain rate), perhaps using supplied simulators, or ...

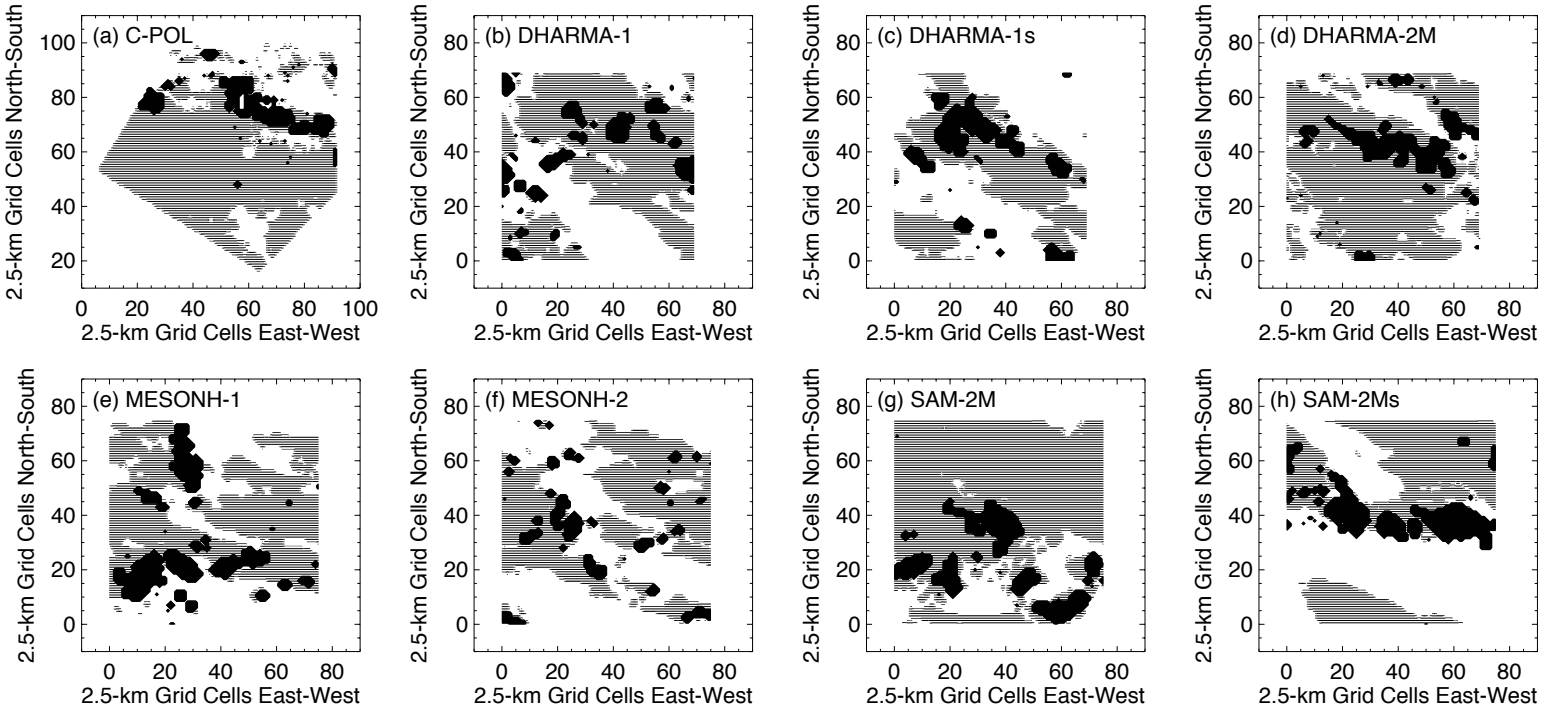
Zhu et al., 2012



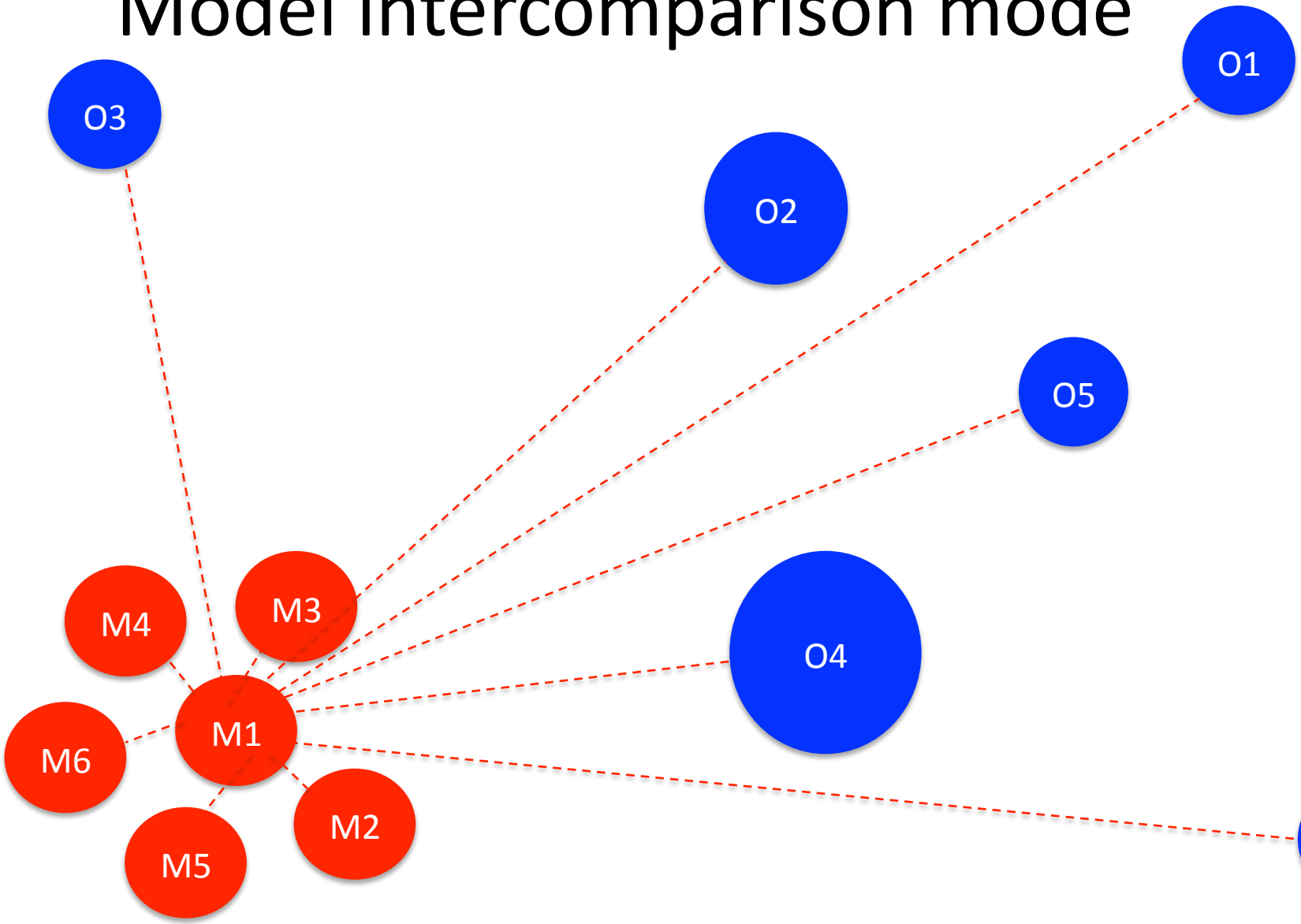
Example: Convection organization

Fridlind et al., in press

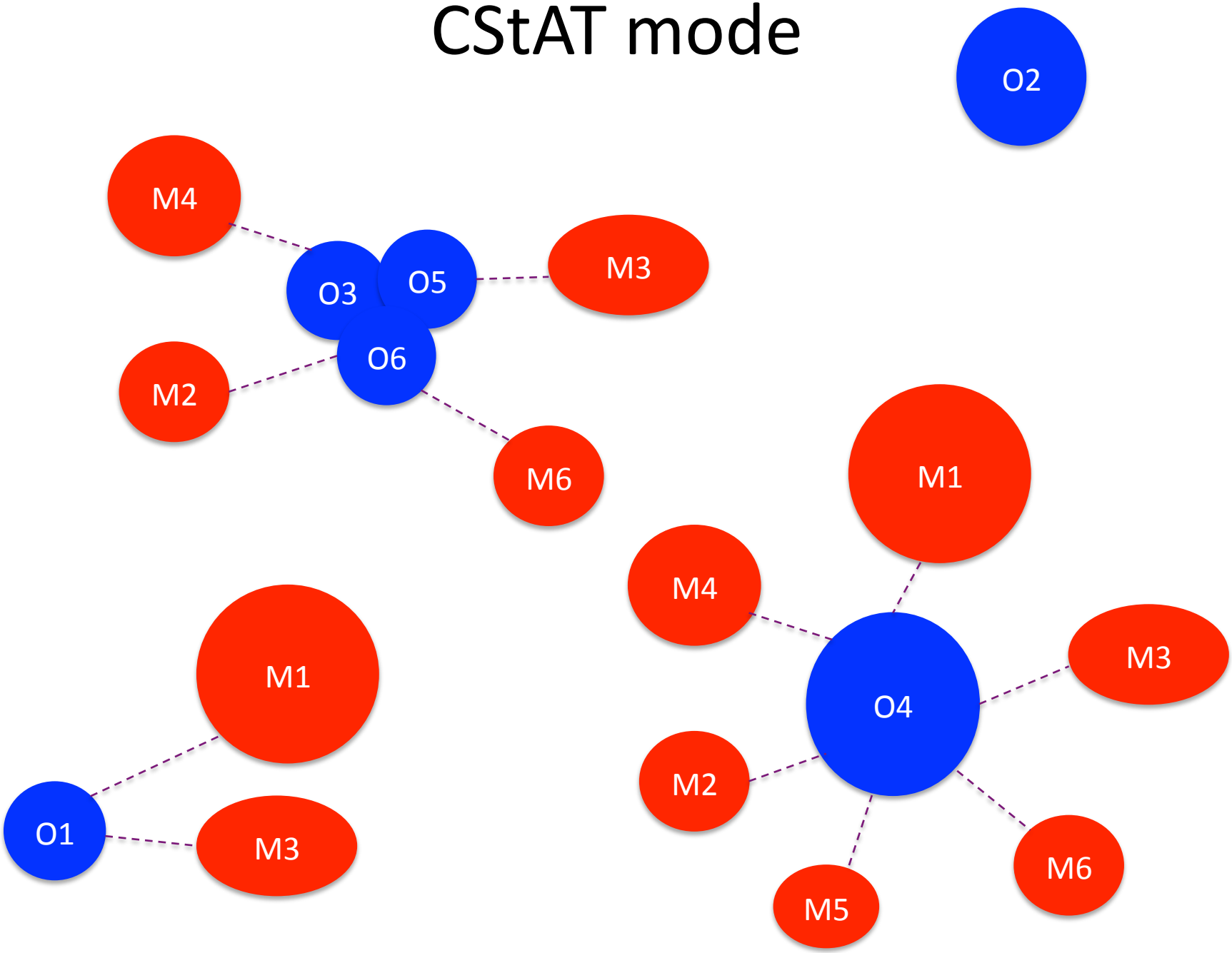




Model intercomparison mode



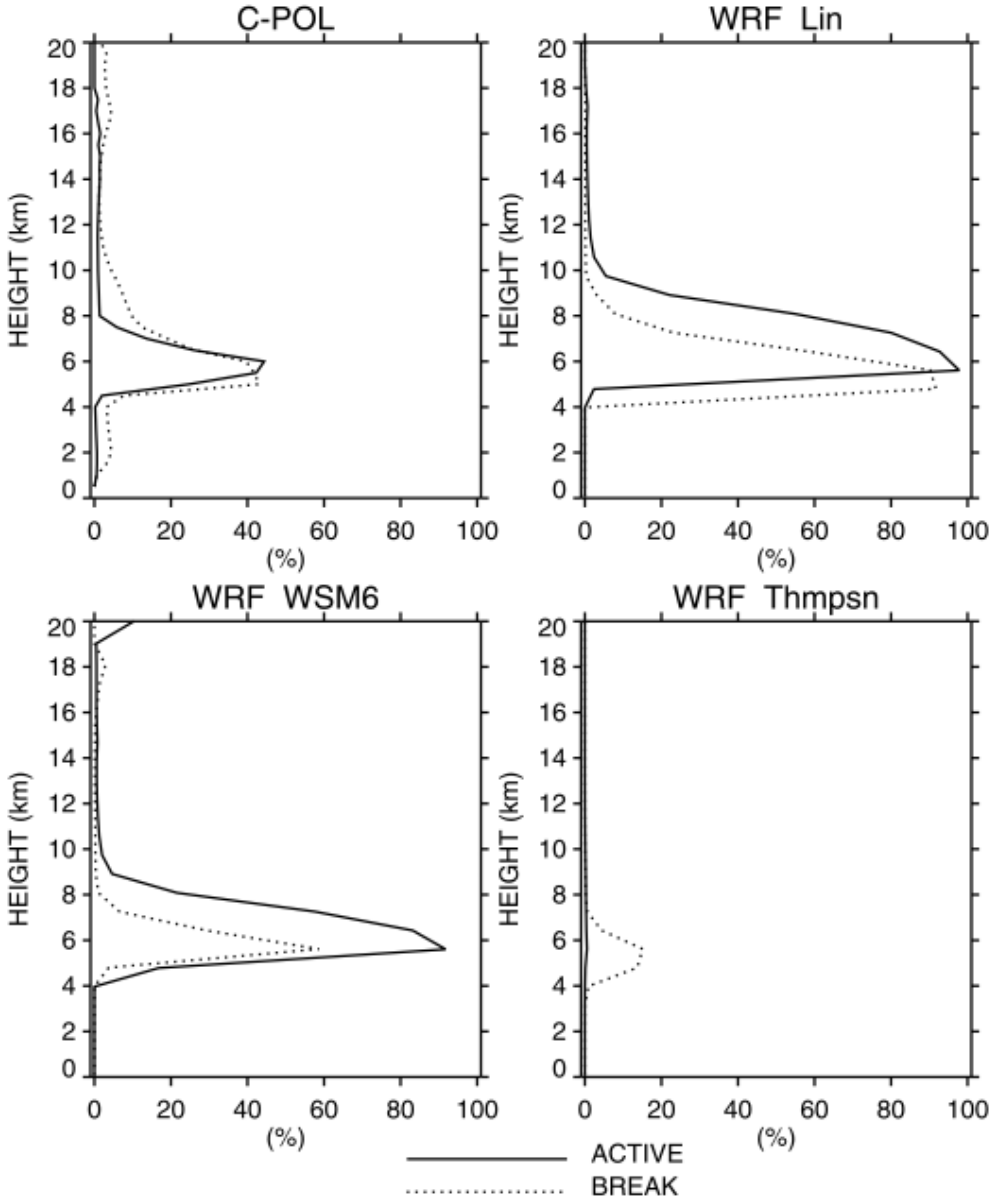
CStAT mode



Model intercomparison vs CStAT mode

- possible benefits
  - leaves modelers in a better position to improve their models afterwards with a stronger "data target" in hand
  - model users/developers/evaluators working with observationalists better understand the properties, uncertainties, relevant details of measurements/retrievals
  - observationalists work with multiple model types
  - may spawn longer-term contacts between modeling and observational groups
  - mode not limited to CRMs or "special" data sets
  - scalable and modular (e.g., multiple MC3E data sets, rounds of sensitivity tests, etc.)
  - may foster innovation on both sides
  - clearer focus on specific scientific questions?
  - retains benefit of multiple modelers working side-by-side

Example: Hydrometeor ID



Wu et al., 2009