Global-mean radiative feedbacks & forcing in the CMIP5 experiments

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Questions

- Do estimates of feedbacks from the different CMIP5/CFMIP2 experiments agree?
- Is the spread in cloud feedbacks from the coupled models captured by the simplified experiments (amip, aqua)?
- What is the relationship between feedbacks and adjustments and is it captured by the simplified experiments?

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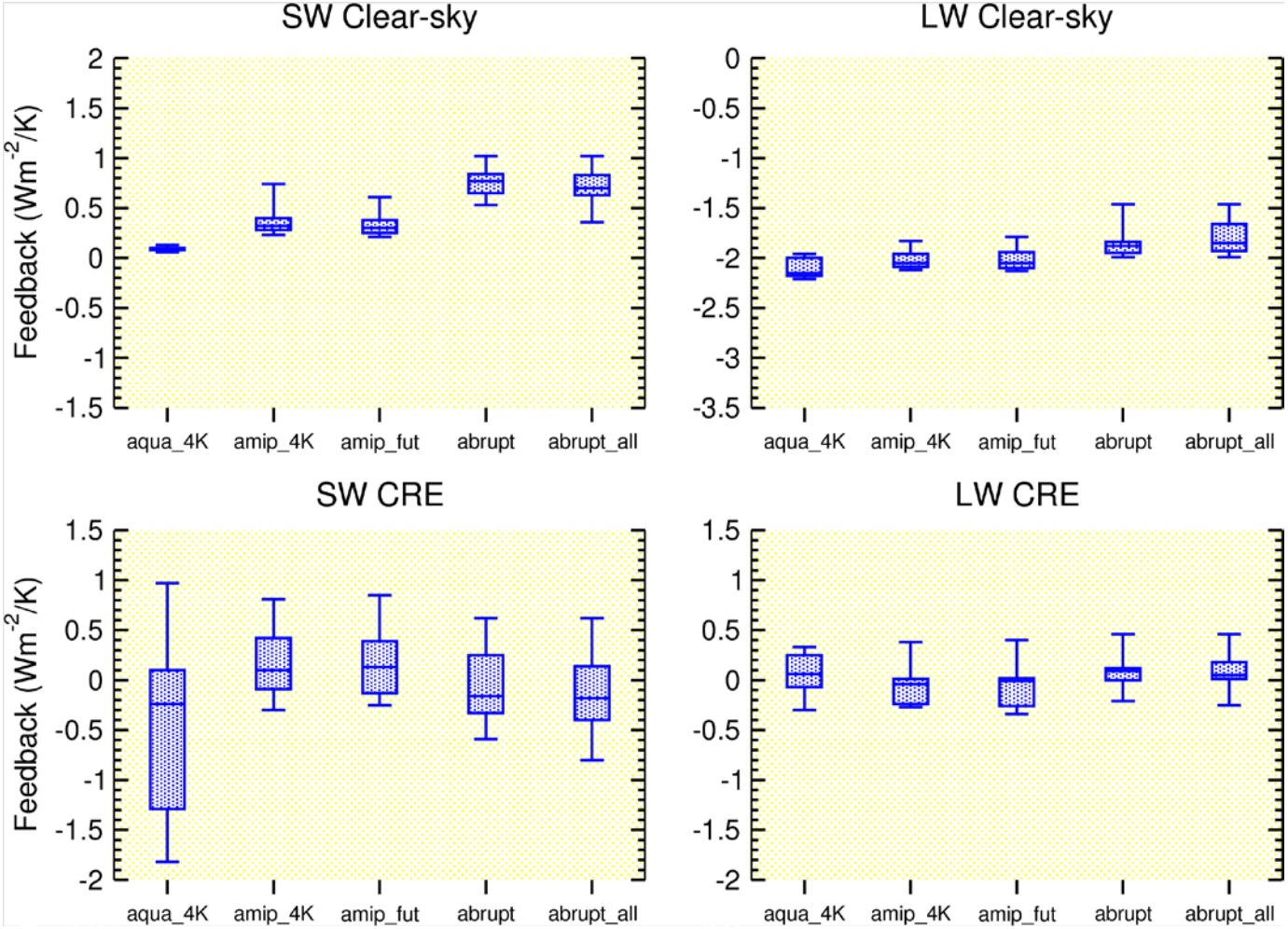
Global mean feedbacks – 1



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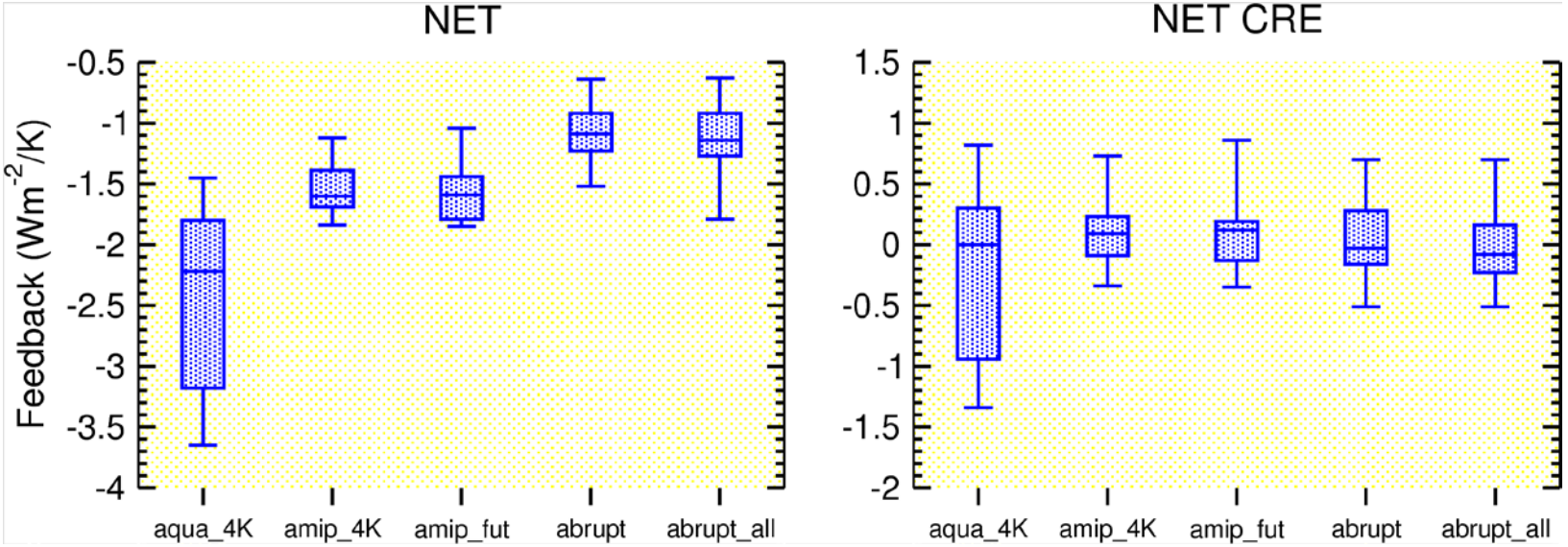
Global mean feedbacks – 2



- Median cloud feedback close to zero in all experiments
- Median net feedback determined by experimental design
- Ensemble spread largely dominated by cloud feedbacks

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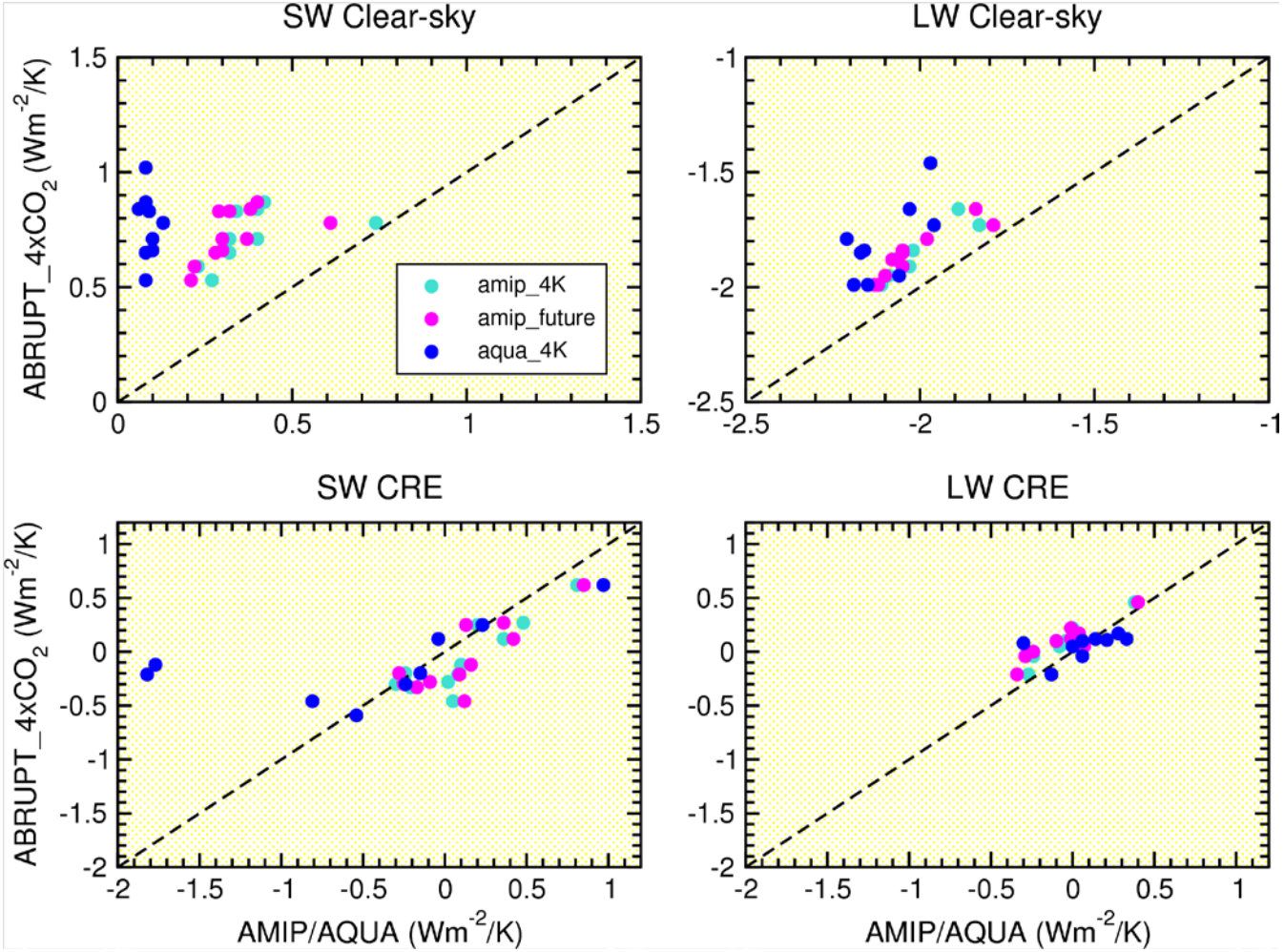
Feedbacks in coupled models vs. idealized experiments – 1



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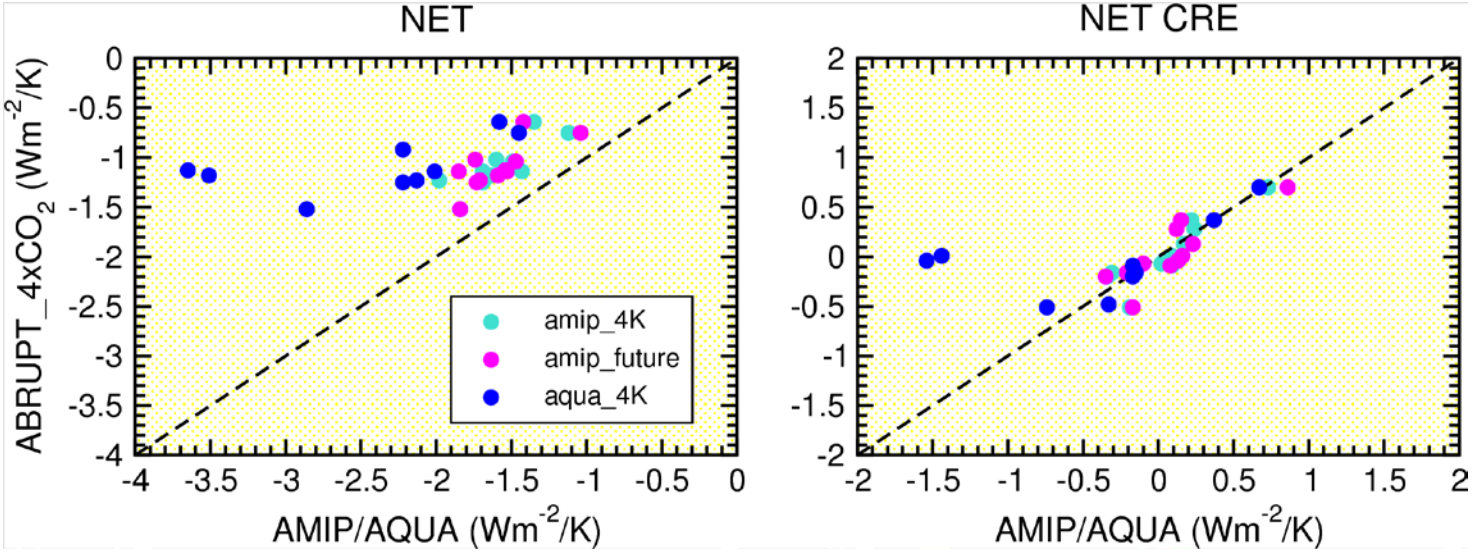
Feedbacks in coupled models vs. idealized experiments – 2



- Spatial pattern of SST warming? Land-sea contrast in warming? Sea-ice reduction?
- Previous studies have often compared climate change with ENSO and suggested SST pattern *is* important

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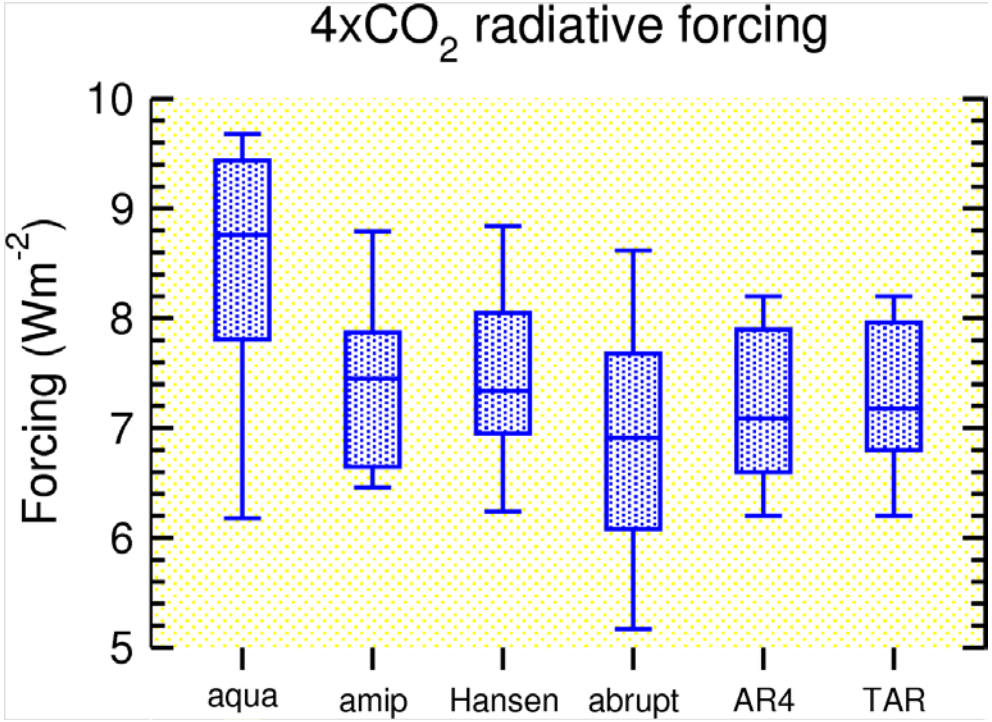
Relationship between feedbacks and forcing



r: ERF vs. λ, λ(CRE)

abrupt: -0.43, -0.46

amipFuture: -0.48, -0.53

amip4K: -0.65, -0.68

aqua4K: -0.82, -0.95

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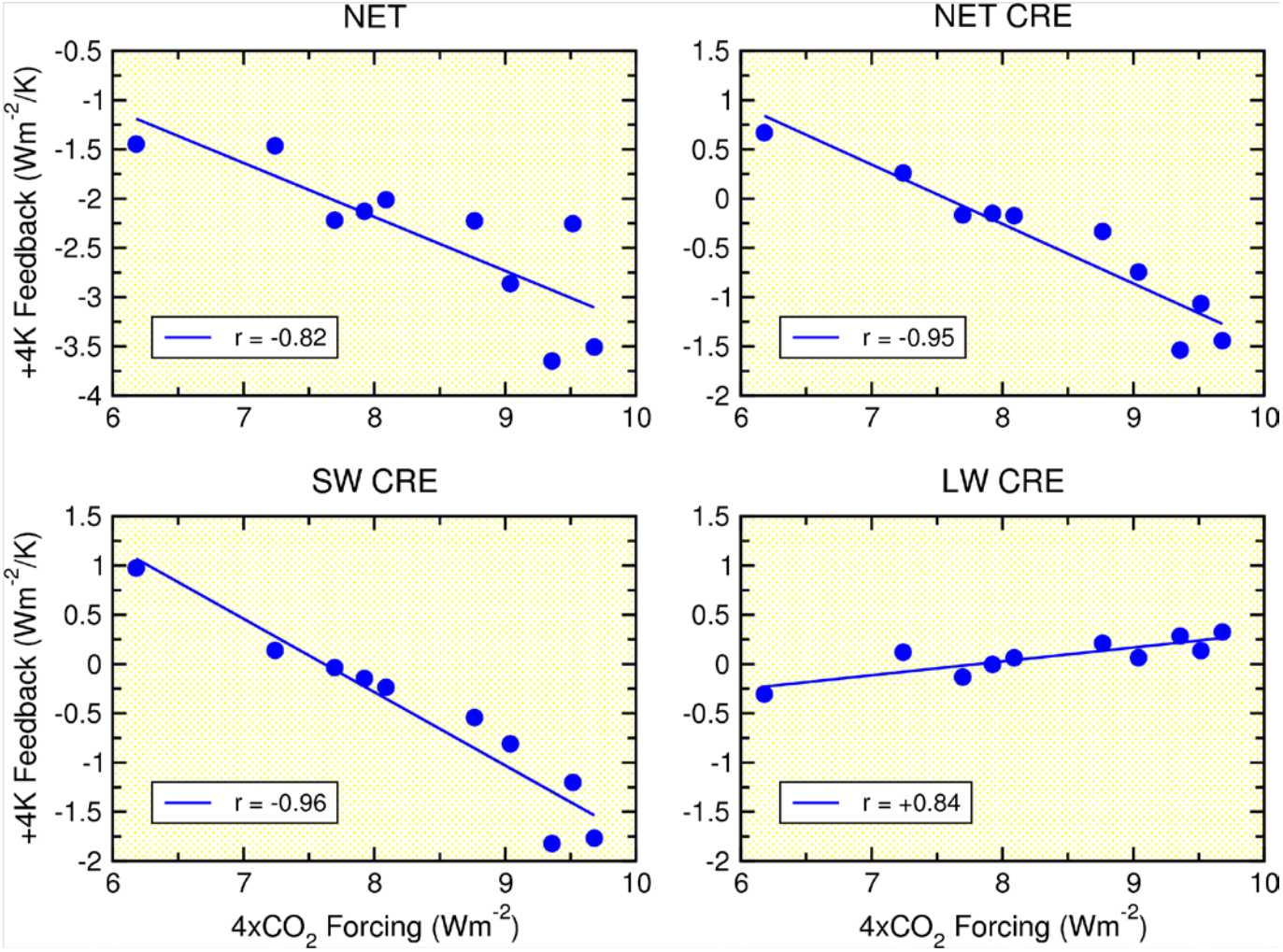
Cloud feedbacks vs. ERF in aquaplanet simulations



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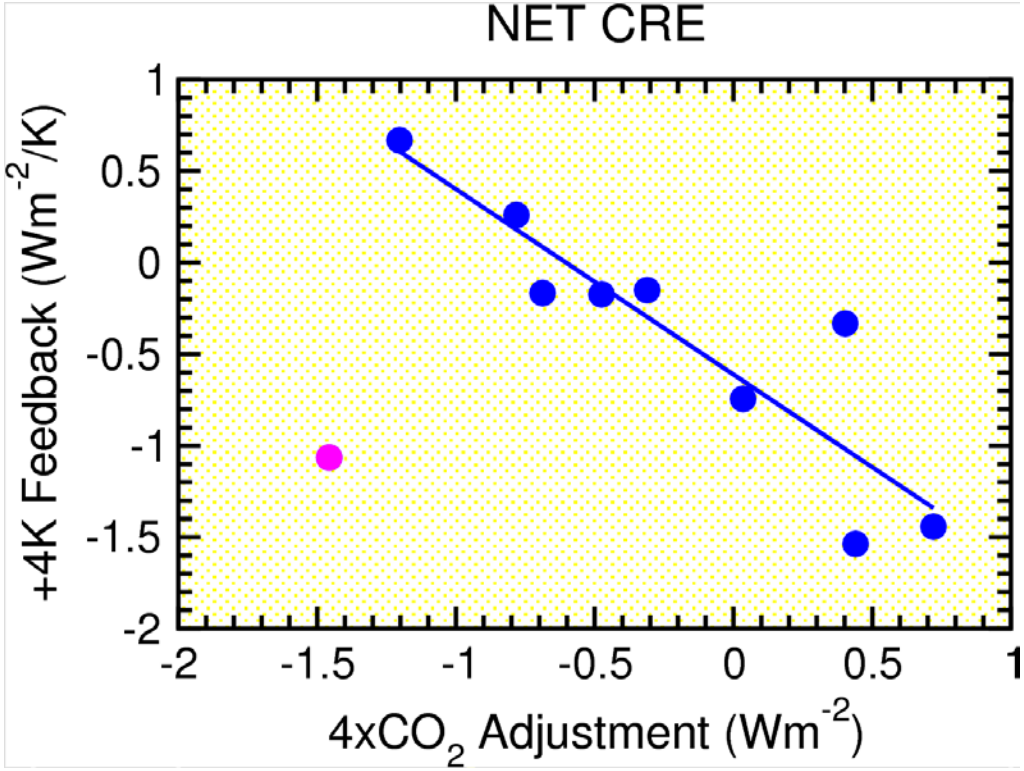
Net cloud feedback vs. net cloud adjustment in aquaplanets



- Clearer relationship between adjustments and feedback in simpler system
- A ‘unified’ theory to explain feedbacks & adjustments?

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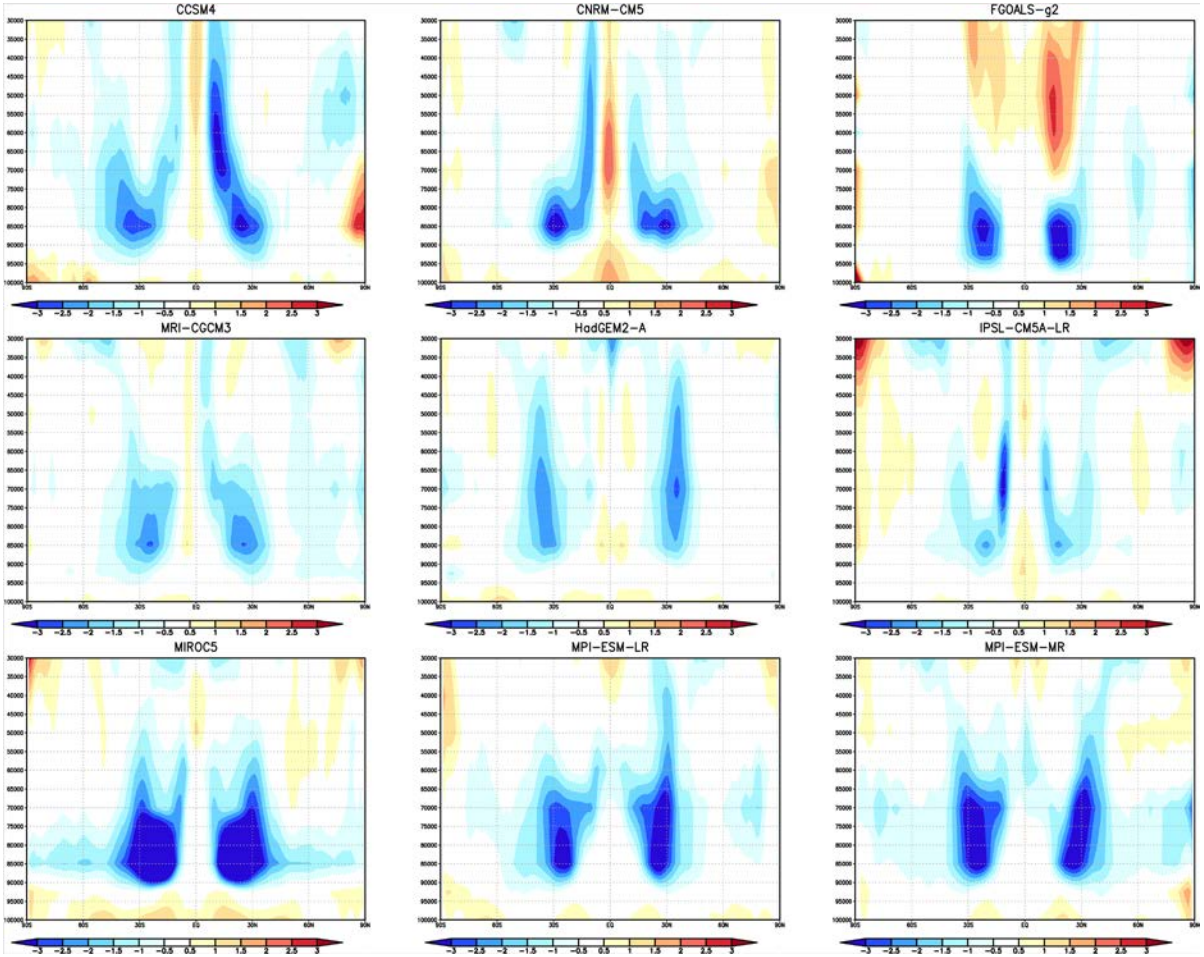
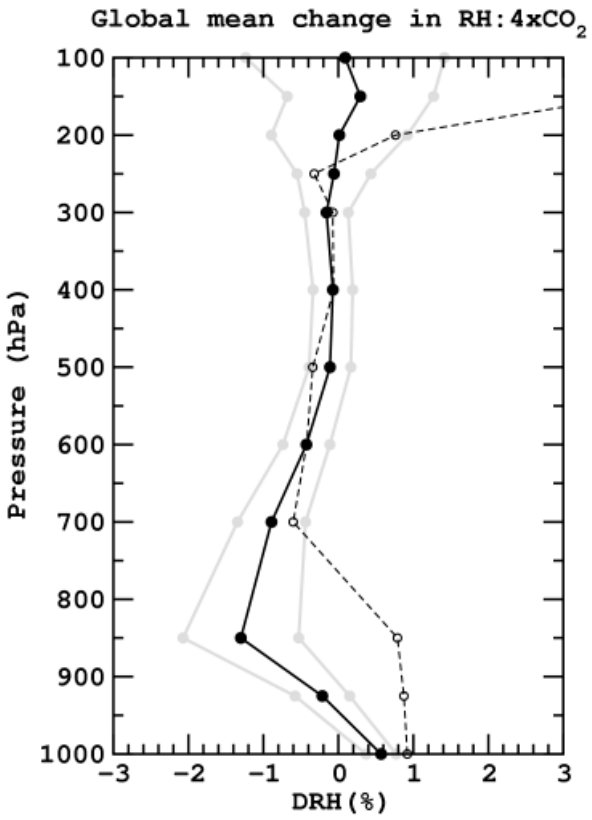
RH response in aqua4×CO_2





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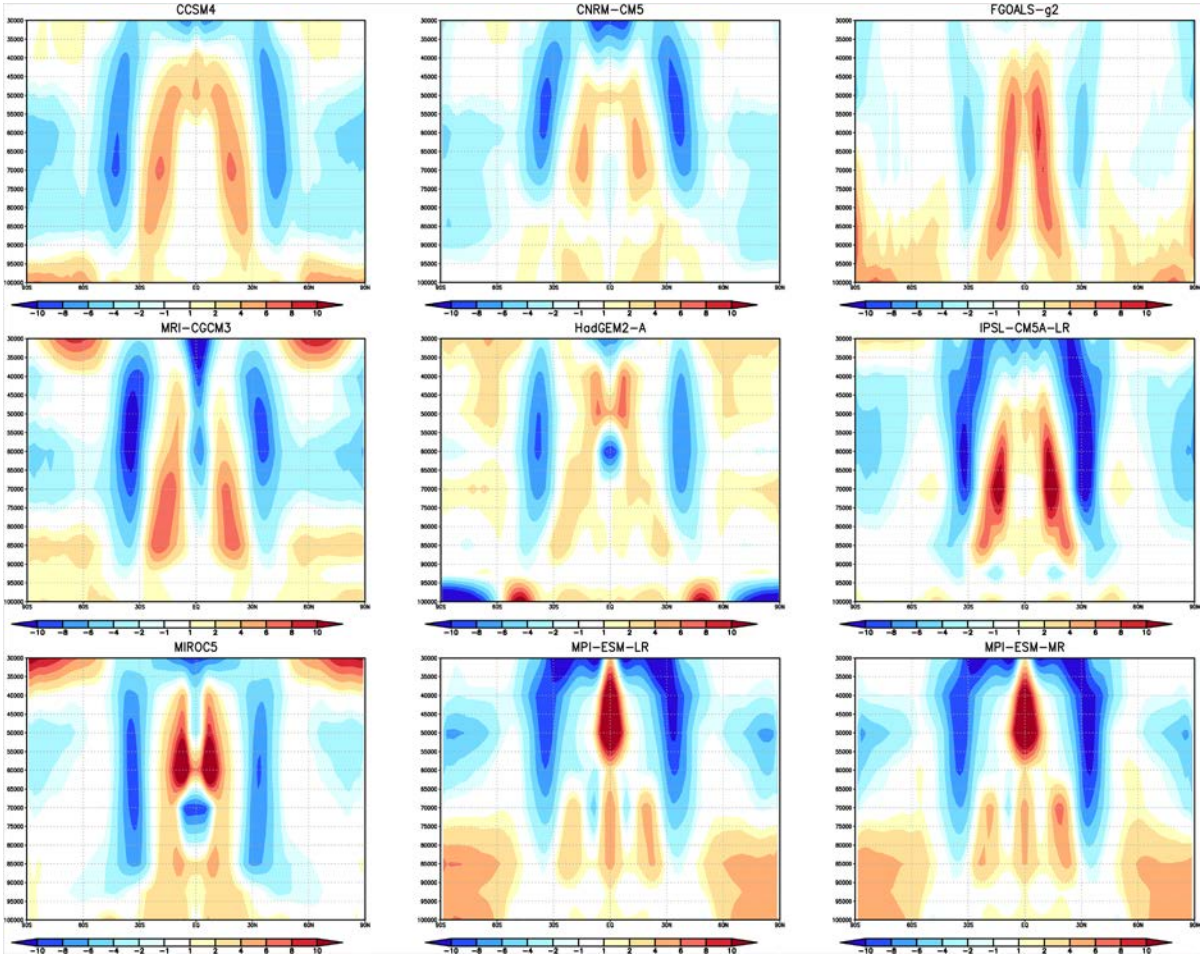
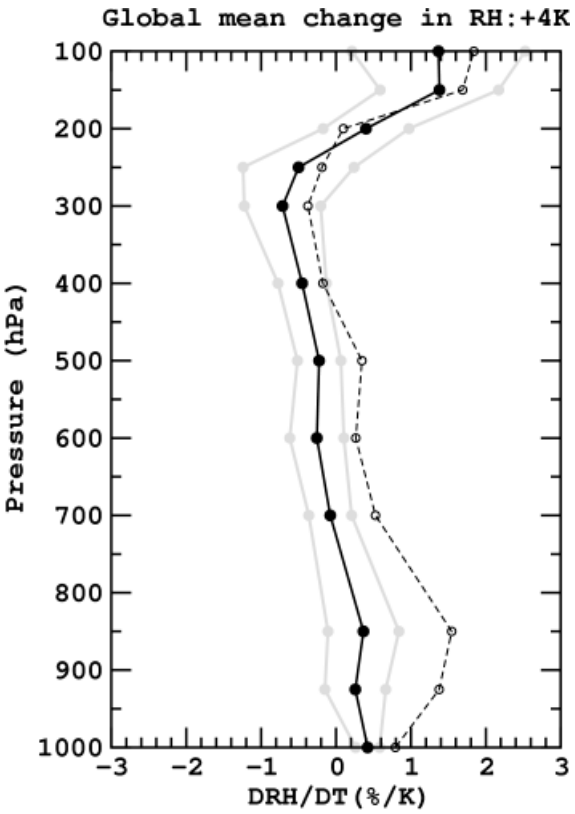
RH response in aqua4K





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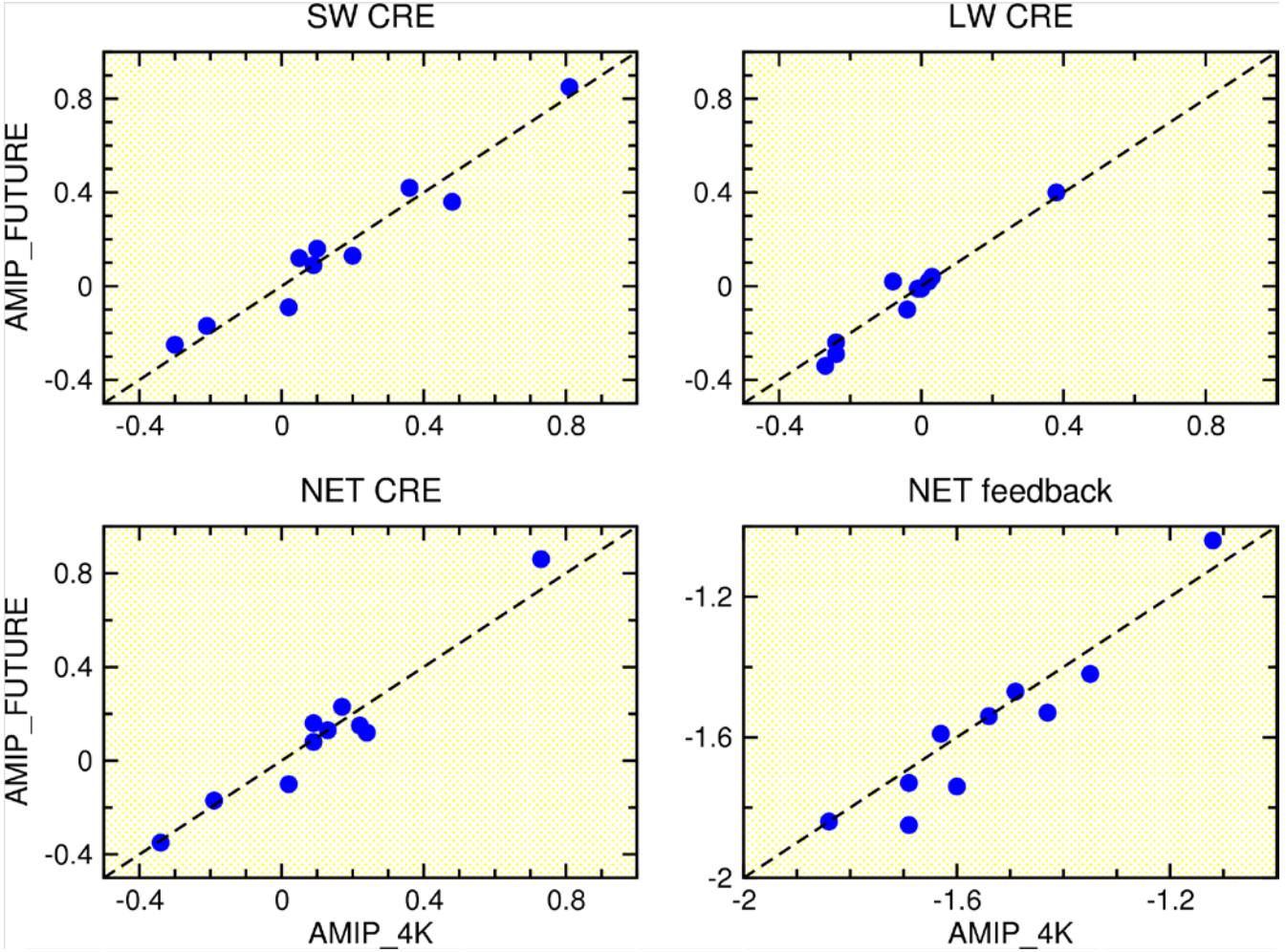
Cloud feedbacks in amipFuture vs. amip4K



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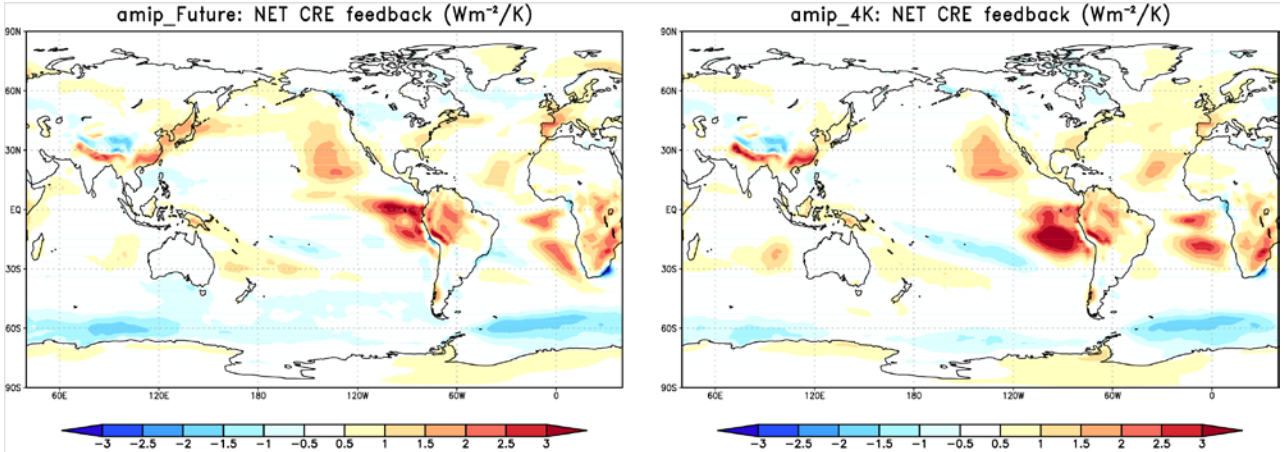
Cloud feedbacks in amipFuture vs. amip4K (HadGEM2)

Future

+ 4K



Difference

Delta Ts

(cf. He et al, 2014)

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Conclusions

- amip & aqua experiments are a good guide to global-mean cloud feedbacks in coupled models, including inter-model spread
- anti-correlation between feedbacks and adjustments more clearly identified in simplified experiments
- simplified experiments provide ideal test bed for investigating relevant processes, consistent with the CFMIP philosophy

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