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Water Vapor Seasonal Variability: AIRS L3 results vs. climate models

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Summary

- AIRS Version 4 Water Vapor Mixing Ratio (MMR) and Relative Humidity (RH).
- The AIRS RH was calculated using the Murphy & Koop Saturation Vapor Pressure with Version 4 Temperatures.
- Only look at low latitude ocean (-30° < Latitude < 0° and 0° < Latitude < $+30^\circ$).
- Only at 3 atmospheric levels: 100, 300, 850 mbar.
- How well do the models match AIRS?
- Are the seasonal variations similar?
- Is there a trend in the AIRS data?

Models

BCCR	Bjerknes Centre for Climate Research
CNRM	Centre National de Recherches Meteorologiques, Meteo-France
CSIRO	Commonwealth Scientific and Industrial Research Org, Australia
GFDL20	Geophysical Fluid Dynamics Laboratory/NOAA
GFDL21	Geophysical Fluid Dynamics Laboratory/NOAA
GISSeh	Goddard Institute for Space Studies
GISSer	Goddard Institute for Space Studies
IAP	Institute of Atmospheric Physics, Beijing
INMCM	Institute for Numerical Mathematics, Moscow
IPSL	Institut Pierre Simon Laplace, Paris
MIROCHR	Frontier Research Center for Global Change, Japan
MIROCMR	Frontier Research Center for Global Change, Japan
MPI	Max Planck Institute for Meteorology, Hamburg
MRI	Meteorological Research Institute, Japan
NCAR	National Center for Atmospheric Research
UKMOCM3	United Kingdom Met Office
UKMOGEM1	United Kingdom Met Office

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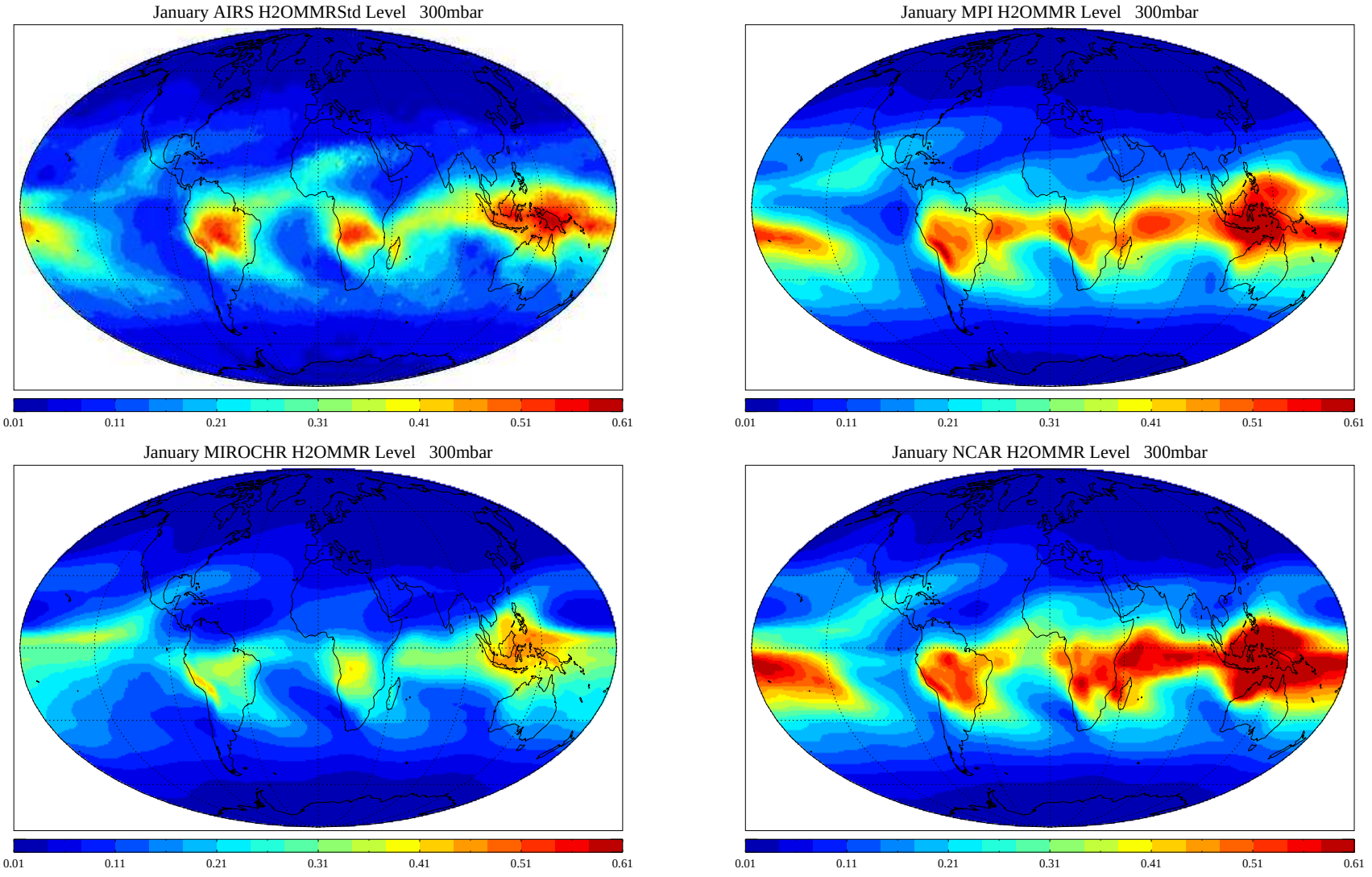
January 300 mbar H_2O MMR



- There are differences in the spatial distribution of H_2O.

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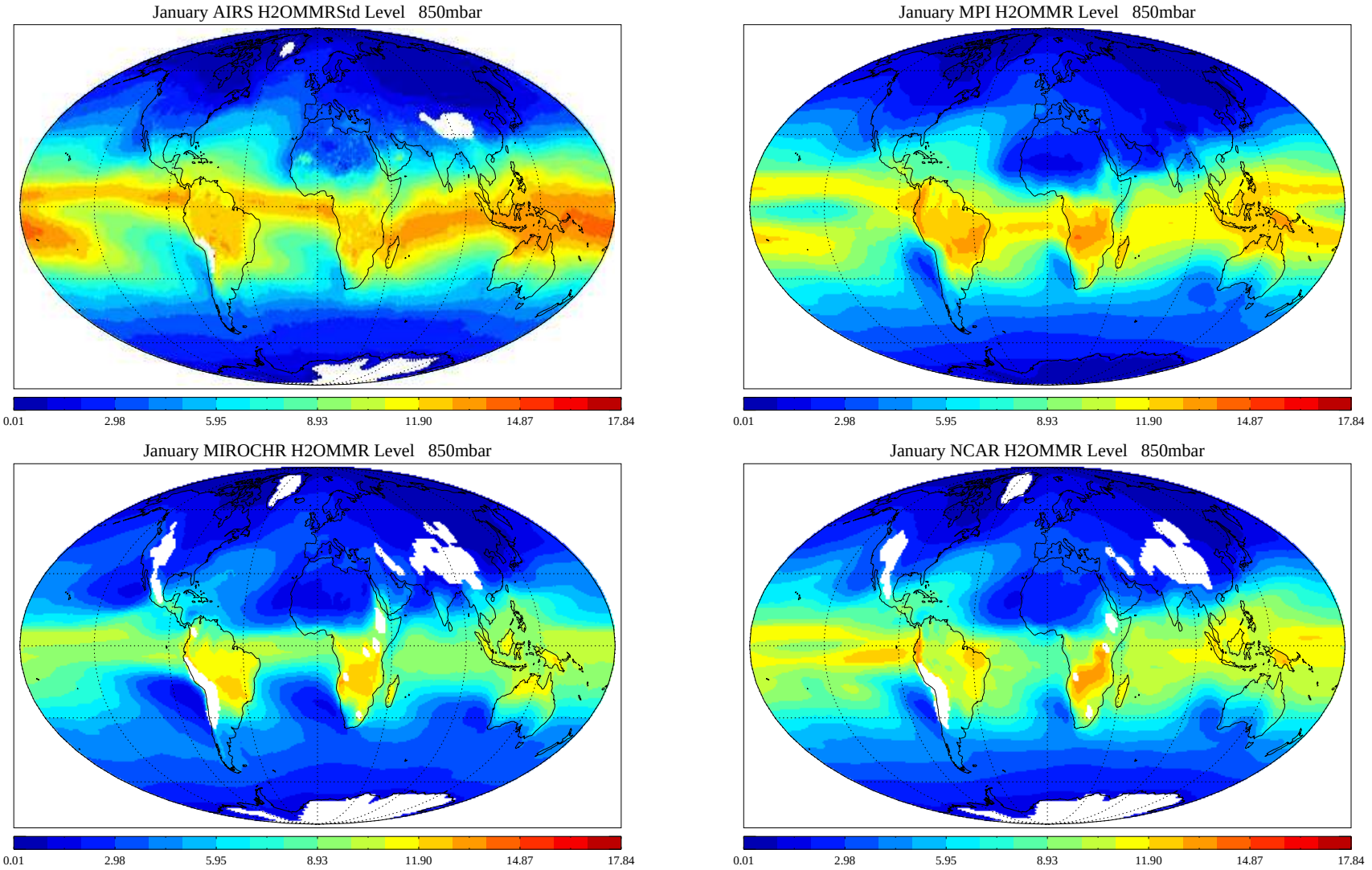
January 850 mbar H_2O MMR



- There are differences in the spatial distribution of H_2O.
- AIRS tends to be wetter

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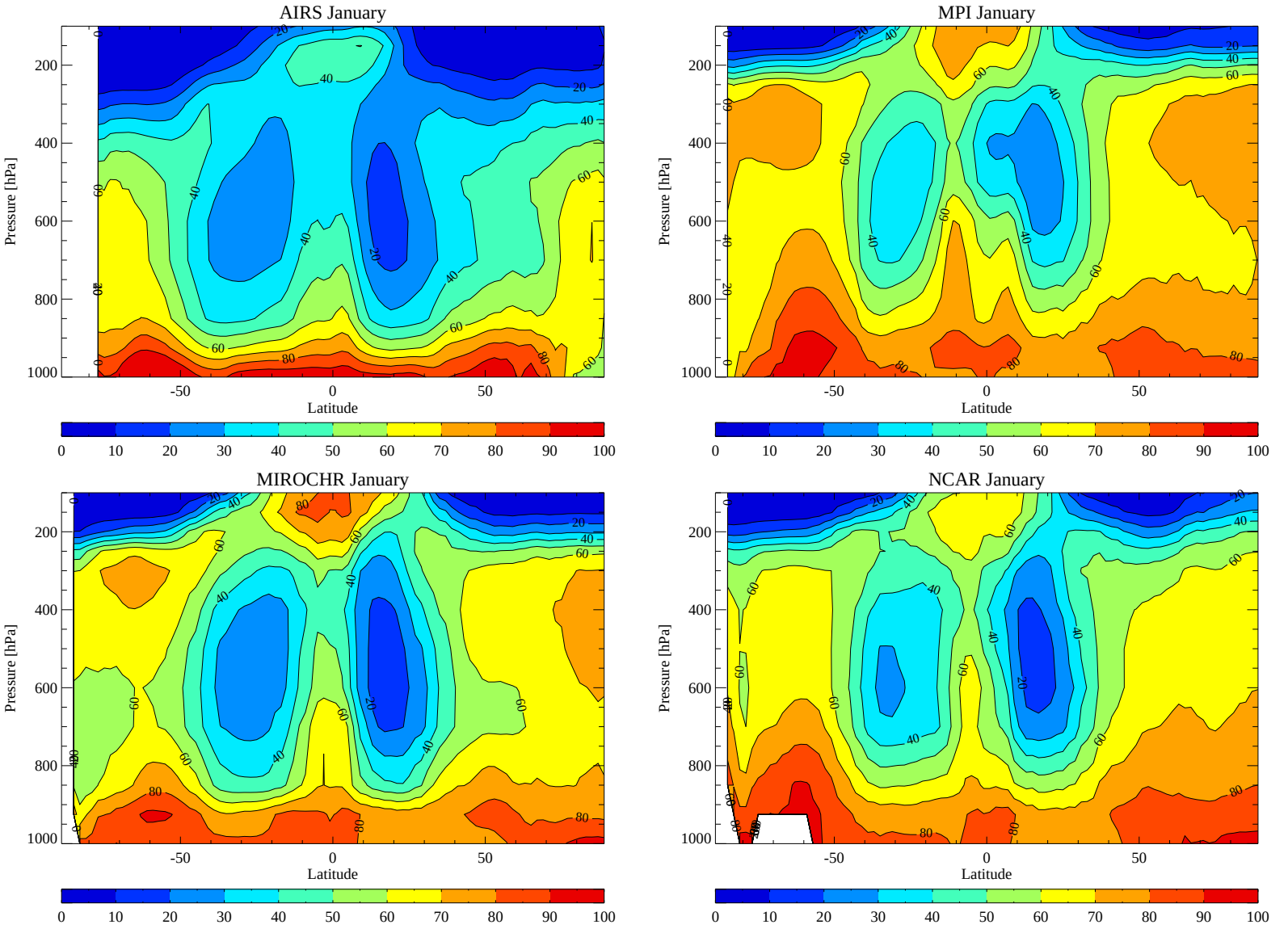
Zonal Map of Relative Humidity



- AIRS tends to be drier everywhere except at the surface.

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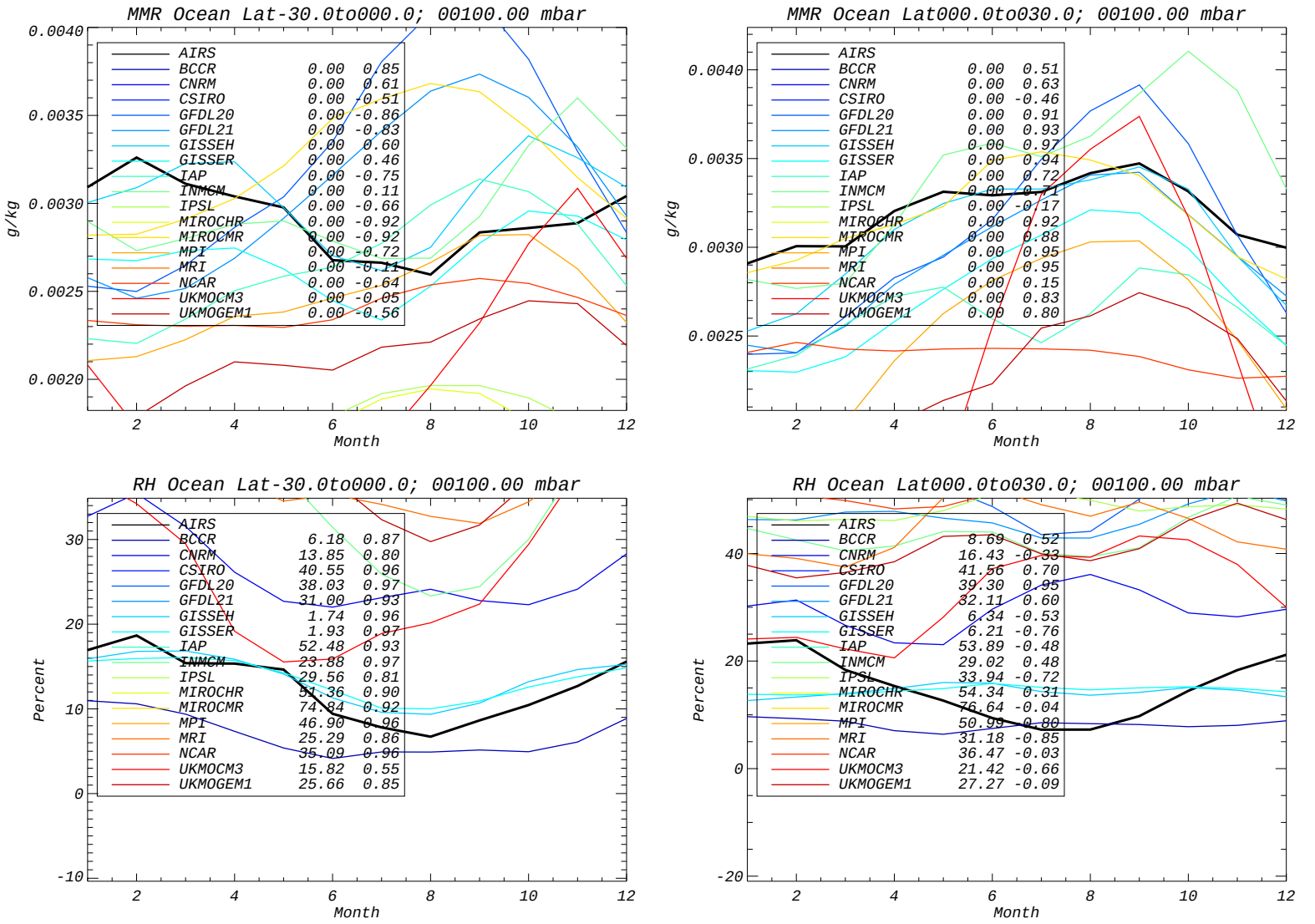
100 mbar



- AIRS 4 year climatology.
- There is not much agreement at 100 mbar.

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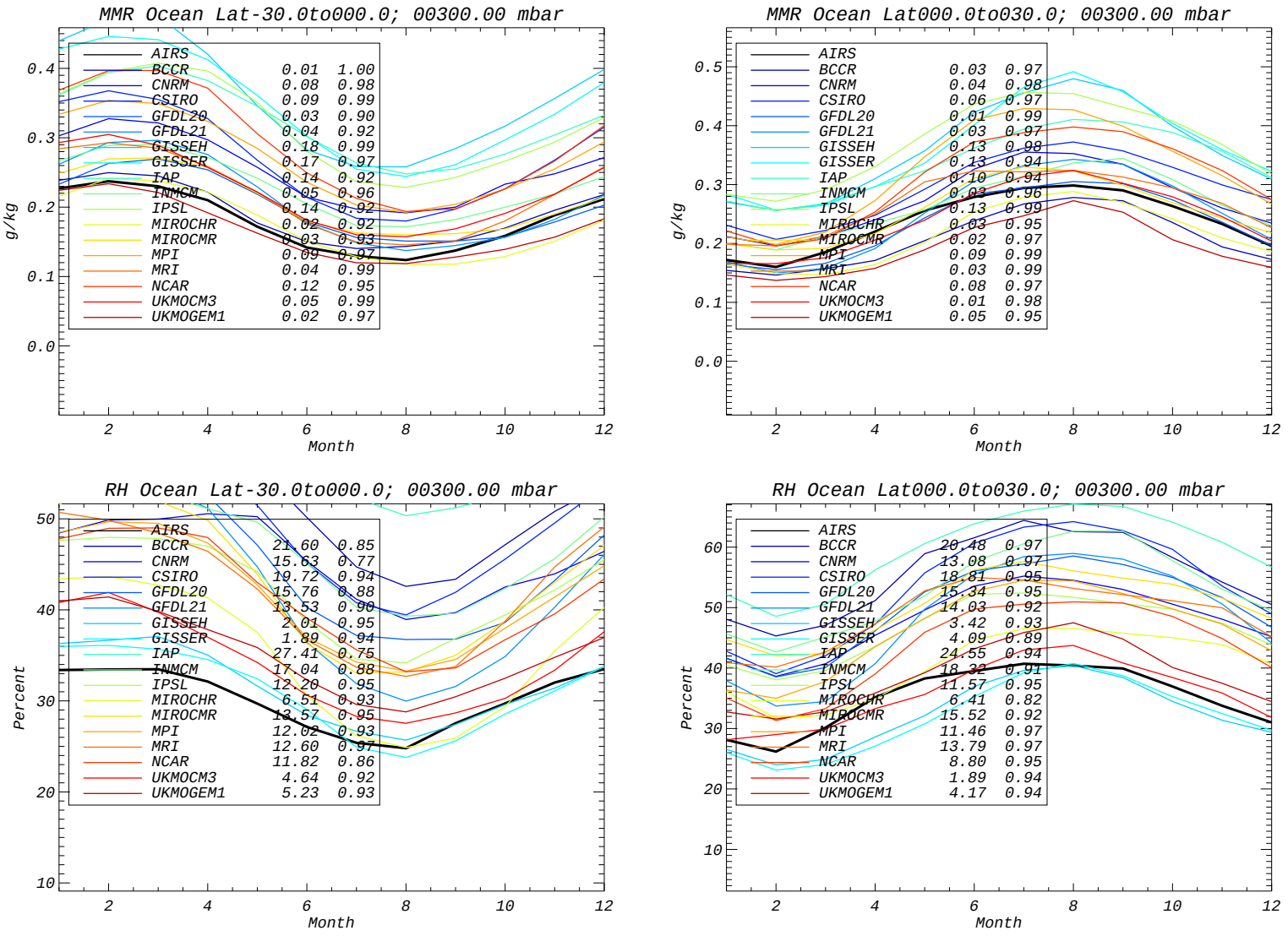
300 mbar



- AIRS is drier than most of the models at 300 mbar. There was a known upper tropospheric dry bias in Version 4.

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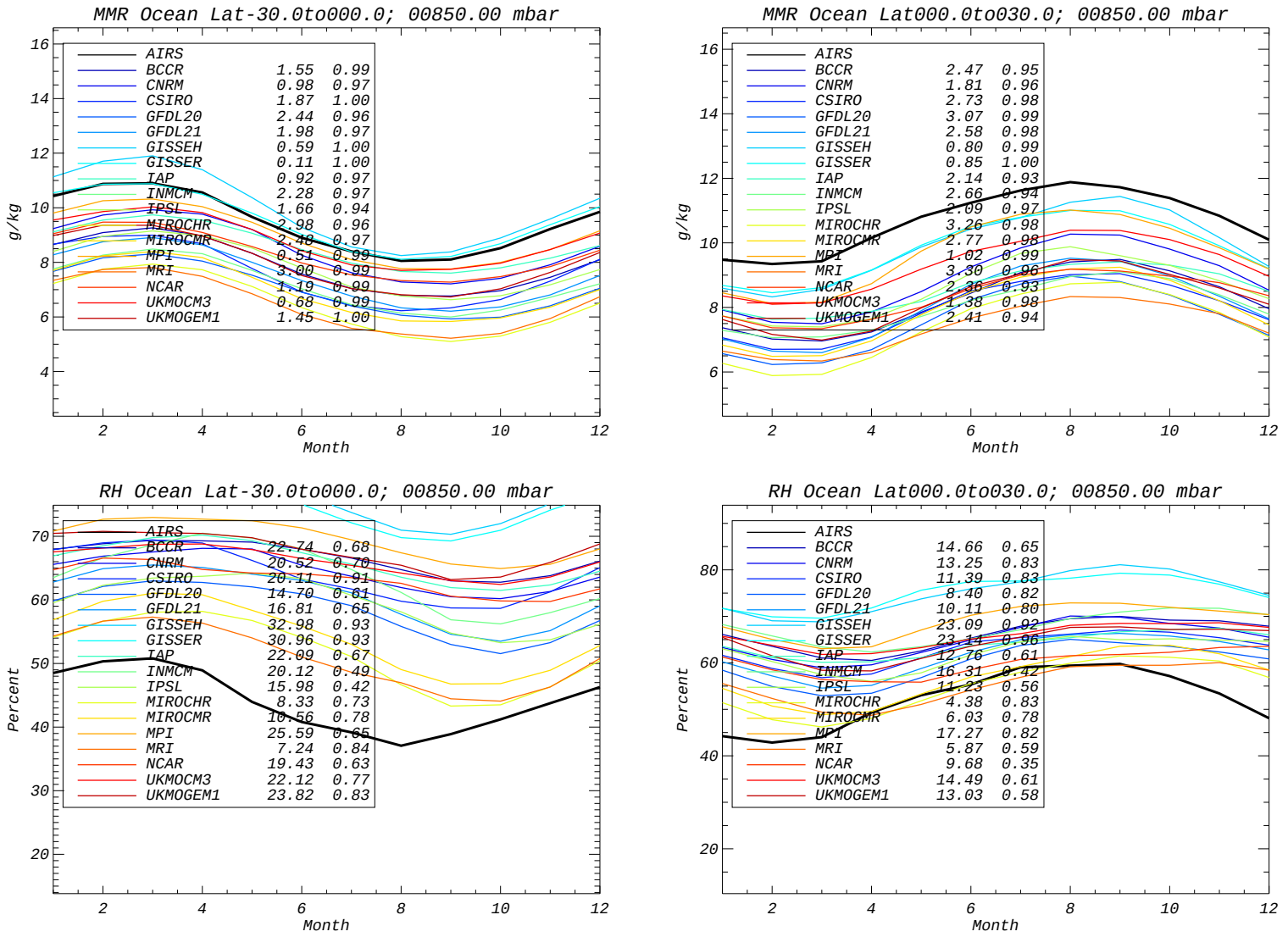
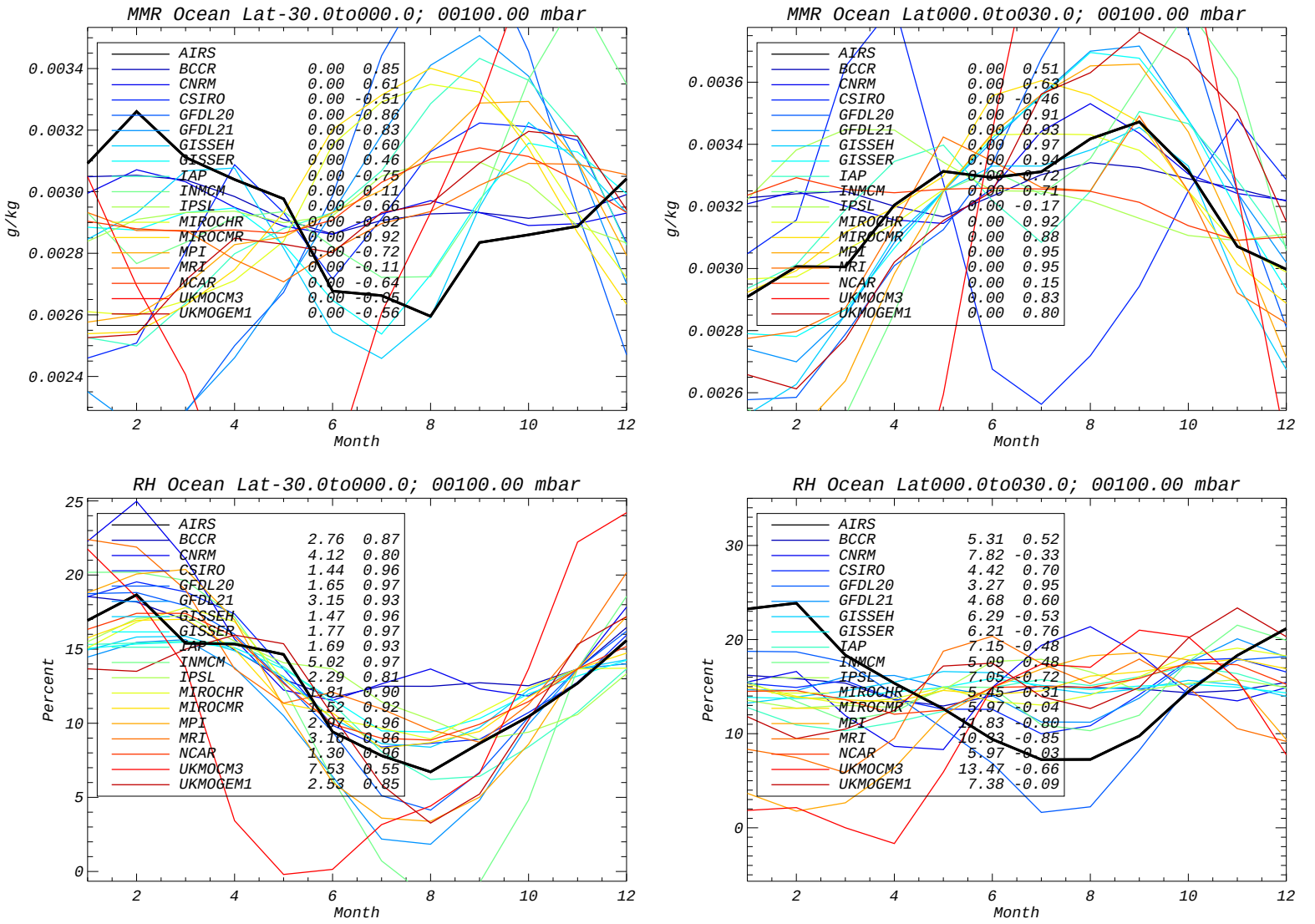
850 mbar



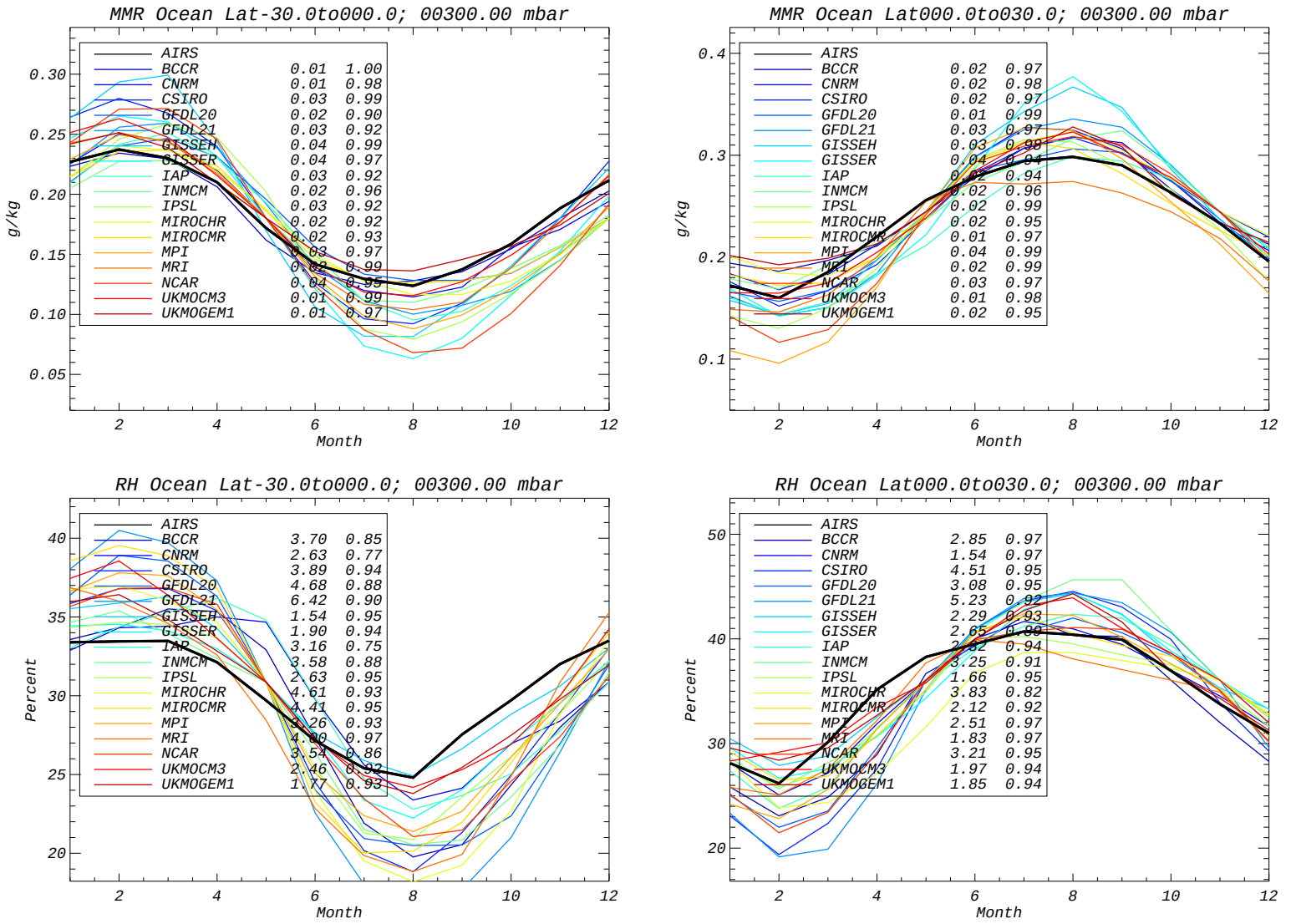
- the Mixing ratio is larger than most of the models.
- the relative humidity is smaller.

Model Shifted to AIRS at 100 mbar



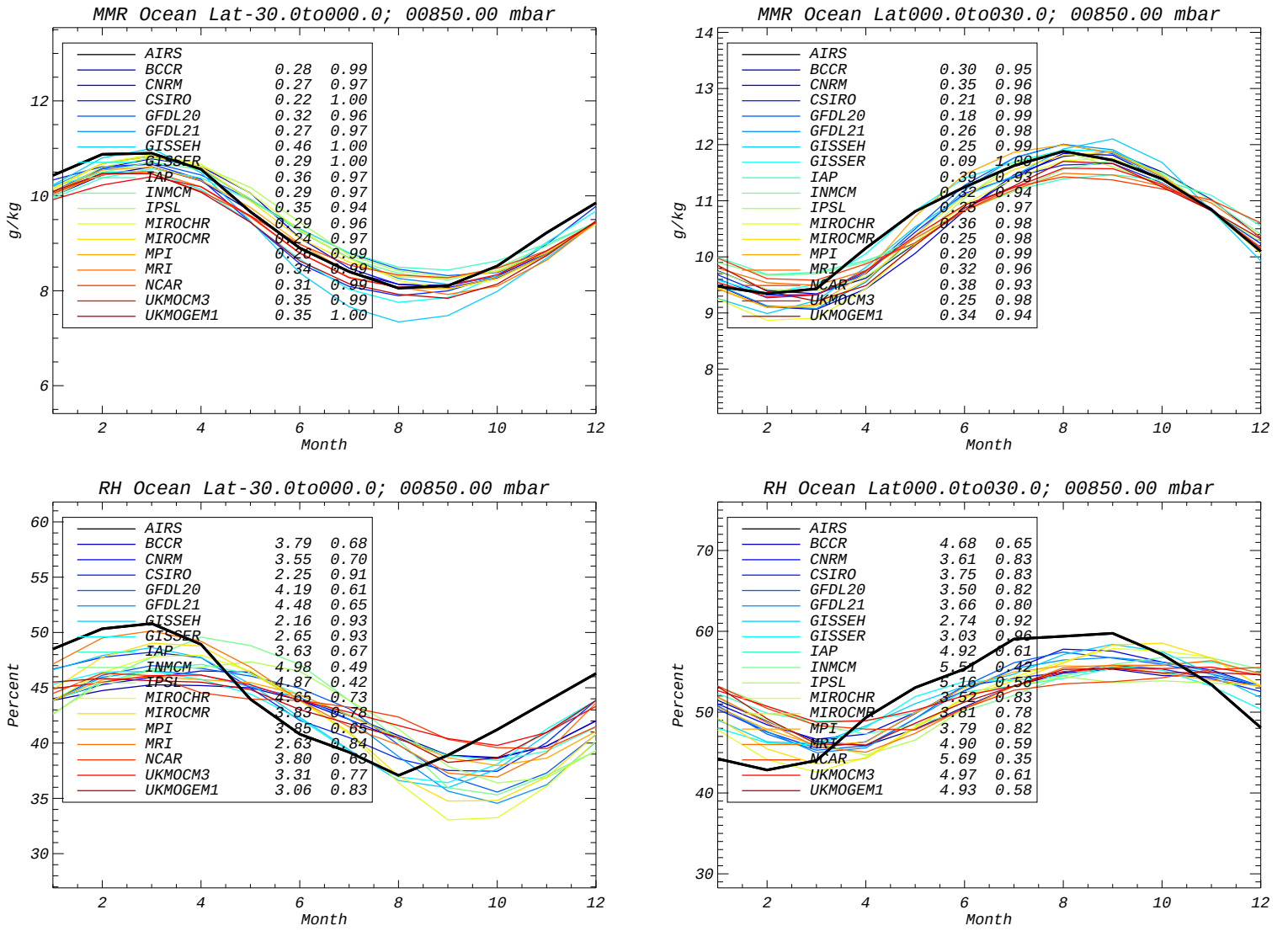
- In the northern hemisphere the mixing ratios agree with AIRS.
- In the southern hemisphere the relative humidities agree with AIRS.

Model Shifted to AIRS at 300 mbar



- the models have a larger amplitude in the seasonal variation.
- The models tend to lag AIRS in both mixing ratio and relative humidity.

Model Shifted to AIRS at 850 mbar



- AIRS and models have a similar amplitude in the seasonal variation.
- The models tend to lag AIRS in both mixing ratio and relative humidity.

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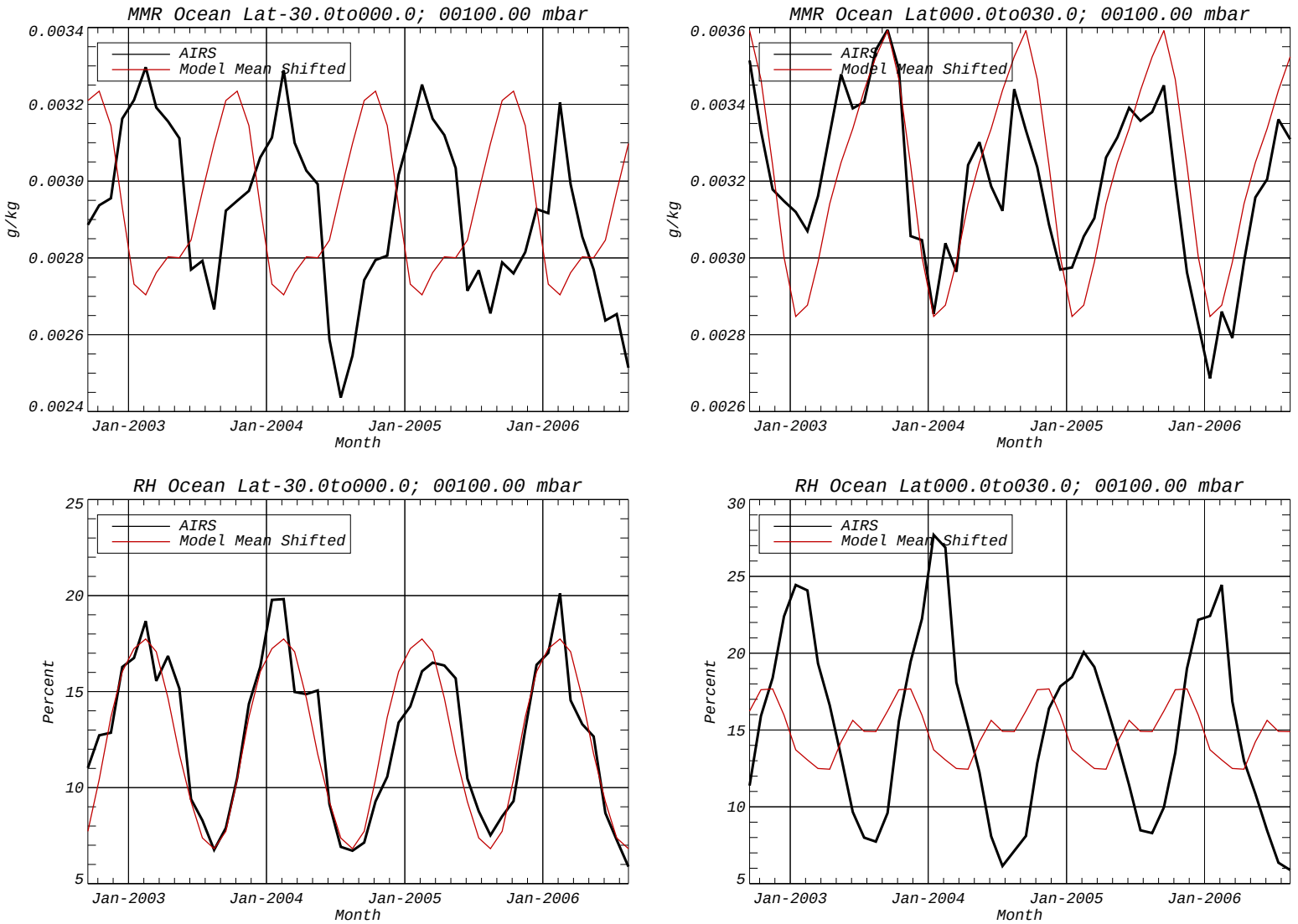
100 mbar



- The north and south are correlated in the models.
- The AIRS MMR and RH are correlated in the south and anti-correlated in the north.

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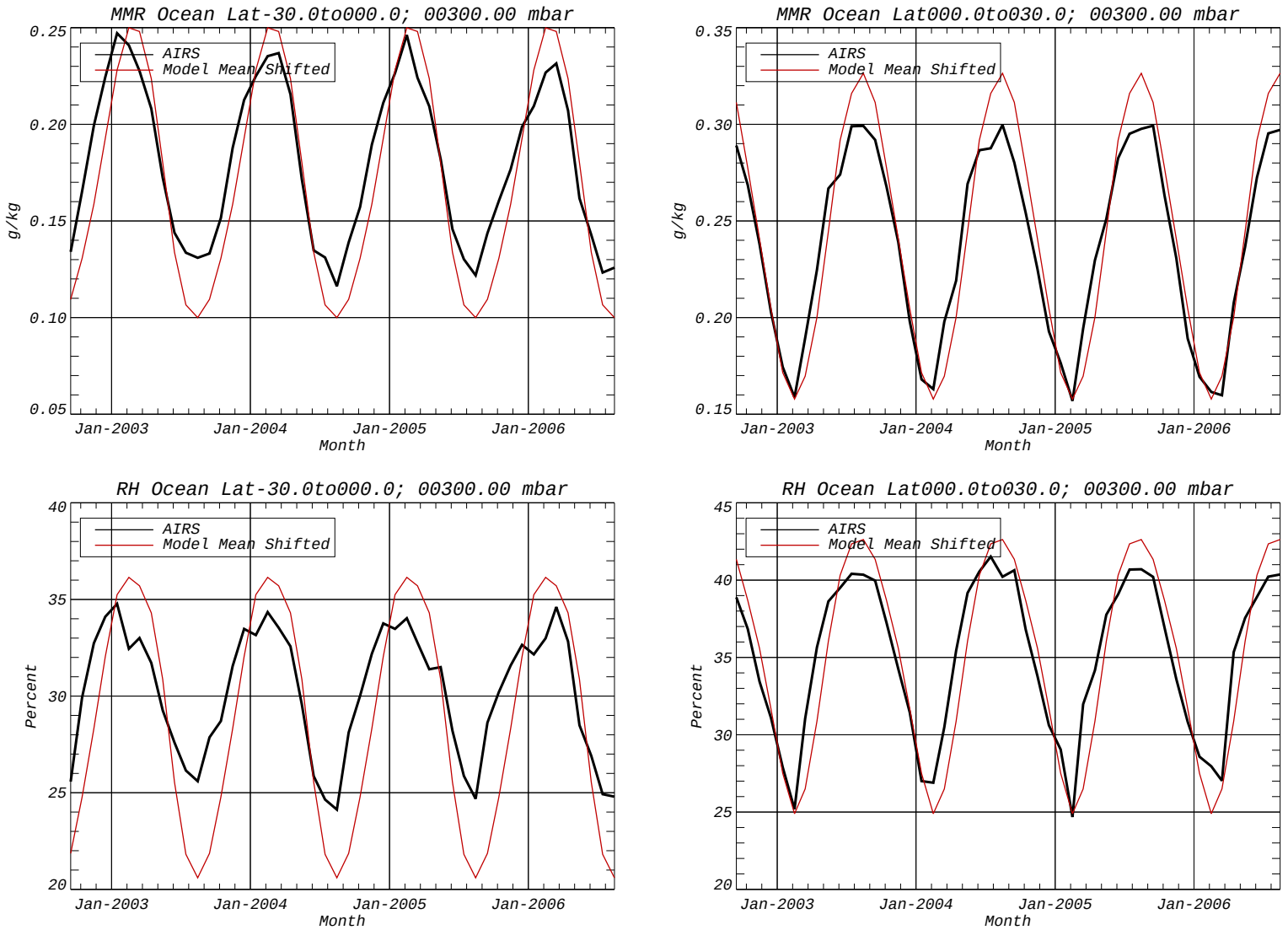
300 mbar



- AIRS leads the models by a few weeks.

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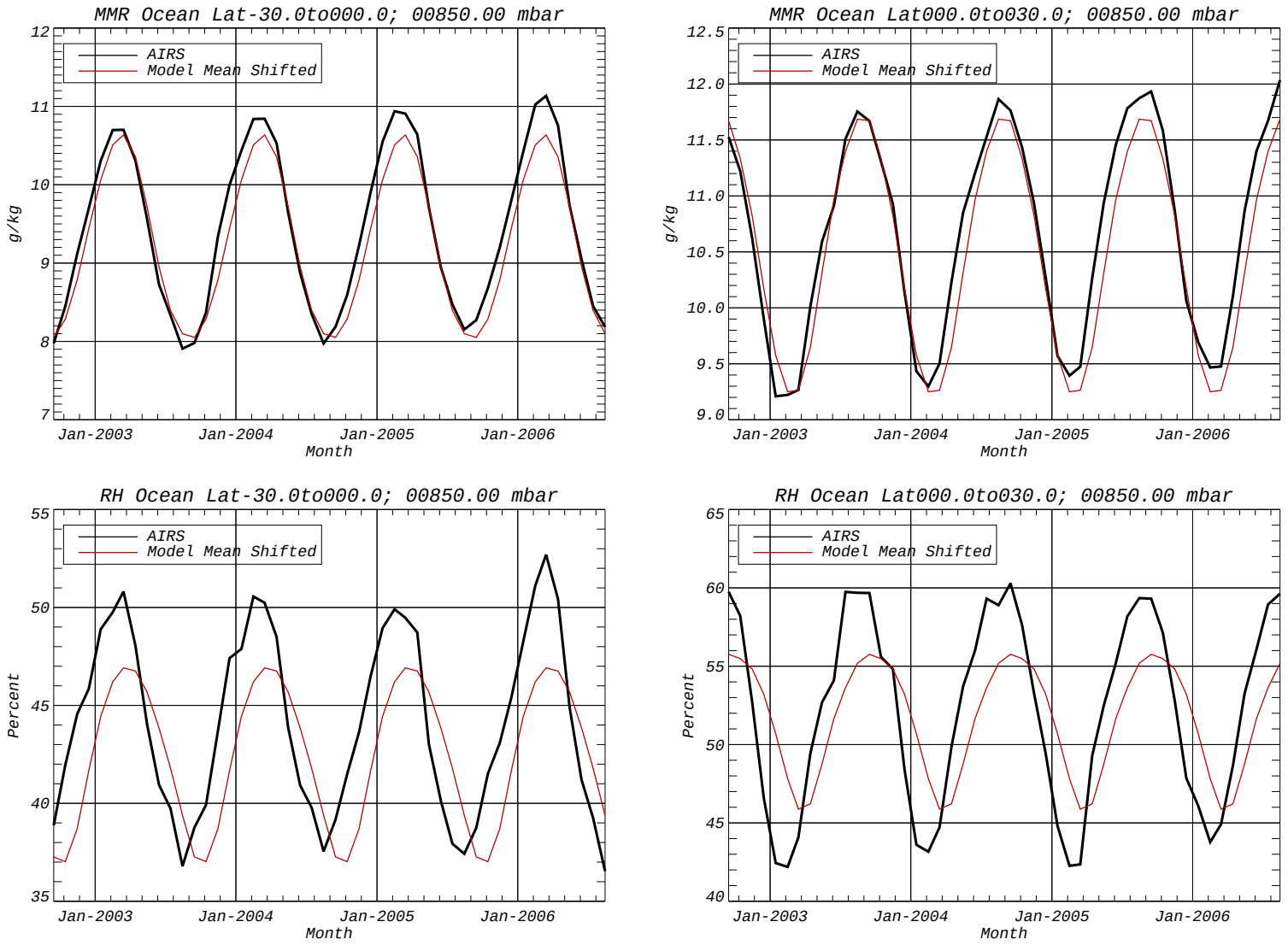
850 mbar



- The AIRS RH leads the models by more than the MMR.
- MMR may be increasing.

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Conclusions

- The AIRS H_2O Mixing Ratio and Relative Humidity show some spatial similarities to the models but there are sometimes significant differences in the spatial distribution and amounts.
- The AIRS H_2O parameters tend to lead the models by a few weeks.
- H_2O MMR may be increasing at 850 mbar.

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Extra Slides

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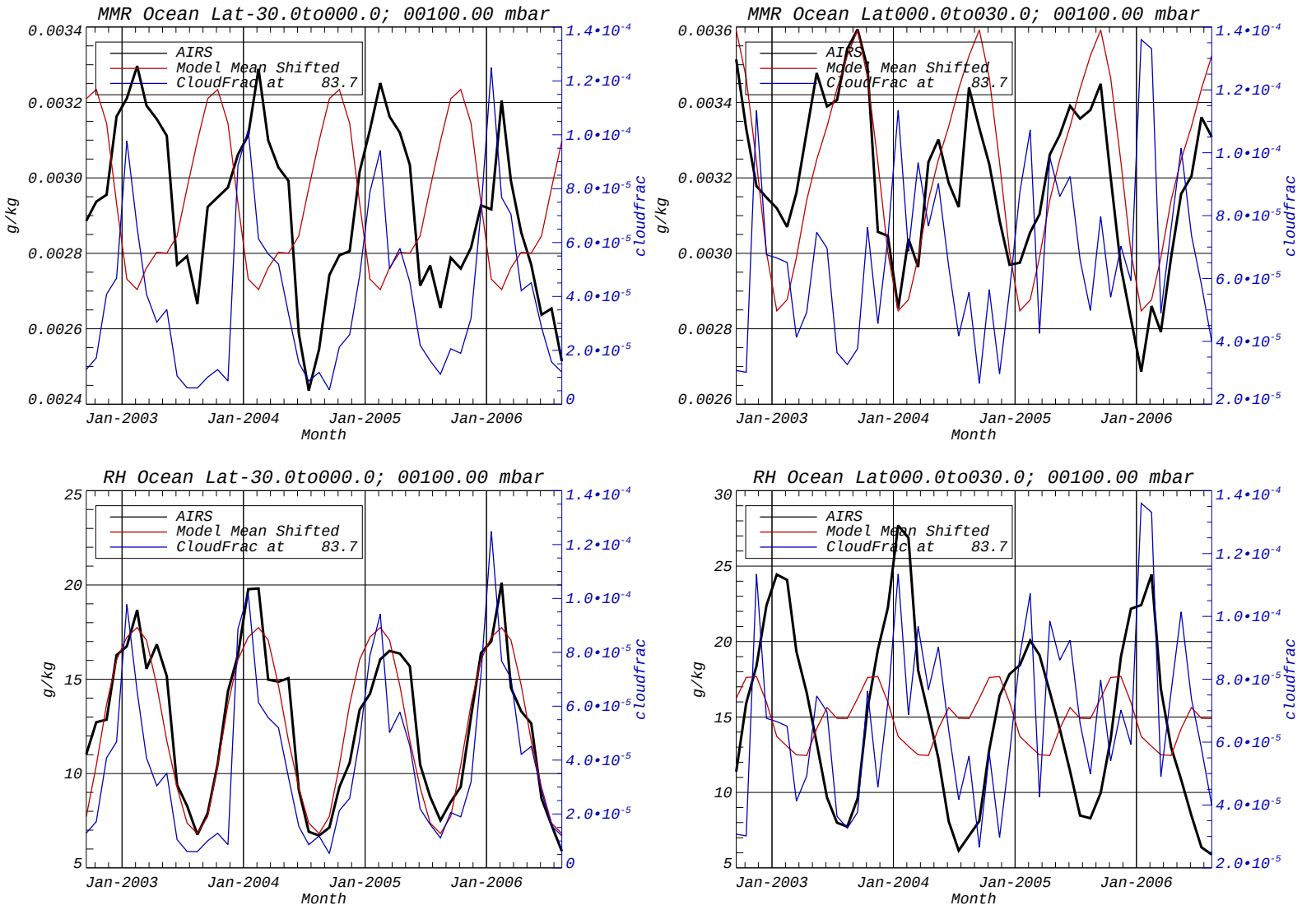
100 mbar



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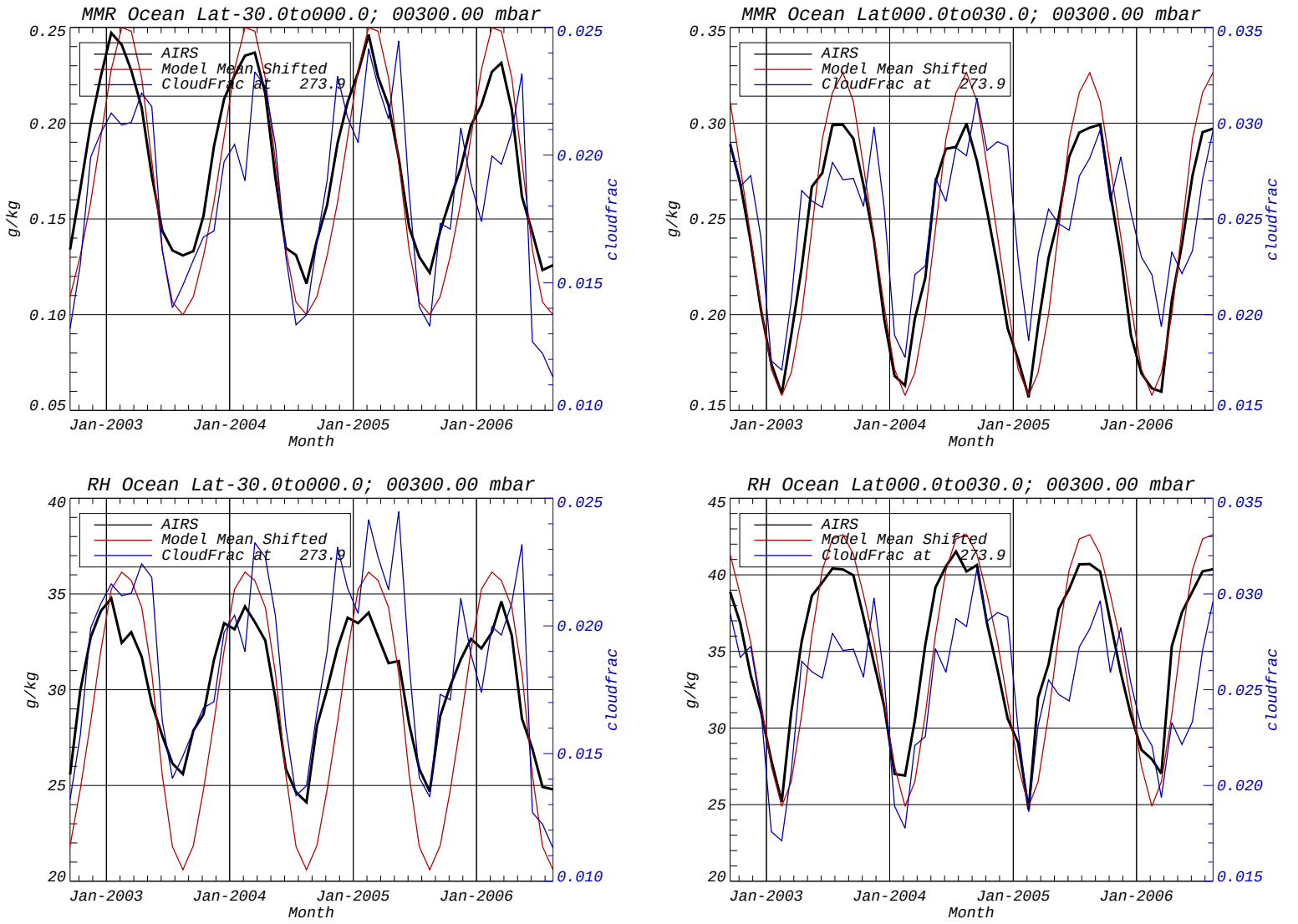
300 mbar



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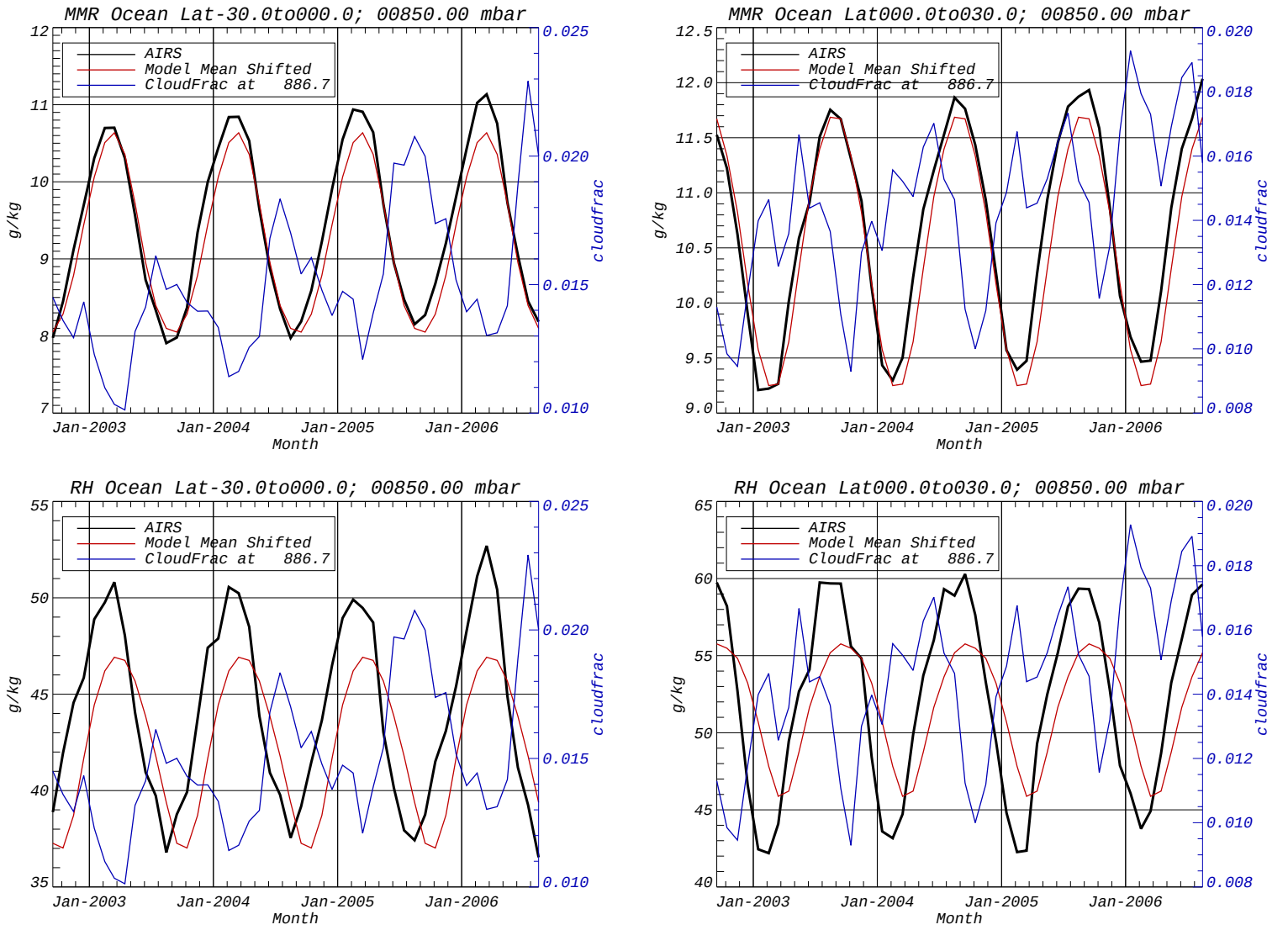
850 mbar