

Assimilation of AIRS cloud-cleared radiances to improve tropical cyclone intensity forecast in the NASA GEOS-5

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Motivation and Outline

- Aside from the difficulties with AIRSv6, the lesson learnt from previous research is the importance of assimilating data in cloudy areas, to improve the representation of TCs in the analysis
- Published AIRS impact studies emphasized the difficulty of analysing some TCs and demonstrated that AIRS data can produce a more confined and better placed TC in the analysis, leading to improved forecasts
- Improved analyses in cloudy regions also improve the moist low-level transport associated with extreme precipitation events.
- **New experiments** with GEOS-5 assimilating cloud-cleared radiances and covering the 2014 TC season
- Assimilation of clear sky radiances as a reference
- Evaluation of global skill, TC analysis, TC intensity forecast

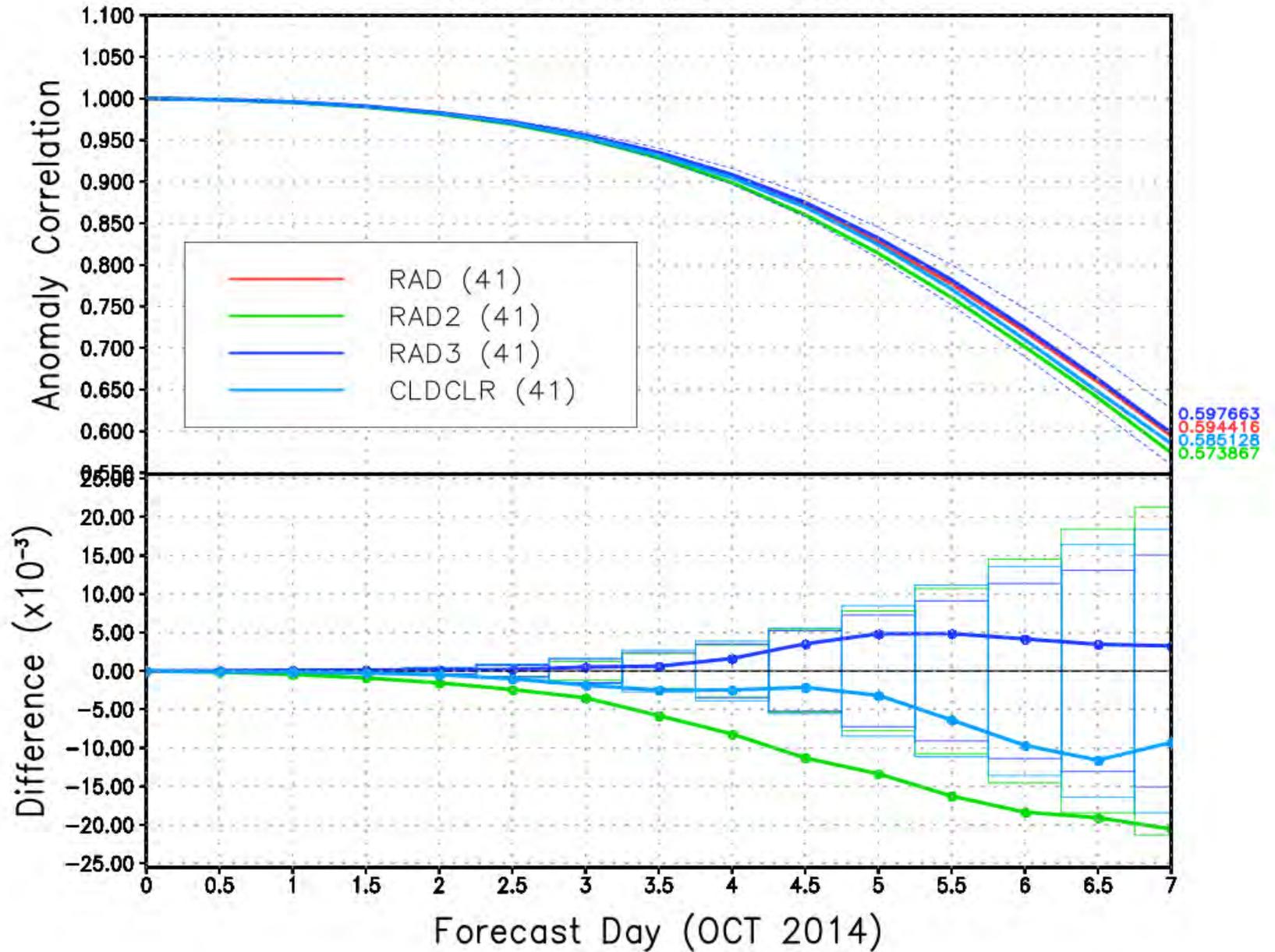
AIRS experiments settings

- **GEOS-5 DAS**: versions **5-13.0**
- Periods chosen: **Sep-Oct-Nov 2014**
- **RAD**: assimilating all conventional and satellite obs, AIRS clear-sky radiances with standard thinning; no vortex relocator
- **RAD2**: As RAD but with half AIRS thinning box AIRS (~4 times more data), as a lower-bound performance for global skill
- **RAD3**: As RAD but with double AIRS thinning box (~4 times less data) as an upper-bound performance for global skill
- **CLDCLR** As RAD but with Cloud-Cleared radiances assimilated
- **10-day Forecasts** at 0.25 degrees

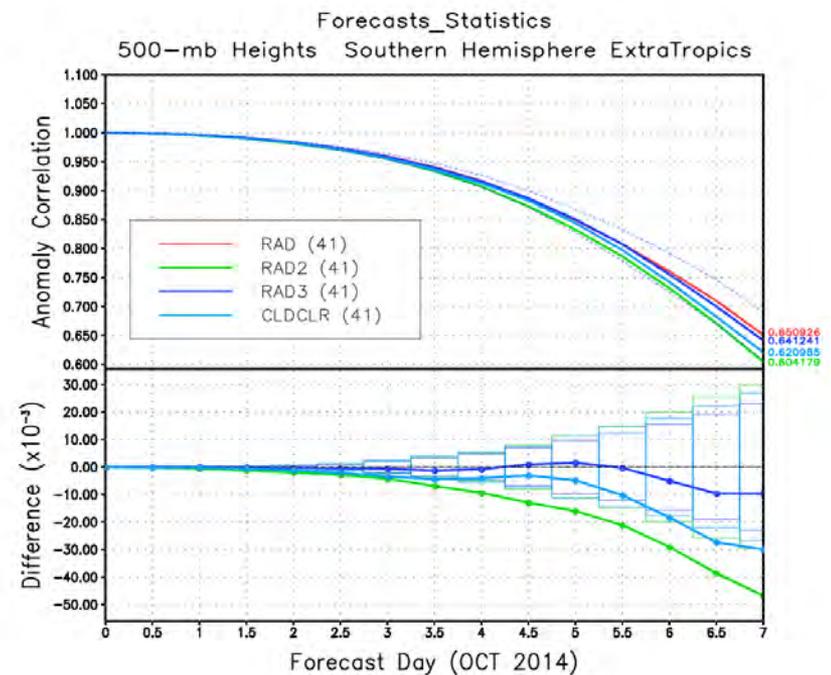
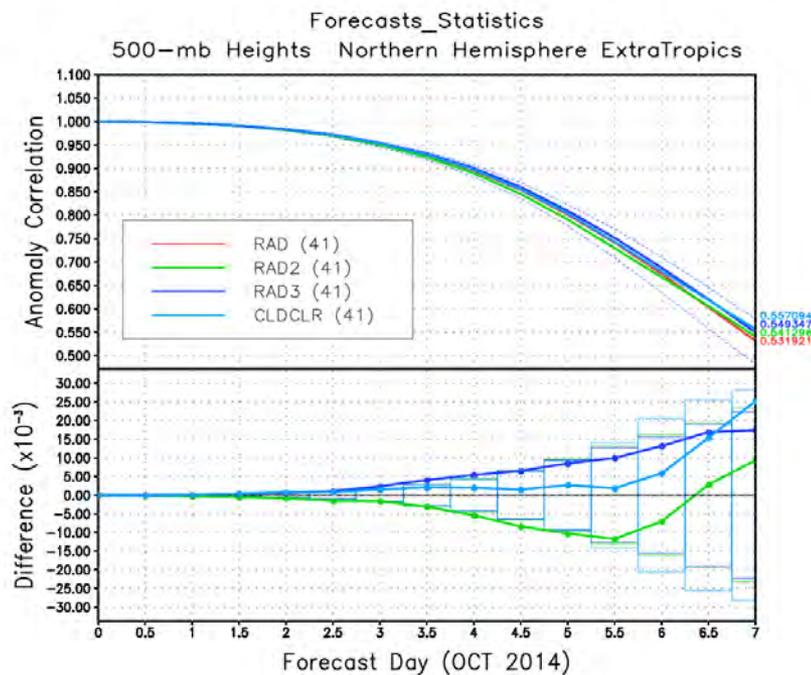


Forecasts_Statistics

500-mb Heights Global



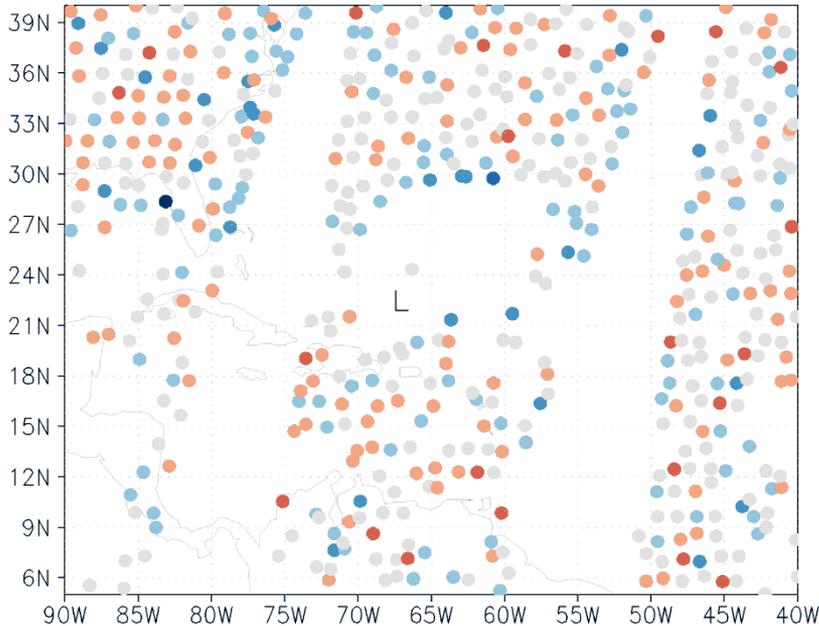
Contrasting impact in the two hemispheres, but not very significant



Coverage around Hurricane Gonzalo

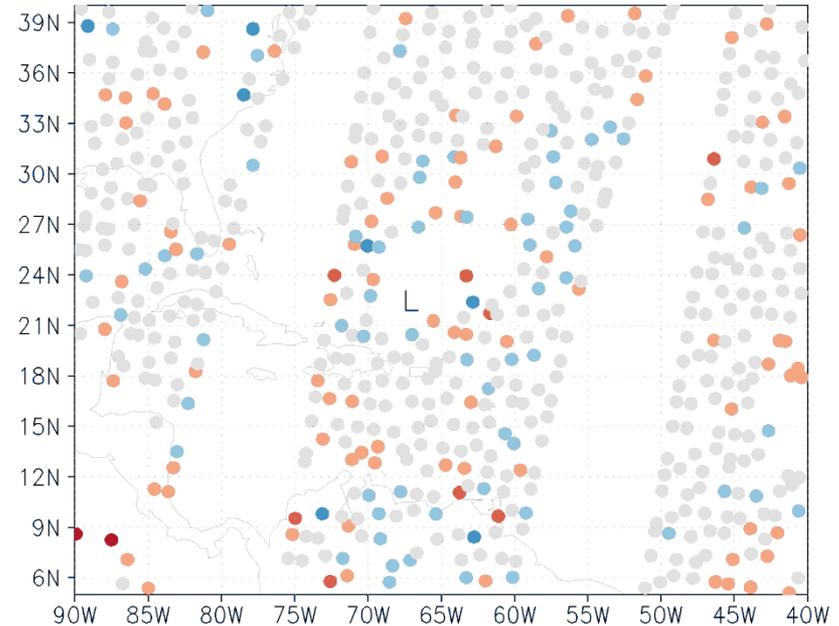
CNTRL

Assimilated AIRS Data
06Z15OCT2014, Channel 169



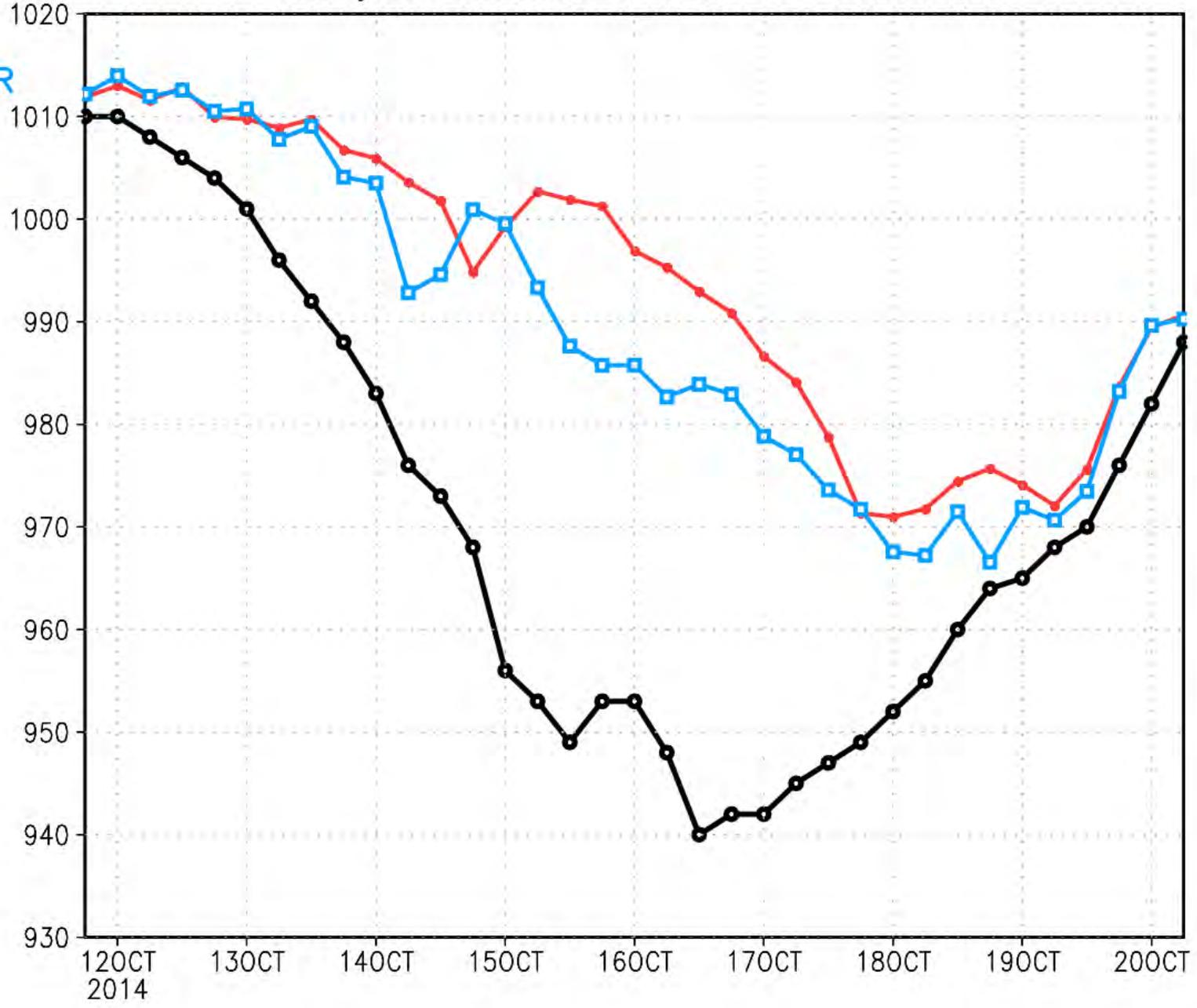
CLDCLR

Assimilated AIRS Data
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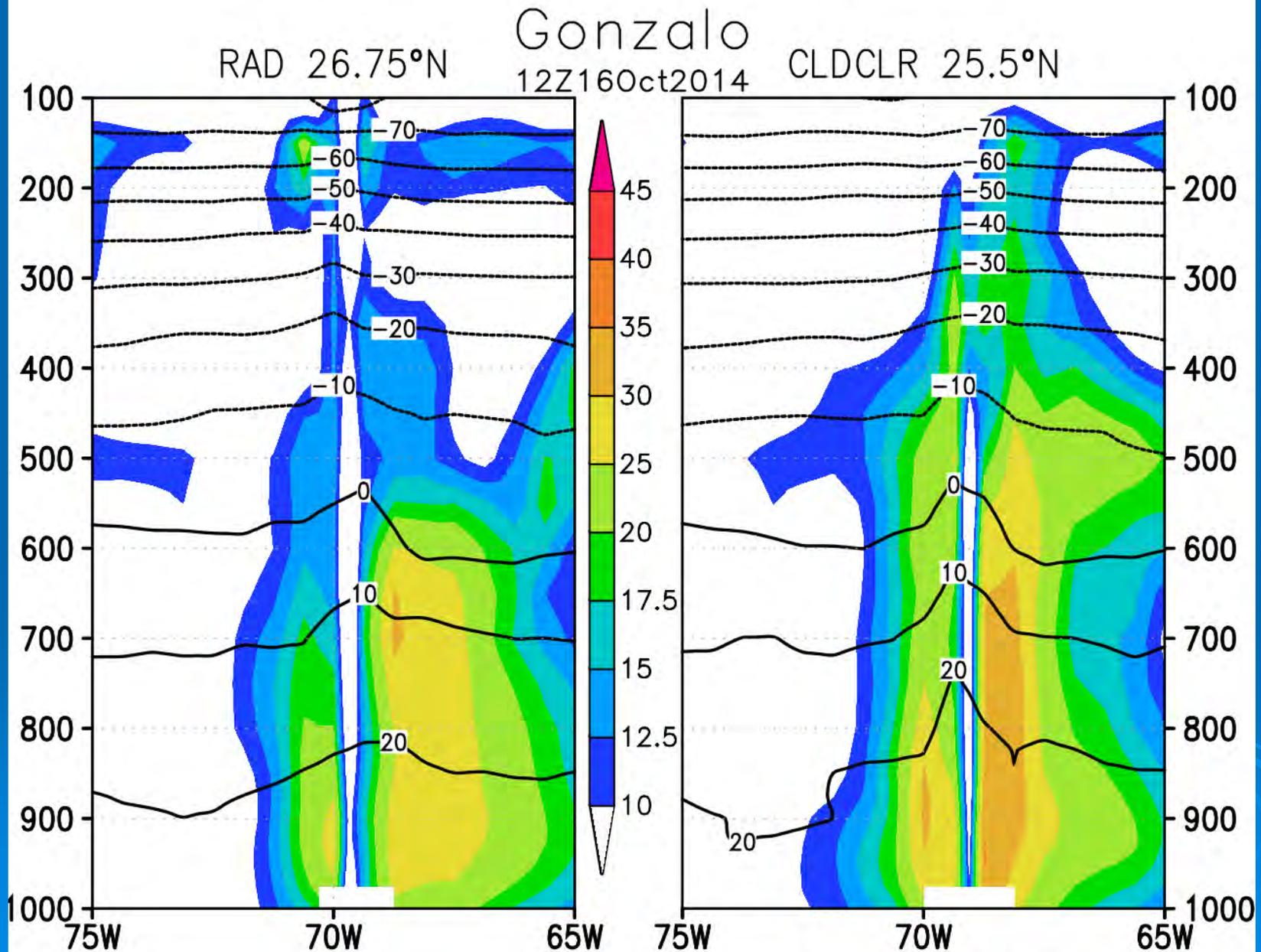


Analysis Minimum SLP for Gonzalo

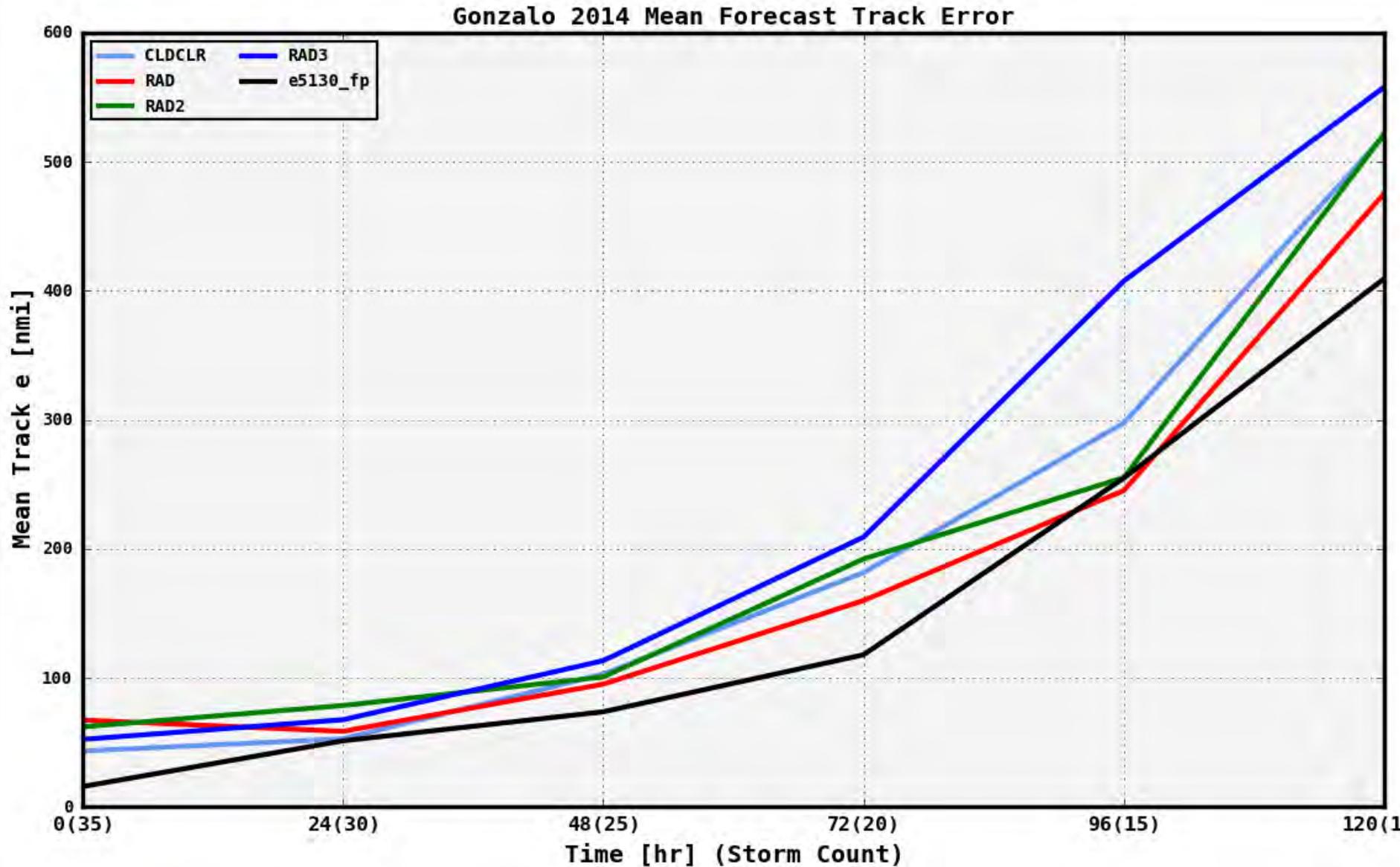
OBS
RAD
CLDCLR



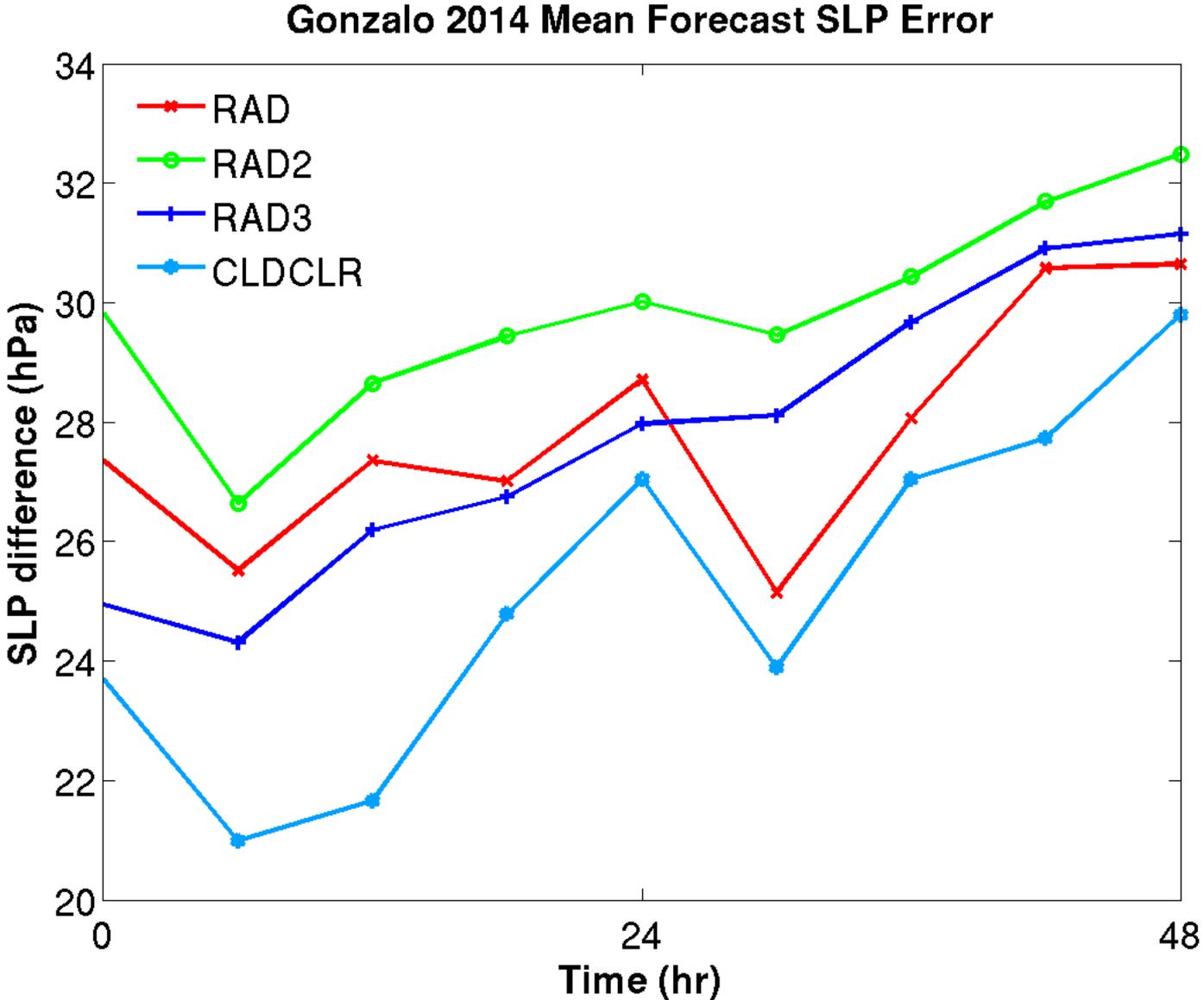
Gonzalo



No degradation of track forecast in the 48 hour range

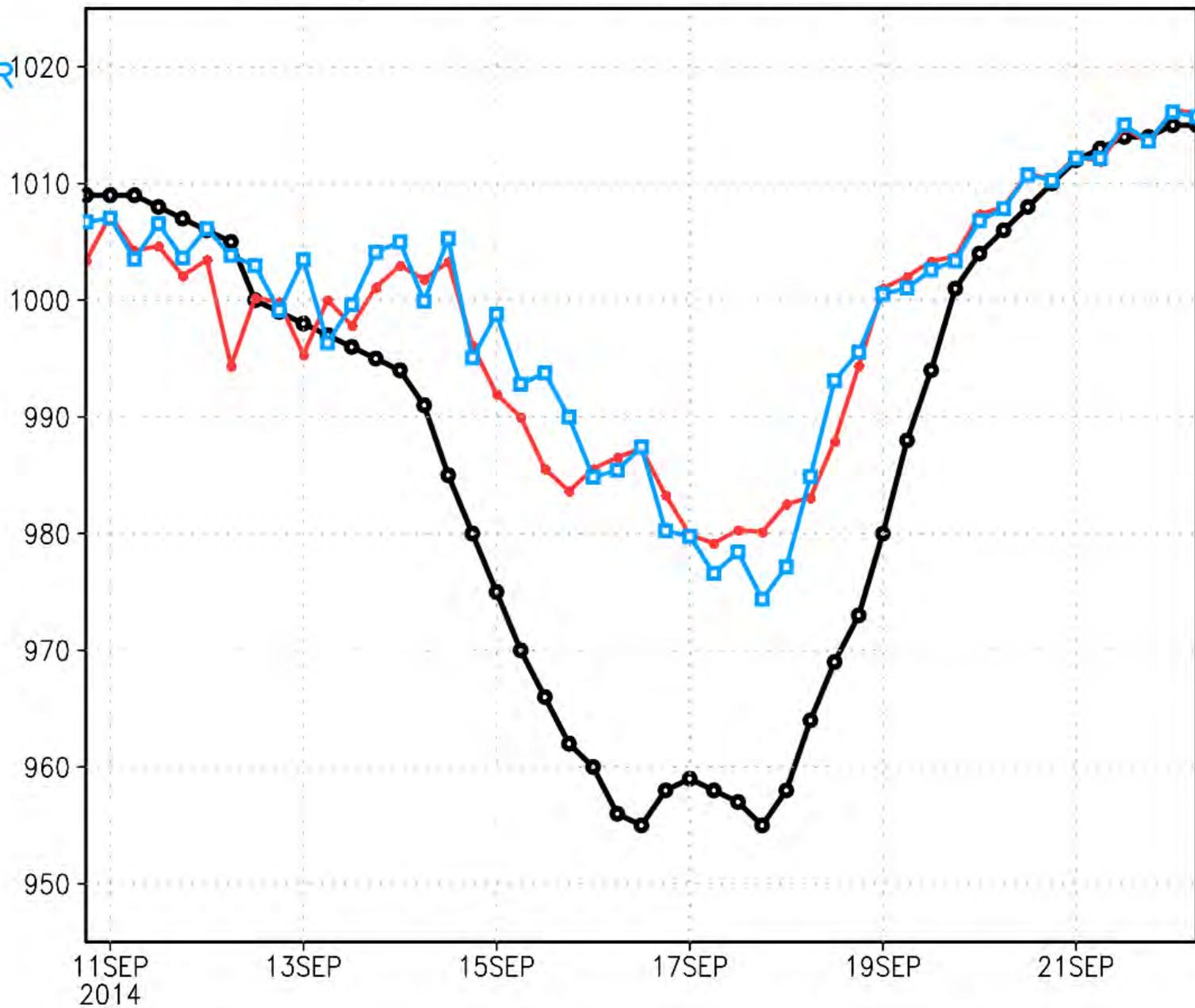


Substantial improvement in intensity forecast up to 2 days

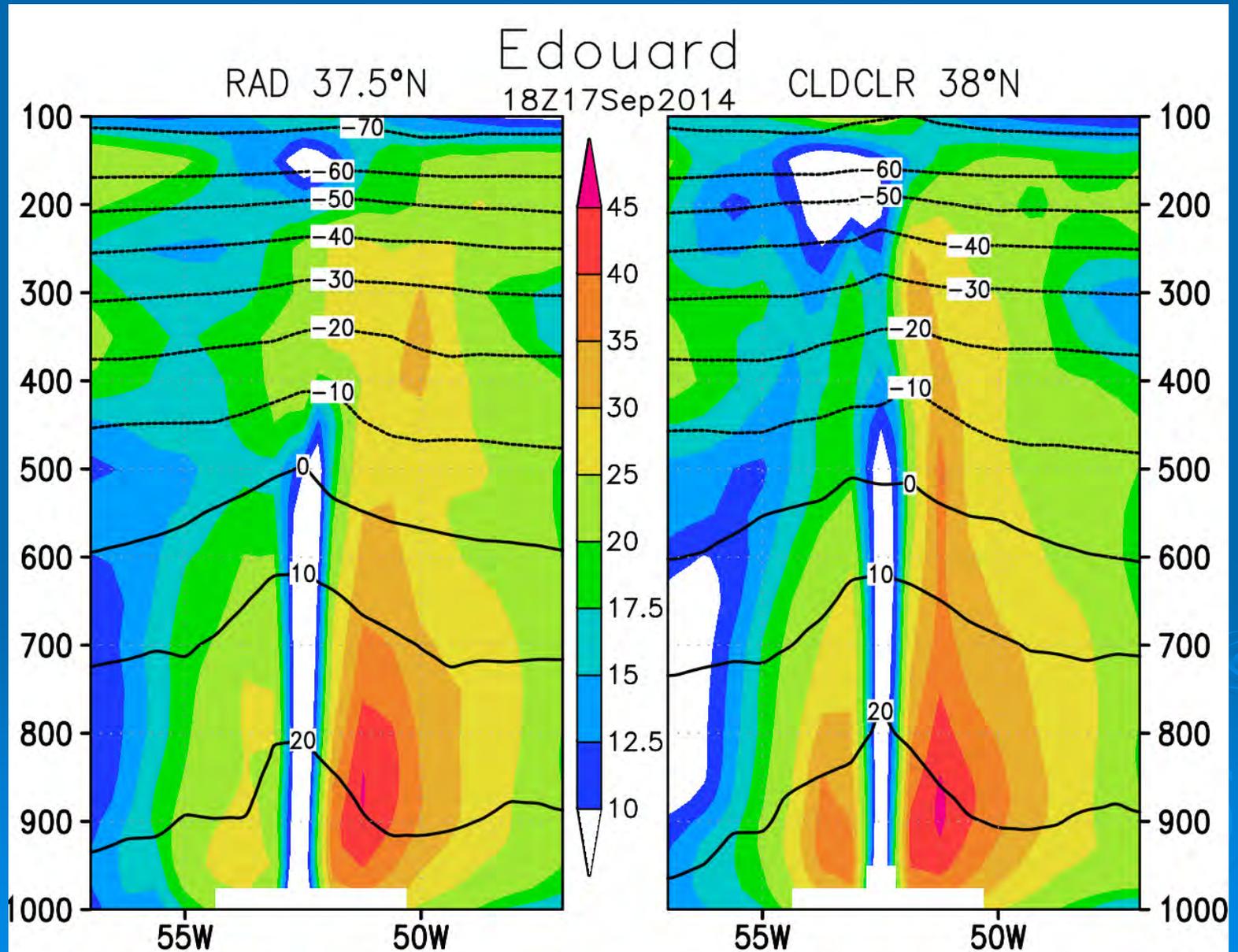


Analysis Minimum SLP for Edouard

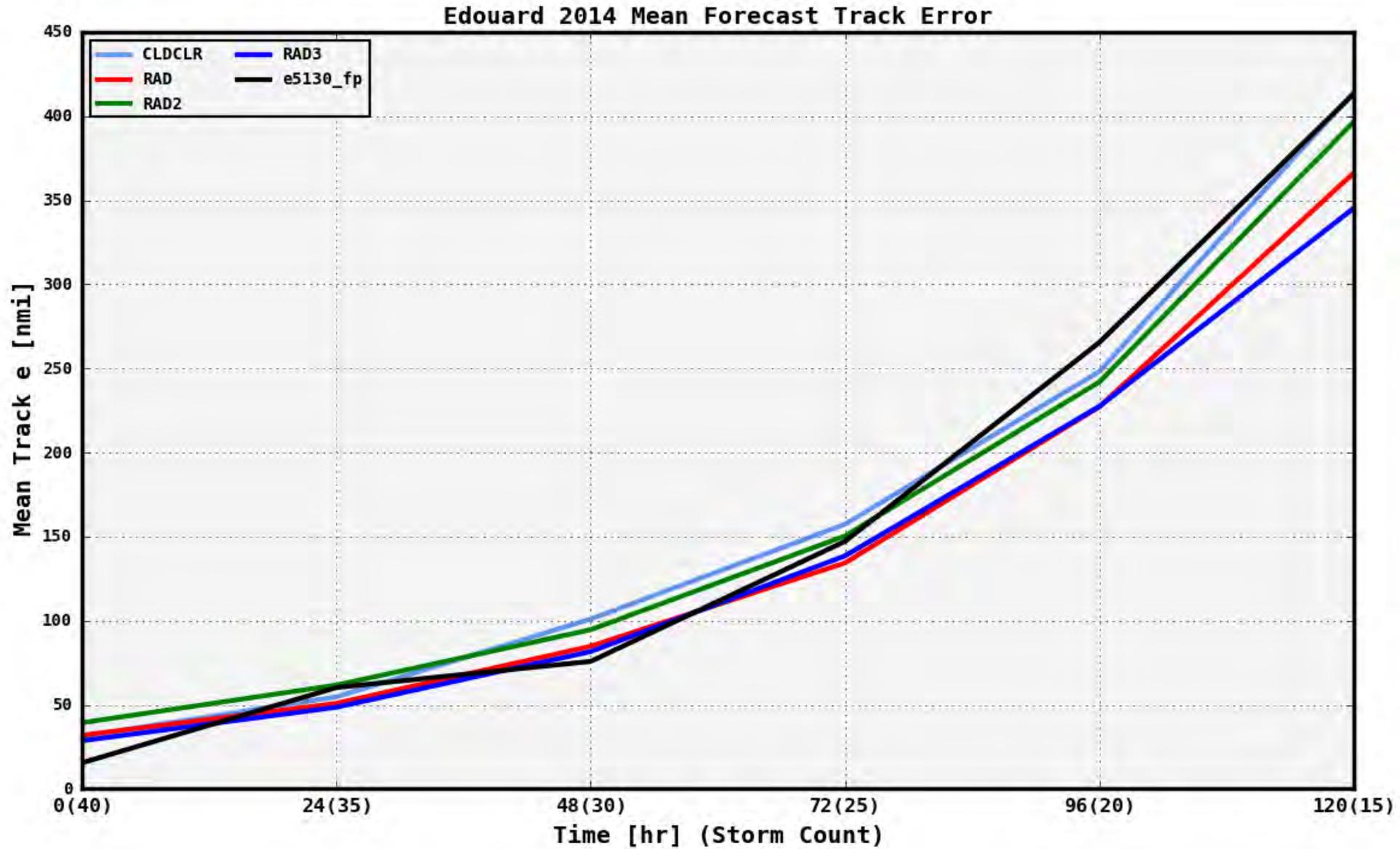
OBS
RAD
CLDCLR



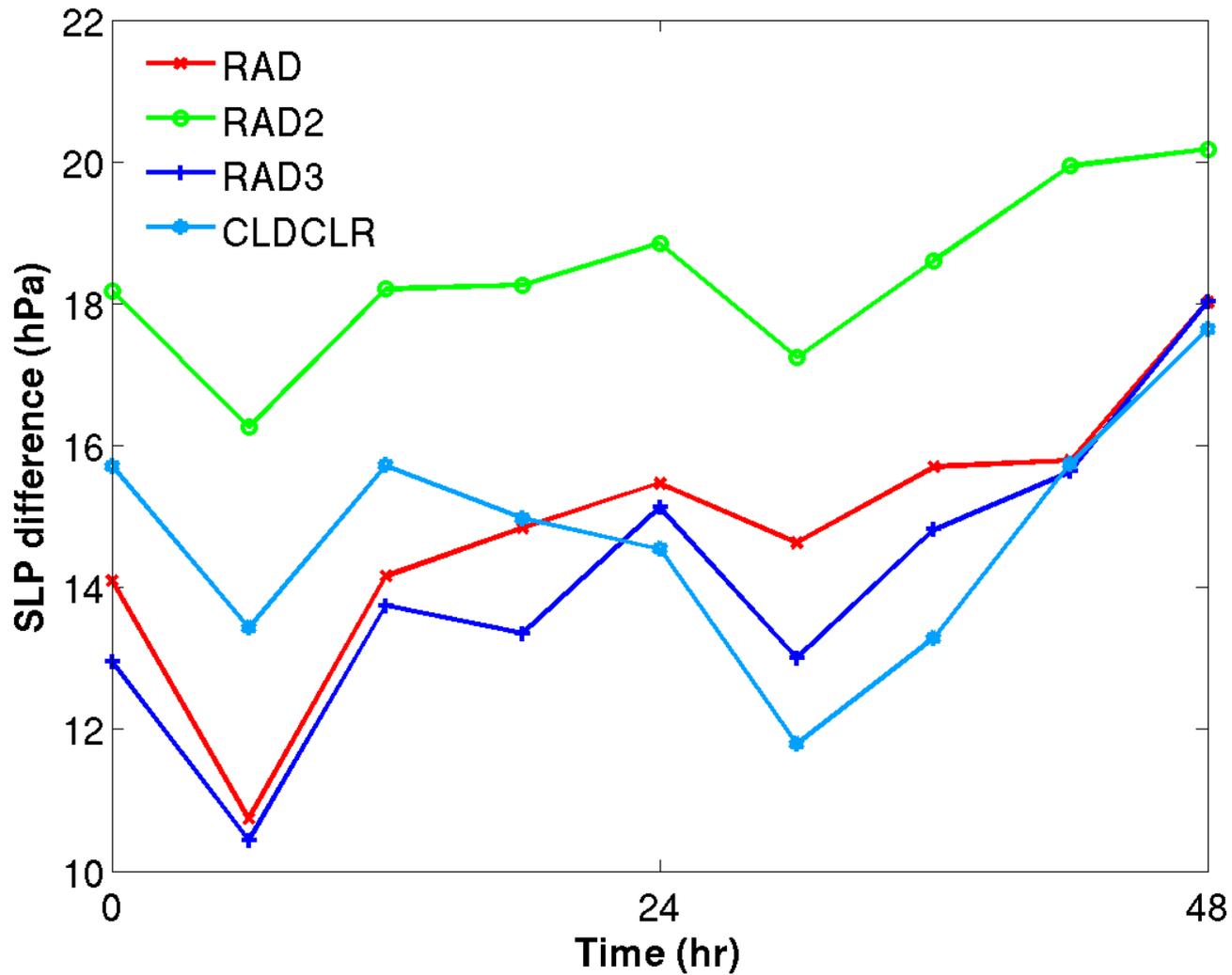
Improved analyzed vertical structure



Negligible impact on track forecast



Edouard 2014 Mean Forecast SLP Error

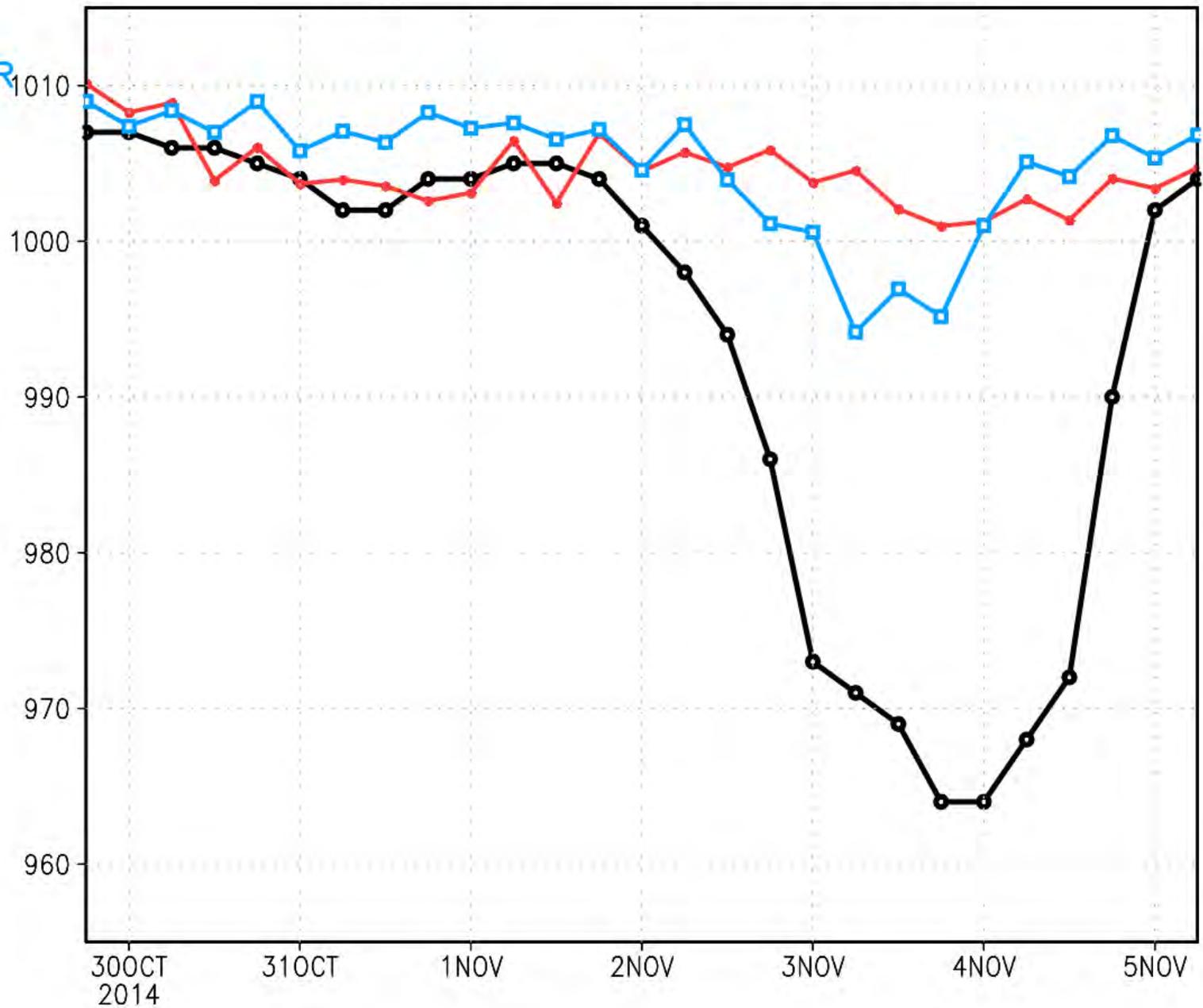


Analysis Minimum SLP for Vance

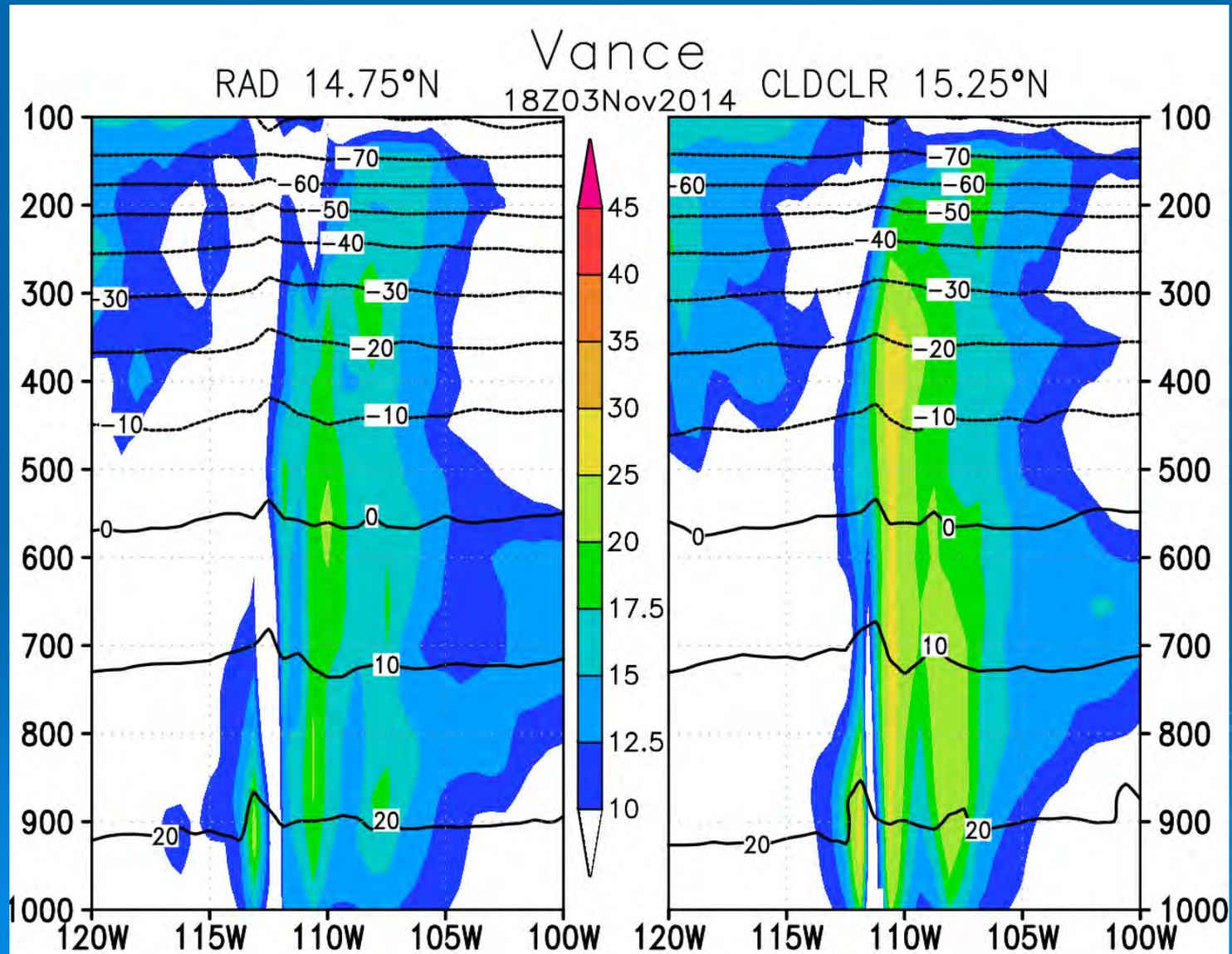
OBS

RAD

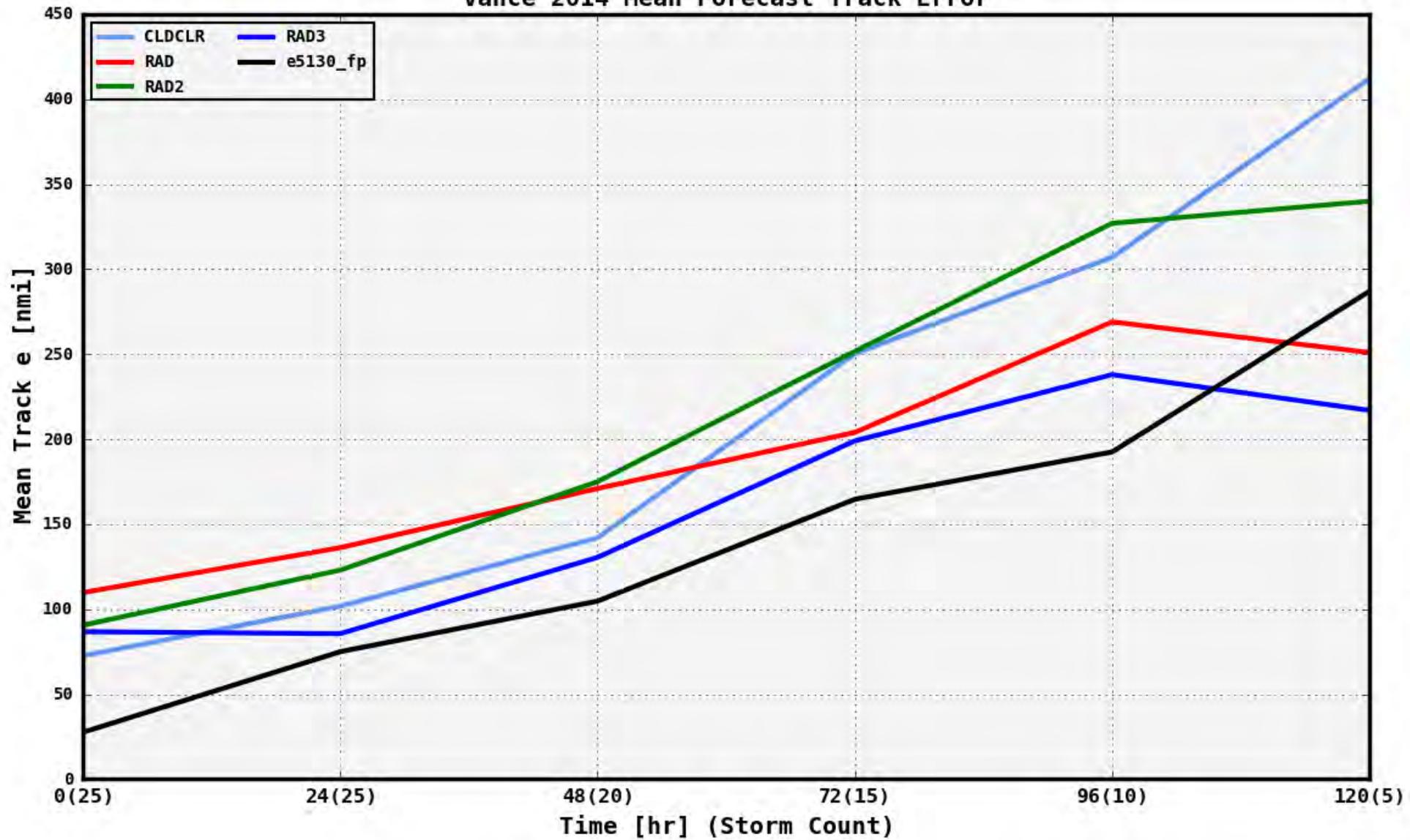
CLDCLR



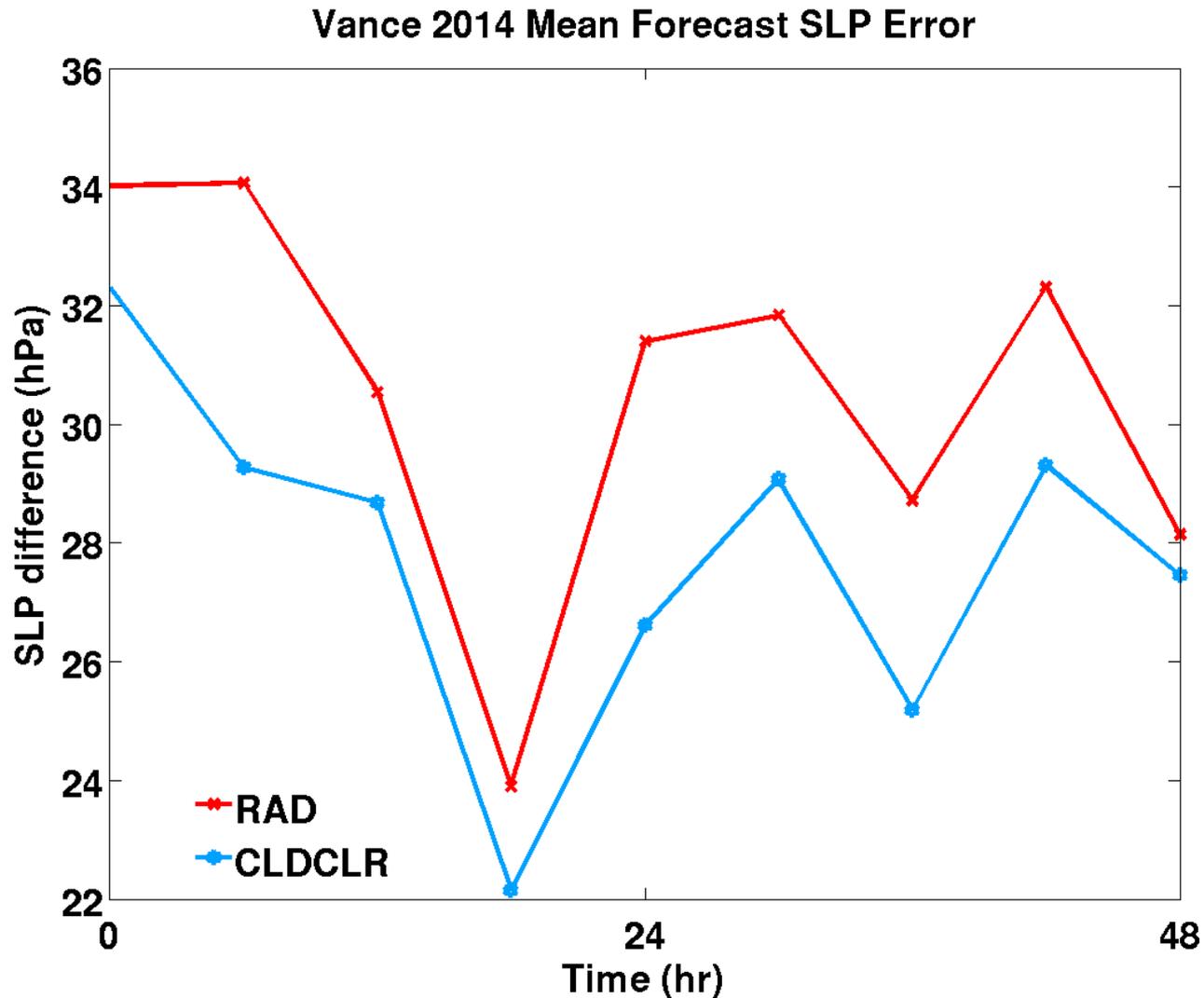
Vertical structure improves



Vance 2014 Mean Forecast Track Error



Intensity forecast improves up to 48 hours



Conclusions

Assimilation of cloud-cleared AIRS radiances in the NASA GEOS-5:

- Does not affect global forecast skill significantly
- Does not degrade TC track forecast
- **Improves** TC analysis in terms of intensity (slp, wind) and structure
- **Improves** 48-hour **intensity forecast**

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AIRS-related articles published by this team

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Zhou, Y., W. K. Lau, O. Reale, R. Rosenberg, 2010: AIRS Impact on precipitation analysis and forecast of tropical cyclones in a global data assimilation and forecasting system. Geophysical Research Letters, 37, L02806, doi:10.1029/2009GL041494.

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