# An Antarctic assessment of surface and mid-tropospheric pressure and temperature in the latest generation of global atmospheric re-analysis datasets

## Introduction

Here six different re-analysis datasets are assessed (CFSR, ERA-40, ERA-Interim, JRA-25, MERRA and NNR1) to determine a best estimate of variability and change since 1979 when the widespread monitoring of the atmosphere from satellites was introduced.

# **Reanalysis compared to assimilated SLP** and SAT observations











**Fig. 3.** Differences in annual mean sea level pressure between different re-analyses and in-situ observations for the period 1989-1999. The title of each panel shows the root mean square error (RMSE) average from subsets of stations in the following locations: coastal stations in the western hemisphere; the Antarctic interior (stations south of 78S); and coastal stations in the eastern hemisphere.

Name (full name)	Horizontal grid (approx. grid size at 50° latitude)
<b>CFSR</b> (NCEP Climate Forecast System Reanalysis)	T382 (~ 34 km)
<b>ERA-40</b> (European Centre for Medium Range Weather Forecasting 40 Year Re-analysis)	T159 (N80; ~125 km)
<b>ERA-Interim</b> (European Centre for Medium Range Weather Forecasting Interim Re-analysis)	T255 (N128; ~79 km)
JRA-25 (Japanese 25-year Reanalysis)	T106 (~120 km)
<b>MERRA</b> (NASA Modern Era Retrospective- Analysis for Research and Applications)	0.5°×0.67° (~50 km)
<b>NNR1</b> (National Centers for Environmental Prediction (NCEP) / NCAR (National Center for Atmospheric Research) Reanalysis 1)	T62 (~210 km)



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# **Reanalyses compared to independent SLP** observations

The performance of recently released re-analysis datasets (CFSR, MERRA and ERA-Interim) over Antarctica has not been rigorously assessed. For an assessment of accuracy in the region of interest a comparison with ice drifter (CALIB) MSLP data over the Bellingshausen Sea (Feb-May 2001) was conducted. This represents an independent test since the data were not released onto the GTS.







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# SAT and orography height







## Mid-troposphere temperature trends.

• ERA-Interim is the most accurate of the six re-analyses. CFSR, ERA-40 and MERRA showed mean biases within the CALIB instrumental error. • Decadal variations of westerly winds congruent with the observed increases in the southern annular mode (SAM) are a consistent feature across the reanalysis datasets.

• In terms of year-to-year variability, the annual mean westerly winds over the Amundsen Sea were found to be weakly correlated with ENSO.





**Fig. 6.** Time series of  $\Delta P_{AS}$  derived from CFSR and MERRA normalised by the standard deviation of year-to-year variability plotted with: (a) the annual NINO3.4 index, (b) the summer SAM index (Marshall (2003)), and (c) the winter SAM index.