



Extra-tropical cyclones

James Renwick

Victoria University, SGEES

james.renwick@vuw.ac.nz

Grand Challenge on Extremes – Data Workshop: UNSW 25-27 Feb 2015

Climate Change
Research Centre



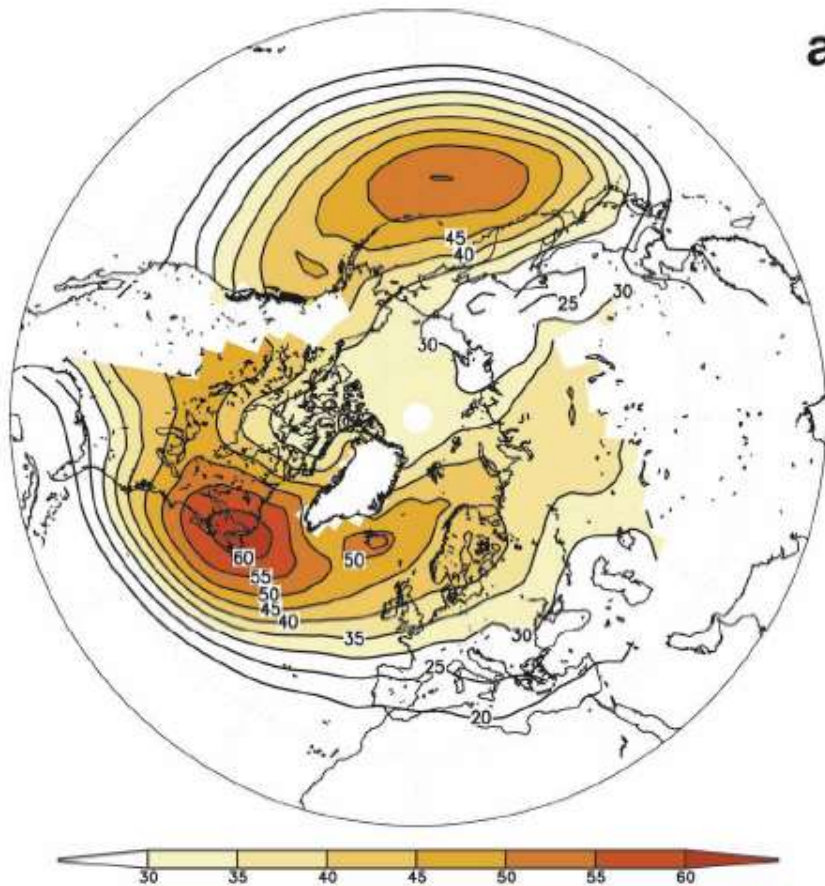
ARC CENTRE OF EXCELLENCE FOR
CLIMATE SYSTEM SCIENCE

WCRP
World Climate Research Programme

Issues/data

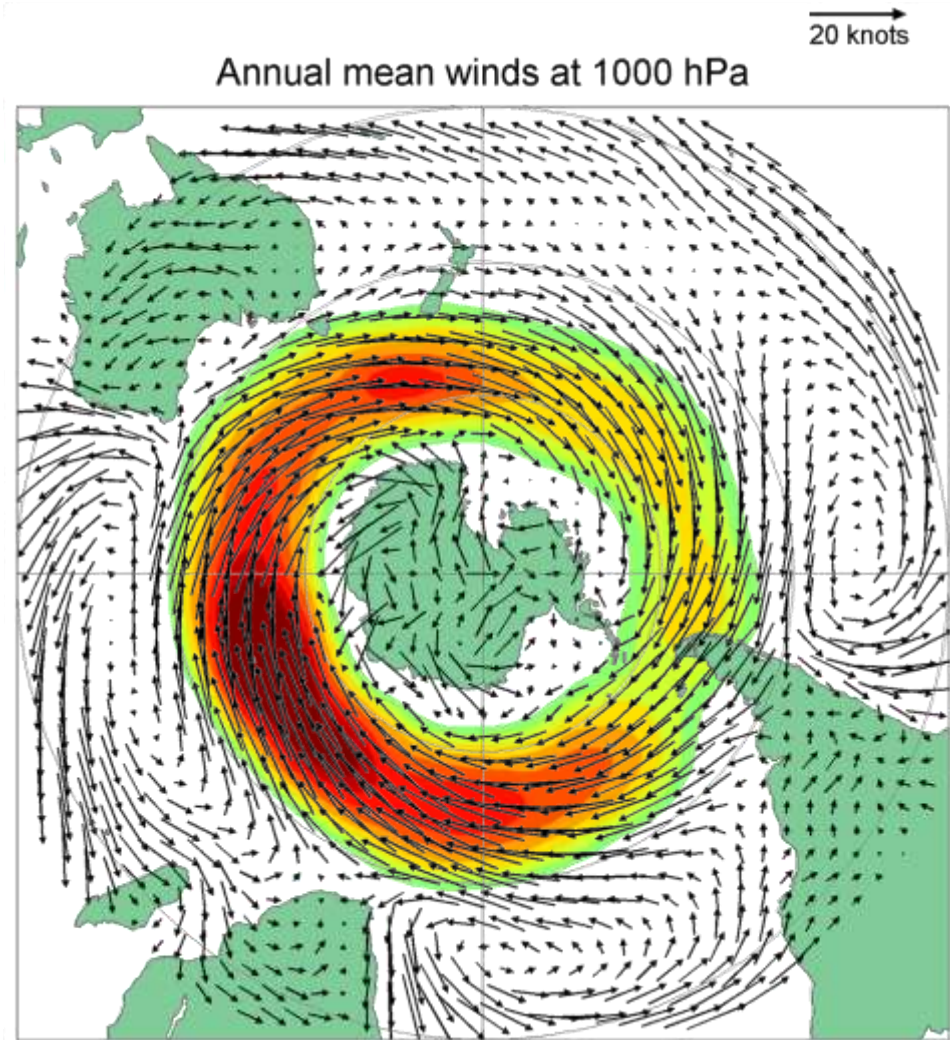
- Extra-tropical cyclones →
 - atmospheric dynamics, large-scale circulation
 - Precipitation, winds, pressure gradients
- Large-scale setting
 - Modes of variability
 - Meridional temperature gradient
 - Baroclinicity
- Data – MSLP, ground-based obs
 - Satellite/remotely sensed observations
 - Analyses, reanalyses, model output
 - Storm track 'data sets' (e.g. U. Melbourne)

Average Storm Tracks



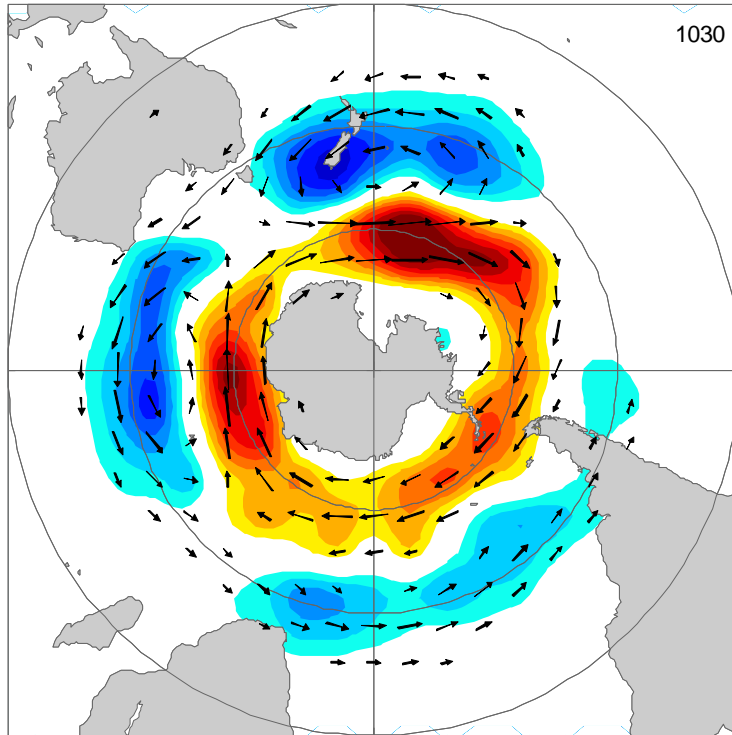
Ulbrich et al (2008), J.Cli

a)

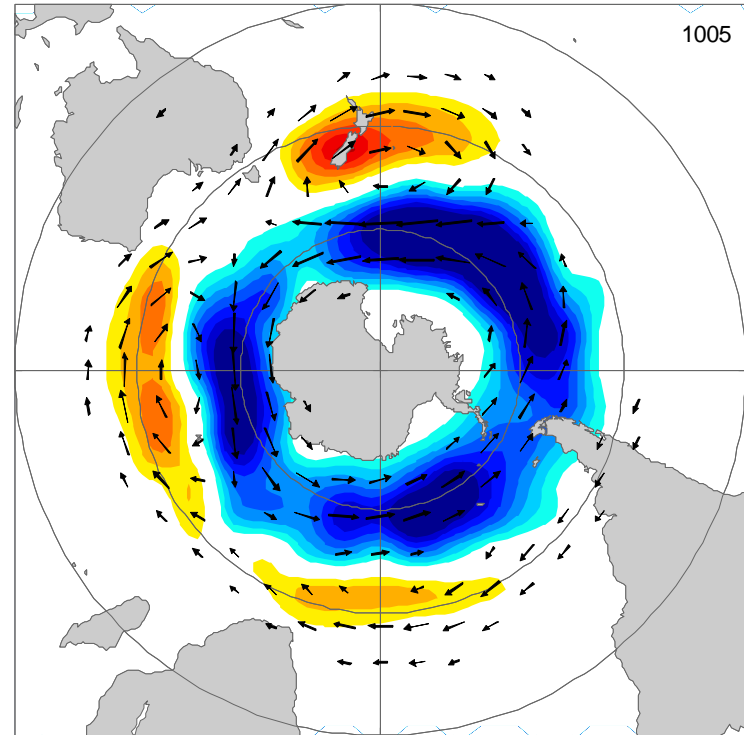


Large-scale variability: SAM

SAM+ composites, NDJFM



SAM- composites, NDJFM

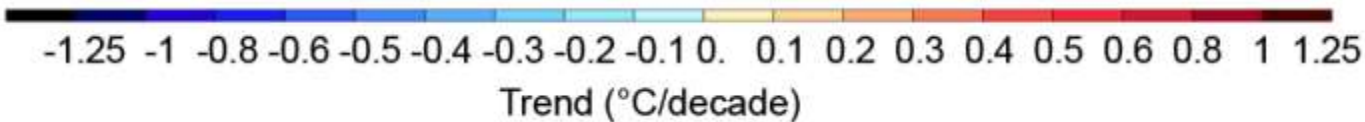
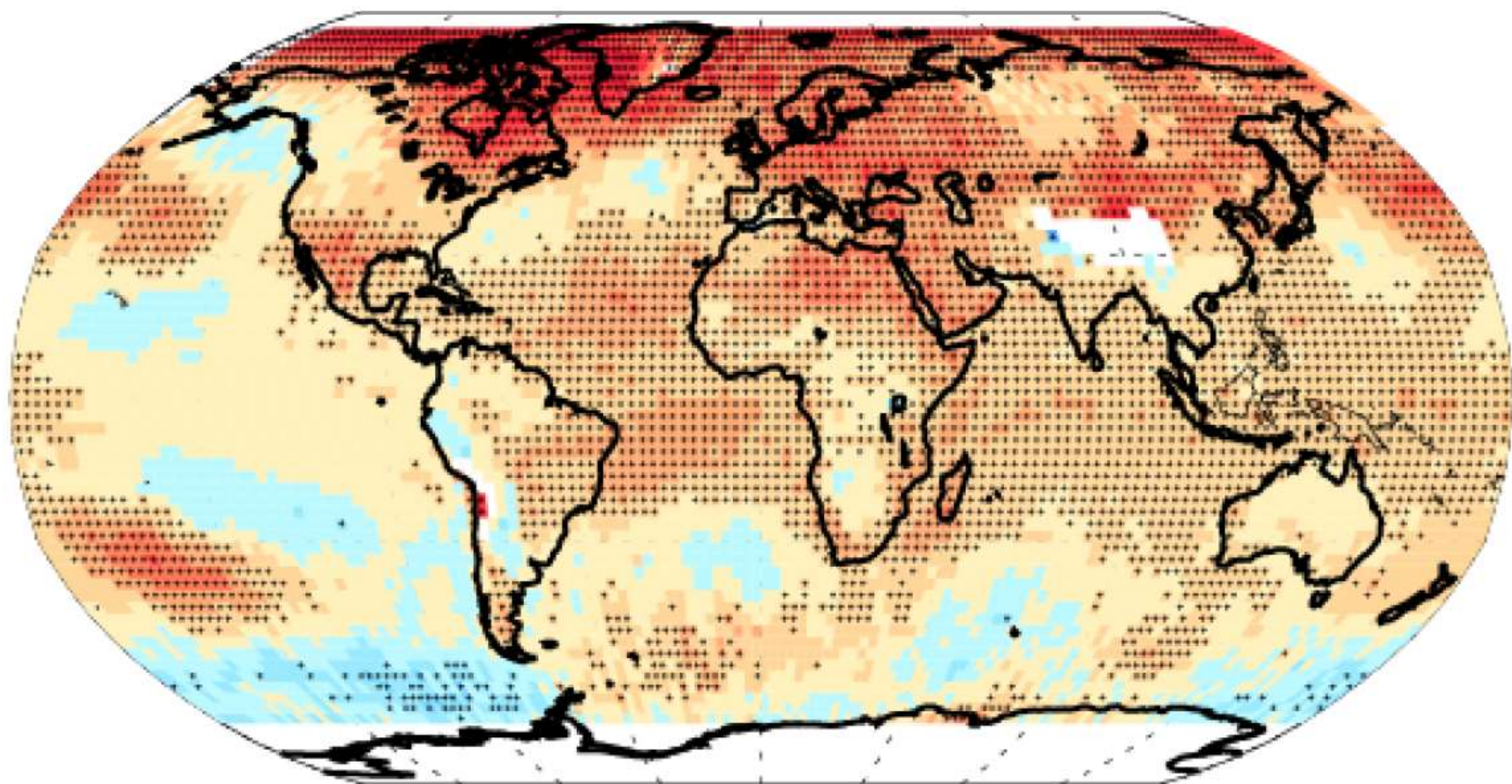


- Also ENSO, NAO, etc

Trends

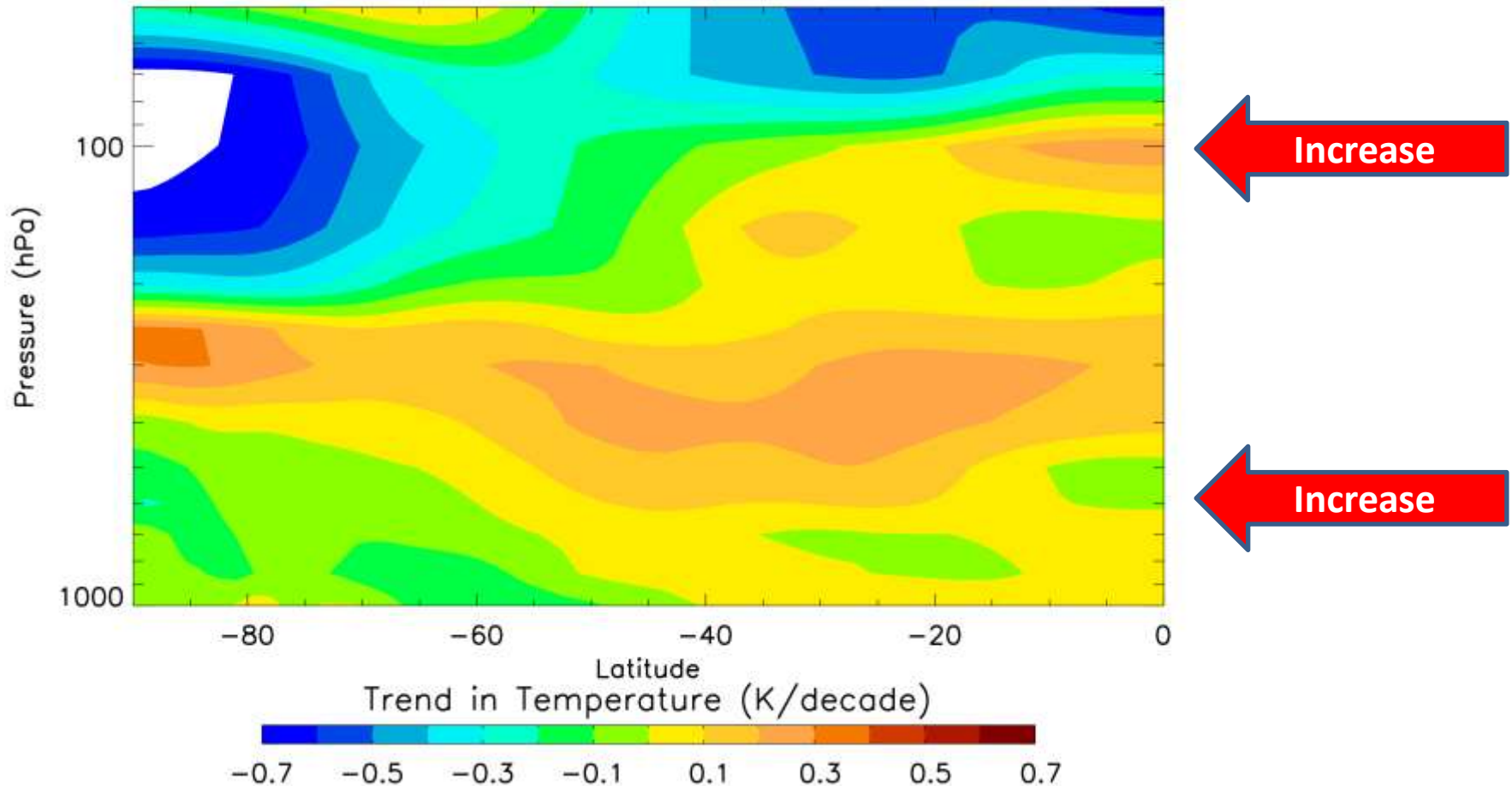
- Storm track shifts & intensity sensitive to
 - Change in meridional temperature gradient, surface and tropopause-level
 - Changes in static stability, baroclinicity
- Storm-associated extremes sensitive to
 - Temperature & temperature gradients
 - Atmospheric moisture
 - Storm intensity
- Indications of
 - Stronger extreme storms
 - Somewhat reduced numbers overall
 - Uncertainties, sensitivity to analysis technique

Meridional Temperature Gradient



Temperature Gradient: SH

ERA-Interim 1979-2012



- Increased dT/dy → poleward shift in storm track/jet
 - NH situation murkier, basins behave differently

Engagement

- “Data” community and “dynamics” community
- Wind data, pressure gradients, storm surge etc
- Reanalysis products
 - Improved synthesis, boundary conditions, DARE
 - Rescue of historic hand-drawn charts?
- Model output, CMIPx
- Dynamical interpretation of regional extremes