ANTARCTIC CLIMATE & ECOSYSTEMS
COOPERATIVE RESEARCH CENTRE

ACE CRC Intern Project for 2015/16 **Number: RP1.4_01**

Supervisors: Dr Andrew Klekociuk and Dr Jason Roberts

ACE CRC Project (RP): 1.4

Project Title: Ventilation of Law Dome over the 20th Century

Background/context of project:

Atmospheric trajectory analysis is a useful tool for understanding the driving mechanism of climate phenomena and for defining the source region for local precipitation. However, such analysis is computationally demanding and requires suitable high quality atmospheric reanalysis data as a primary input. Applications focusing on Antarctica and the high latitude Southern Ocean have been hindered by the lack of high quality long term reanalysis, especially coupled with driving climate modes with up to multi-decadal time-scales. The recent publication of the ECMWF ERA 20th century reanalysis (ERA-20C) offers a new opportunity to apply atmospheric back-trajectory methods to key Antarctica atmospheric circulation and moisture delivery questions.

Project outline:

The intern will perform runs of an atmospheric trajectory model and undertake analysis for a specific locations and possibly a range of atmospheric reanalysis data sets.

This will use the HYSPLIT model and ERA-20C reanalysis (and possibly also NOAA 20CR) to primarily look how air masses arriving at Law Dome are influenced by Interdecadal Pacific Oscillation (IPO) regimes. As a by-product, other climate drivers may be investigated (SAM, IOD, ENSO). The basic approach will be to take a set of trajectories and composite these in IPO positive and negative phases and see if any clear patterns emerge as to the air-mass history, sub-setting for air-masses that result in snow-fall at Law Dome. Initial post-analyse will aim to produce maps of air parcel dwell time and movement as a function of latitude and height to examine meridional and vertical motion. This will enable us to see, for example, if there is stronger downward and poleward transport in IPO positive that might be expected to be associated with expansion of the Hadley cell in this regime. Extensions to this work include further sub-setting for SAM/IOD/ENSO phase, and for more local influences (e.g. under low and high surface pressure, or low and high precipitation).

Key deliverables:

- Production of a dataset of backward and forward atmospheric trajectory data.
- Development of software and analysis to summarise and visualise the trajectory data.
- Significant progress towards production of a manuscript for submission in a high quality peer reviewed journal.

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Any specific skills required:

- This project is aimed at final year or honour level students with a physical sciences or mathematics background although other applicants will be considered on merit.
- Well-developed computing skills, with familiarity of the Linux computing environment and use of MatLab or IDL an advantage.
- An aptitude for climate research.

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