

Report on my SCAR Visiting Professor trip to the National Centre for Antarctic and Ocean Research, Goa, India

I visited NCAOR in Goa over 3 – 14 October 2016 under the SCAR Visiting Professor programme. My visit involved giving a series of lectures on Antarctic climate and climate change, discussions with a number of scientists engaged in Antarctic research and data management, and conducting a small research project concerned with the climate of Dronning Maud Land, where we were combining ice core data with atmospheric reanalysis fields. I spent most of my time with Dr Thamban Meloth, who heads the NCAOR ice core programme, and one of his staff, Dr Waliur Rahaman, who is engaged in the analysis of ice core data. I also had discussions with the new Director of NCAOR, Dr. M. Ravichandran, who has carried our research into atmospheric and ocean science, and who has been keen to develop climate research at NCAOR. Dr Ravichandran is also very interested in atmospheric and oceanic links between the Antarctic and the tropics and would like to see NCAOR carry out more research into this topical subject.

My three lectures provided an introduction to the climate of the Antarctic and past and possible future change over the coming century, a talk on our recent Nature paper concerned with the cessation of the Antarctic Peninsula warming and a presentation on theories regarding the increase in Antarctic sea ice extent since the late 1970s. The talks were well attended and I pitched the level to be appropriate to the wide range of science dealt with by the attendees. The titles of my talks were:

1. Antarctic climate variability and change
2. The recent cessation of the Antarctic Peninsula warming
3. The increase of Antarctic sea ice extent since the late 1970s

I had discussions with several scientists from the centre, including:

Dr Nuncio Murukesh who is investigating the modes of climate variability across the Antarctic and at high southern latitudes using EOF analysis. He was particularly interested in how his work relates to our recent paper on the cessation of the Antarctic Peninsula warming.

Dr. Manish Tiwari who is a palaeoclimatologist and who is interested in teleconnections between high and low latitudes, and how the data we hold for the recent period and the models we run can help in understanding past climates.

I also had discussions with the staff of the Indian National Polar Data Center, which is hosted at NCAOR. I was given a demonstration of the front end that has been developed into their data holdings and we discussed the needs of climatologists and how the user interface might be developed. I demonstrated the web interface to the SCAR READER data base of Antarctic climate data, which provides a simple means of accessing station data, allowing researchers to download data into a spreadsheet and investigate climate variability and change. I stressed that researchers need access to the data rather than just metadata providing information on where the data are held.

I spent much of my time at NCAOR with Waliur Rahaman investigating climate change over Dronning Maud Land using temperature and accumulation data from their ice core IND-25/B5 in conjunction with meteorological fields from the ECMWF reanalysis. The ice core covers the period 1905 – 2005, while reliable atmospheric fields are available from 1979. The

period 1979 – 2005 therefore provides an excellent opportunity to utilize these two very different, but complementary, forms of data, where the ice core record has a temporal resolution of one year, while the reanalysis fields are available every 6 hours. The goal was therefore to gain insight into the meteorological factors that control accumulation at the ice core site so that the accumulation record can be used to infer conditions in the early part of the Twentieth Century, before the routine observing programmes were established. Some of our conclusions are:

- There is good agreement in the accumulation amounts from the ice core and reanalysis fields.
- The ice core site receives small amounts of precipitation on many days as ‘clear sky precipitation/diamond dust’, with a few days each year of large accumulation when major storms are just off the coast.
- Much of the diamond dust is lost as a result of sublimation so that the ice core accumulation record is dominated by the few major storms.
- The ice core accumulation record contains a signal of the El Niño Southern Oscillation, which is transmitted from the tropical Pacific via a quasi-stationary Rossby wave train. However, the signal is not as strong as found in ice cores from West Antarctica, which are closer to the ENSO centre of action in the Pacific.
- The reanalysis fields at the core site reveal a signal of a wave train from the tropical Atlantic Ocean, which is not found in the ice core accumulation. We don’t fully understand this, but it’s worth further investigation.
- The ice core accumulation has a good signal of the Southern Annular Mode from the late 1950s to the late 1970s, however, the relationship between accumulation and the SAM broke down after the late 1970s. This is an interesting result that we don’t think has been reported before.

We think we have enough material from our work to write it up for a journal such as the Journal of Geophysical Research, so we will pursue this over the coming weeks. NCAOR currently don’t have good access to the ECMWF reanalysis fields, which are a powerful tool in climate research, so we will try and develop a long term collaboration between BAS and NCAOR so they can exploit these data.

I would like to thank SCAR for enabling me to spend time as NCAOR. I found it a very stimulating place to work and hope that the institute benefitted from my talks on climate modelling, which is not a subject they have a great deal of expertise in at present. In turn I learnt a lot about the Asian monsoon and how it may interact with other elements of the climate system as far away as Antarctica.

Prof. John Turner
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