

Australian–Italian glaciological program success

Glaciologists from Italy and Australia have formed a joint project to measure the amount of ice flowing out from the ice sheet in the large sector of East Antarctica between Dumont d'Urville and the Amery Ice Shelf. The project was conceived during discussions between Massimo Frezzotti and Neal Young at a SCAR workshop on ISMASS held in June 2001 in Annapolis, USA. (ISMASS is a SCAR initiative to assess the past, present, and future mass budget of the Antarctic ice sheet and its contribution to sea level change, and to investigate related processes.)

The joint project to measure the mass flux combines expertise, knowledge, and capabilities of the glaciology groups and national expeditions of Italy and Australia to achieve a common goal. The Italians are contributing the field work involving radio echo sounding of ice thickness by an Italian team and aircraft. The Australians are providing support and accommodation at Casey and Davis, and deploying fuel depots, in addition to the science results from satellite remote sensing measurements of ice movement, and associated data.

The initial planning for the project had activities spread over two seasons because of the large area to be covered and the likelihood of weather or scheduling constraints on the availability of the Italian aircraft limiting the amount of work that could be achieved in a single season. Fuel was pre-positioned at Mirny by the Russian Antarctic expedition ship for the long leg between Casey and Davis. Two fuel depots were deployed east of Casey using Australia's chartered Twin Otter aircraft in November 2003 – one inland of Blair Glacier, west of Porpoise Bay, and another closer to Casey inland of the Moscow University Ice Shelf. This second depot was also used to support the glaciology ITASE project, east of Casey, in January 2004. A third depot was deployed on Apfel Glacier near Bunger Hills. Fuel from the Mirny depot was also used to support flights by Australian chartered Twin Otter aircraft during this season.

Field work for the joint project started with the flight by the Italian team in their Twin Otter from Dumont d'Urville to Casey on 1 December, taking up fuel at both depots along their route. The field phase of the project was completed with the return flight from Casey to Dumont d'Urville on 14 December. In total, there were seven flying days, and seven days for crew rest or lost to weather. Seven nights were spent at Casey, and six nights at Davis.



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Members of the field team (from left: Jim Haffey, Dave Bewett, Achille Zirizzotti, Alessandro Forieri, Andrea Passerini, Professor Ignazi Tabacco) in front of their aircraft at Lanyon Junction near Casey. The Italian aircraft was the third Twin Otter to operate out of Australian bases during the 2003–04 season. It was used to support the Italian National Antarctic Research Program at Zucchelli station at Terra Nova Bay (TNB) and for associated work at the Concordia station at Dome C (DC), as well as the radio echo sounding work in the sector between TNB, DC, and Dumont d'Urville, and the joint Australian–Italian project between Dumont d'Urville and Amery Ice Shelf. The aircraft was fitted with the ice radar developed by the Italian group under Prof. Tabacco, GPS navigation equipment, and a digital logging system. The complete field party comprised the four Italians in the science team together with two pilots and an aircraft engineer.

The field program completed in the 2003–04 season was immensely successful. The field team flew all of the combined pattern of flight lines planned for both field seasons including a pattern of lines over the Amery Ice Shelf. Good ice thickness data was acquired along most of the length of the flight lines, with some gaps that were to be expected because of conditions in the glaciers. The flight plans had been revised in the weeks prior to departure so as to minimise the fuel uptake from Casey and these depots. This exercise maximised the scientific returns for reduced fuel consumption, minimised the impact on the project and released fuel for use in other operations.

The flight pattern was designed to achieve two goals. The first was to gather ice thickness data along a connected set of lines close to the coast for measurement of the ice flux out of the grounded ice sheet. These lines were actually placed some distance in from the coast or grounding zone so that they avoided the more extreme sub-glacial topography at the margin, and to avoid areas of extreme crevassing. The very broken nature of the ice in these areas scatters the radar energy creating a lot of strong clutter in the returned echoes, which then obscures the weaker echoes from the bottom of the ice.

The second goal was to gather ice thickness data on the ice shelves and major outlet glaciers, which are those parts of the ice cover that are expected to exhibit a larger or quicker response to change in atmospheric or oceanic climate. The areas where this was done in order from east to west included Porpoise Bay, Moscow University Ice Shelf, Totten Glacier, Law Dome ice cap, Vanderford Glacier, Shackleton Ice Shelf, Denman Glacier, and West Ice Shelf.

The success of the field work owes much to the excellent support provided by the air crews, and the support and hospitality of the station teams at Casey and Davis, as well as to the dedication of the Italian science field party under the direction of Prof. Tabacco. The data collected includes all that was planned for this season and indeed much more than was hoped for, although there is still plenty remaining that can and needs to be surveyed. Now begins the long task of analysis of the field data and associated phases of velocity measurement and integration of the various data sets. The work provides a very sound basis for planning details of future surveys and investigations.

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