I attended two separate scientific events in Italy during June-July 2007 thanks to ARCNESS funding; The Alpine Summer School on problems in geophysical fluid dynamics, and the XXIVth IUGG conference.

1 Summer School Overview

The summer school is held annually, addressing topical problems in GFD. This year’s topic was ocean and atmosphere convection. This consequently divided the student body and lectures into atmospheric and oceanic groups. There was a small degree of overlap where more theoretical fluid dynamics topics were presented, but in general only half of the audience had a good background understanding of the topic being discussed at any particular time.

The course could broadly be split into thematic areas

- Peter Rhines and Dick Lindzen respectively discussed ocean and atmosphere convection and its broad scale impact on climate, and the feedback of climatic changes onto regions of deep convection such as the Labrador Sea and tropical atmosphere.

- Charles Doering and Joel Sommeria described the fluid dynamical basis for convection and convective cells, from both a purely theoretical perspective and also in terms of laboratory experiments. After describing the system for Rayleigh-Bernard convection regimes, the onset of turbulence in convective regimes became a major theme, and much of the discussion centered on the relation of the Nusselt number to extremely precise powers of the Rayleigh number and to functions of the Prandtl number.
John Marshall and Ross Griffiths both discussed the dynamical role of ocean convection in the context of the greater thermohaline circulation and overturning circulation. John focused on modeling studies of idealized situations such as ‘water worlds’ with no land mass, or with a zonally blocking land mass and an open ‘Drake Passage’ to emphasize the relative contributions of the wind and convection driven components to the overall ocean circulation. Ross approached the problem using tank experiments to demonstrate the setup of stable convective overturning cells, and their sensitivity to environmental parameters such as the Ra number.

Pier Siebesma and Jean-Claude Gascard both discussed convection phenomenology, from an atmosphere and ocean perspective respectively. In contrast to the other observational discussions which focused on deep convection, both Pier and Jean-Claude touched on shallow convective events, such as shallow tropical atmosphere convection, and its role in cloud formation, as well as oceanic mode water formation.

These presentations were run in lecture format, but there was almost always opportunity for asking questions as the talk was proceeding. Unfortunately in some cases the questions came from other lecturers, rather than students, and debates would arise which largely excluded student participation. Additionally some student questions were handled in an aggressive manner by some lecturers, resulting in many questions being left unasked where the student wasn’t absolutely sure of themselves.

Student participation was encouraged through two sessions where students were invited to give presentations on their own research. There were also daily student poster sessions, and it was fascinating to see the broad range of scientific backgrounds that were present at the summer school. On the final day a round table discussion was held on open questions in convection, and there was much lively and open discussion between both students and lecturers. Much of this was good and productive, but unfortunately ended with a very polarizing discussion on climate change, where few constructive ideas were addressed.

Networking and socialising activities with the students were very valuable, and I enjoyed the exchange of ideas, interests and resources with a diverse group of people. It was also an excellent opportunity to meet established researches doing topical research in a relaxed social setting, and make connections with them, both socially and in a professional sense.

Slides and pdf documents from the course are available online at http://www.to.isac.cnr.it/aosta/frame_general_info.htm
2 IUGG conference overview

I attended the XXIVth IUGG conference in Perugia, Italy between the 2-11th of July. This was a large conference and many areas of geoscience were represented there. Of most interest to me were the IAPSO sessions on oceanic mixing, Southern Ocean water mass variability and ARGO observations. A few talks in particular were of interest to me and are highlighted below.

- Harry Bryden discussed an observing system for the North Atlantic meridional overturning circulation based on fixed CTD moorings over the broad return flow, with a continuous cable recording the western boundary current. When combined with wind field induced Ekman transport this closes the circulation to $\pm 1.5 Sv$ and will be able to detect long term trends.

- Matthew England summarised water mass variability and change in the Southern Ocean. This is of particular interest to my studies, and the neat summary of key water mass changes was particularly useful for focusing my efforts. He also discussed the projection of the SAM onto the Southern Ocean water masses, identifying a key mode of oceanic forcing.

- Rosemary Morrow continued this theme by discussing the response of ACC fronts to atmospheric forcing, particularly the SAM and ENSO modes. She also presented changing subsurface signals in response to climate forcing, a subject that is directly related to my own studies.

- Lynn Talley, Bernadette Sloyan and Teri Chereskin presented results of their recent voyages to the region of SAMW/AAIW formation off the coast of Chile. They addressed the interesting and much debated method of AAIW formation, presenting evidence for localised formation of AAIW through deep wintertime convective mixing, really as the coolest and freshest of the SAMW in this region. They disputed the competing theory of circumpolar cross frontal ‘sliding’ of and deep subductive advection of AASW as unlikely in this region due to the very strong and defined frontal features.

- Andy Thompson discussed a recent hydrographic section taken near the Antarctic Peninsula in the Weddell Sea. This was of interest to me due to his unique method of combining LADCP and geostrophic current profile data together to produce absolute cross section transports. This has been a thorny problem for my own work with Antarctic coastal
sections, and subsequent discussions with him have allowed me to refine my approach.

- Sebastiann Swart introduced his PhD work on the cross section ACC transport south of Africa. He used an identical technique in diagnosing subsurface T-S profiles from sea surface height records to my own, and so his work is of extreme interest to me.

There were several other talks of great relevance to my own work, as well as many others that were interesting in their own right, presenting cutting edge material to an established and knowledgeable group. The small size of the Southern Ocean session venue gave a personal atmosphere making it easy to meet the speakers and have more involved discussions of their work, and get to know them personally. I met and got to discuss many researcher’s work, as well as presenting my own studies to them, receiving much positive feedback.

Despite the generally chaotic nature of the conference, and the poorly though out accommodation situations that found many having to commute for several hours a day, it was still possible to meet other participants in a social setting. I made many valuable contact with whom I remain in correspondence, and through whom I receive papers, datasets, ideas and feedback on my own work. Overall the conference provided an intensive working environment for hothousing ideas and research, and a concentration of some of the foremost scientists in my field that was immensely valuable to my studies and also those I work with in my home institution.