

20 MARCH 2002 : FLOW OVER OROGRAPHY FROM SMALL SCALES TO HIMALAYAS

Dr Andrew Brown - Introduction to flow over orography - andy.brown@metoffice.com

This talk will present some examples illustrating the importance of orography to weather and climate, and review non-dimensional numbers, that allow us to characterise hills and mountains as 'small' or 'large' scale. Some of the important issues associated with the representation of orography in numerical weather prediction and climate models will also be introduced.

Dr Nigel Wood - Flow over small scale hills - new directions - nigel.wood@metoffice.com

Small-scale hills play a significant role in determining the characteristics of the turbulent atmospheric boundary layer. Given the difficulty of the problem (high Reynolds' number turbulent flow in complex geometry) our understanding has advanced primarily through the use of simplified, usually linear, analyses supported by observations, experiments and, increasingly, idealised numerical model simulations. Attention has generally been limited to either two-dimensional flows (ridges) or axisymmetric flows (circularly symmetric hills). This talk will present some recent developments in this field with respect to anisotropic three-dimensional effects, the impact of wind direction changes and the role of stratification.

Prof Stephen Mobbs - Gravity Waves, Flow Separation and Rotors - stephen@env.leeds.ac.uk

This talk will cover recent developments in our understanding of how gravity waves affect the near surface and boundary-layer flow. In particular, the effect of the gravity-wave pressure field in promoting flow separation and the formation of rotors will be discussed. Both numerical and observational studies will be described, including recent results from field experiments on the Isle of Arran and the Falkland Islands.

Dr Adrian Broad - An overview of the Mesoscale Alpine Programme - adrian.broad@metoffice.com

The Mesoscale Alpine Programme (MAP) is an international project with participation from many European countries, Canada and America. It is an integrated experimental and numerical modelling campaign which officially began in autumn 1994. The scientific objectives of MAP are:

- to improve the understanding and numerical prediction of orographically influenced precipitation events, and related flash flooding episodes, involving deep convection, frontal precipitation and runoff
- to improve the understanding and forecasting of gap and foehn related phenomena

- to improve the understanding of gravity waves and gravity wave breaking in complex mountainous terrain.

To meet these objectives MAP has been organised as a three-phase project with Phase I a pre-experimental modelling period, Phase II as an experimental observational period, and Phase III a post-observing period. Phase II was a 10 week Special Observing Period (SOP) which took place in the Alps in the autumn of 1999 involving additional remote sensing instrumentation and airborne measurements. An overview of the scientific objectives of MAP, the SOP and some results from analysis of the SOP data will be given.

Dr Christian Keil - Diagnostics on the ECMWF model using MAP data - C.Keil@ecmwf.int

At ECMWF a new synthesis of the in-situ and remotely-sensed measurements made during the Special Observing Period (SOP) of the Mesoscale Alpine Programme (MAP) is performed using the latest 12-hr-4D-Var global data assimilation system. The MAP Re-Analysis will produce analyses of high temporal and spatial resolution, with a grid-spacing close to 40km in the horizontal and with sixty levels in the vertical located between the surface and a height of about 65km.

Diagnostics on the operational ECMWF model forecasts during the SOP in autumn 1999 as well as first results of a control experiment of the Re-Analysis excluding the additional MAP observations will be presented for dedicated episodes within the SOP.

Dr Stuart Webster - Modelling the Himalayas in the Met Office Global Forecast Model - stuart.webster@metoffice.com

The Himalayas is the biggest chain of mountains on earth. They form a distinct geographical divide between the Tibetan Plateau to the north, which is itself the largest plateau on earth, and the low-lying Indian sub-continent to the south. Their size and location, together with the fact that the subtropical jet flows close to or directly over them, make the Himalayas the severest test of the representation of orography in global numerical weather prediction (NWP) models.

This talk will describe recent numerical and scientific improvements that have been made to the representation of orography at the Met Office. These improvements have been made during the development of the new, soon to be operational, global NWP model. The improvements (and the problems that had to be overcome) will be illustrated by focussing on the flow over and downstream of the Himalayas.