Monash Fluids Seminar Series

Tuesday September 15 at 4pm

room 340, 9 Rainforest Walk (maths/EAE building)

Aerodynamics of cycling: 'Rider Flow Topology'

Tim Crouch (Monash, Mechanical and Aerospace Engineering)

Abstract: At the elite level optimising the aerodynamics of the bicycle-rider system is one of the most efficient and effective ways to reduce race times. Practically, the drive to minimise aerodynamic drag can be seen in the extreme aerodynamic positions of time-trial cyclists, the geometry and drag-reducing surface finishes of the equipment they use, race tactics employing drafting, and the significant resources that leading nations and teams devote to improving the aerodynamics of their athletes. Looking forward, further gains in cycling performance are likely to arise from an improved fundamental understanding of the governing fluid mechanisms and universal principles that can enhance aerodynamics. Recent studies at the Monash Wind Tunnels have started to piece together a general picture of the large scale wake structure of cyclists that includes the unsteady aerodynamics of the leg motion. Findings have led to an improved understanding of three-dimensional flows around cyclist geometries which has provided a new perspective on how to improve the aerodynamics of cyclists and their equipment.

Bio: After completing his PhD last year Timothy is currently collaborating on an ARC Linkage project with the Monash Wind Tunnel group and the AIS which aims to improve the performance of Australian Olympians, through further understanding flows around complex geometries. Findings from the sports research group at Monash, of which Timothy is a member, have contributed to recent podium finishes in both Summer/Winter Olympic and Paralympic games and major cycling events.

Dynamics of tornadopyrogenesis

David Kinniburgh (Monash, Earth, Atmosphere and Environment)

Abstract: The Australian wildfires during 2003 that reached the outer suburbs of Canberra produced a series of pyro-cumulonimbus cells and the first recorded Australian pyro-tornado during the afternoon of 18 January. Here the dynamics of these pyro-tornadoes are investigated using the cloud resolving model, CM1. Sensible and latent fluxes are specified at the lower boundary of the model through a parameterised representation of a bushfire. The resulting pyro-cumulonimbus and structure of the vertical vortices are consistent with previous literature. Spatial resolution dependencies are tested, and it is shown that the fundamental structure of the generated vortex is consistent for both: uniform grid spacing of 100 m, and non-uniform grid spacing with horizontal grid spacing of 25 m in the region of the parameterized fire. A vorticity budget is calculated within the region of the vortex formation and results show that the dominant physical process in the formation of intense vertical vorticity is the vertical tilting and stretching of buoyancy-produced horizontal vorticity near the surface. The sensitivity of vortex generation to the availability of moisture is also tested, by removing the latent heat release of the fire.

Bio: David Kinniburgh: Phd candidate in the School of Earth, Atmosphere and Environment.