MITACS Seed project: Environment & Natural Resources

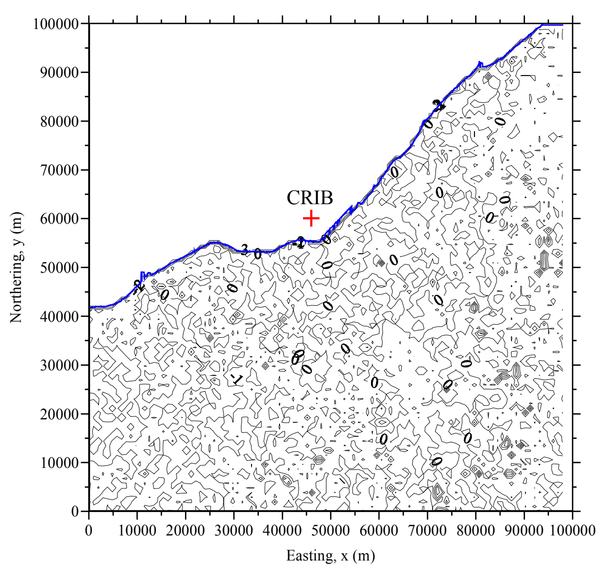
Modeling Atmospheric Boundary-Layer Flow for Wind Energy and other applications

Progress, Nov 1, 2009 - Oct 31, 2010

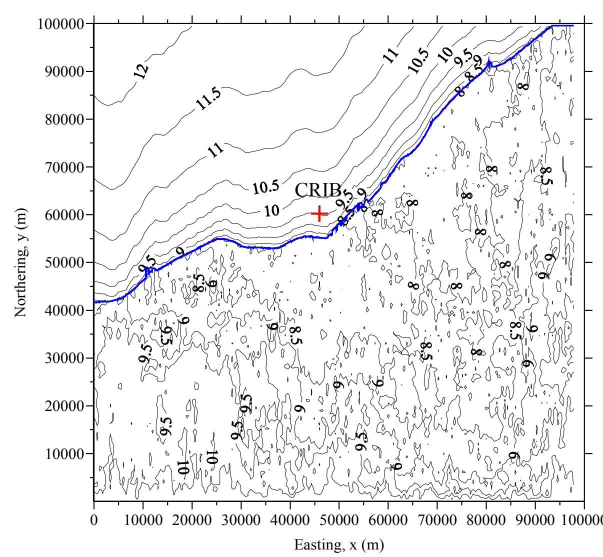
Our main focus has remained on the modeling of winds blowing over complex terrain in the form of spatial variations in surface roughness and thermal properties and over hills and other topographic features.

For roughness changes Wensong Weng and Peter Taylor have now developed a 2-D model of planetary boundary-layer flow over step changes in roughness (Weng et al, 2010) and, under the present project, we have been applying that model to situations appropriate to wind energy applications. This has included extending the model to include situations with non-neutral thermal stratification and step changes in thermal properties as well as roughness. A poster based on this work was presented at the American Wind Energy Association, Windpower 2010 Conference, held in Dallas in May 2010. An oral presentation on both the 2D and 3D models was given at the American Wind Energy Association Offshore conference in Atlantic City in October 2010. We included sample results from the 3D model a for southerly flow over Lake Erie offshore from Cleveland Ohio (see below).

Contour plot of $\log_{10}(z_0)$ field



Contour Plot of Wind Speed at z = 80 m, Wind Direction: South



Similar calculations have been made for other locations. Work on 3D models of flow over topography has continued. Some revised approaches are being tried for steep terrain and some tests are being run for Zephyr North, our industrial sponsor.