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DIURNAL CYCLES OF SLOPE WINDS WITH OPENFOAM

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Thermal winds arise due to the changes of local temperature gradients and buoyancy along slopes occurring during the diurnal cycle. Katabatic (down-slope) winds are of interest since they can have implications on air quality, when possibly returning pollutants downward, whereas anabatic (up-slope) ones play an important role in the exchange process between the lower and the upper atmosphere layers. Additional interest in slope winds can be found for wind energy applications. This rapidly growing sector can find advantages in thermal winds since, for example, they present more regularity than synoptic ones, and they may avoid the impact of increased turbulence on turbines. Slope flows have been studied for many decades [1], from analytical theory to numerical simulations, and very recently they have risen interest in the open-source computational fluid dynamics software community, with some works completed using OpenFOAM, studying uniformly heated slope [2], or applying steady altitude-dependent temperature boundary conditions on the slope [3, 4].

In this work, OpenFOAM's solver *buoyantBoussinesqPimpleFoam* is used to study thermal wind generation on an idealized numerical model of a mountain-valley system. Diurnal cycles are simulated for different temperature gradients and mountain slope angles, in order to replicate various topographic and climate environments. The influence of the chosen turbulence models is discussed, a comparison of their respective computational times is included. Results of velocity profiles, turbulence kinetic energy and position of possible vortices/convective cells are presented, aiming at assessing the possible use of slope flows to wind energy generation.

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