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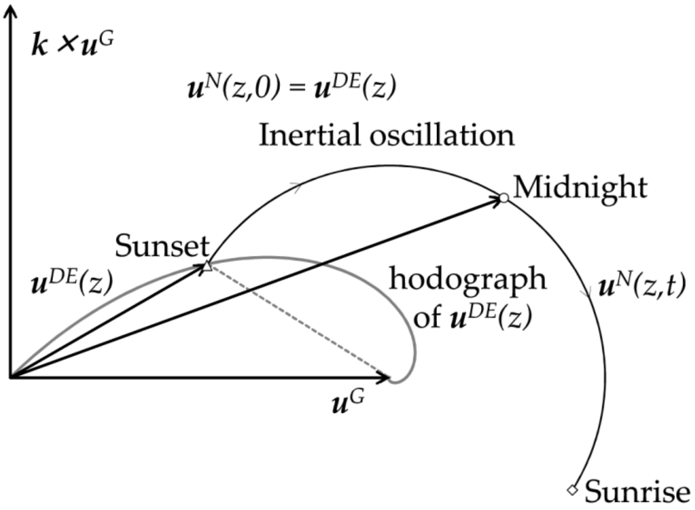

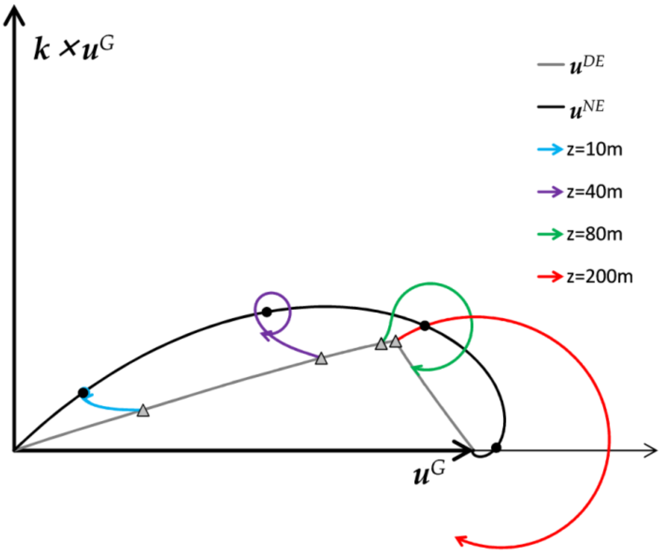

Figure 1. Schematic of the inertial oscillation of the nighttime wind velocity $\mathbf{u}^N(\mathbf{z}, \mathbf{t})$.
$\mathbf{z}$ and $\mathbf{t}$ are height and temporal coordinates, respectively. $\mathbf{u}^G$ is the geostrophic wind velocity, $\mathbf{k}$ is the unit vector pointing vertically upwards. $\mathbf{u}^{DE}(\mathbf{z})$ is the daytime equilibrium wind velocity.

Figure 2. The hodographs of the nighttime wind velocity. An example of the analytical solution. Triangles (▵) mark the daytime equilibrium wind velocity. Circles (•) mark the nighttime equilibrium wind velocity.

- An analytical solution of nocturnal low level jets is presented. The present model is an extension of Blackadar who described the nocturnal low level jet as a result of an inertial oscillation (see Fig. 1).
- In the present model, the momentum equation in the daytime atmospheric boundary layer includes a term representing convective mixing in addition to a mixing with a constant diffusion coefficient.
- With the convective mixing, the daytime equilibrium wind velocity becomes vertically more uniform than the Ekman solution. In the nighttime atmospheric boundary layer, the convective mixing is assumed to be absent, and the diffusion coefficient, which is assumed to be constant, is smaller than that in the daytime. Without the convective mixing, the nighttime equilibrium wind velocity is the same as that of the Ekman solution.
- The analytical solution describes the temporal evolution of nighttime wind velocity as a damped inertial oscillation around the nighttime equilibrium wind velocity, starting from the daytime equilibrium wind velocity.
- By appropriately choosing the values of parameters in the analytical solution, already published some results are reproduced. For example, the height of maximum wind speed decreases as time goes on. There exist backward inertial oscillations in addition to the well-known forward inertial oscillations. In the lower levels, the oscillations are damped rapidly (see Fig. 2).