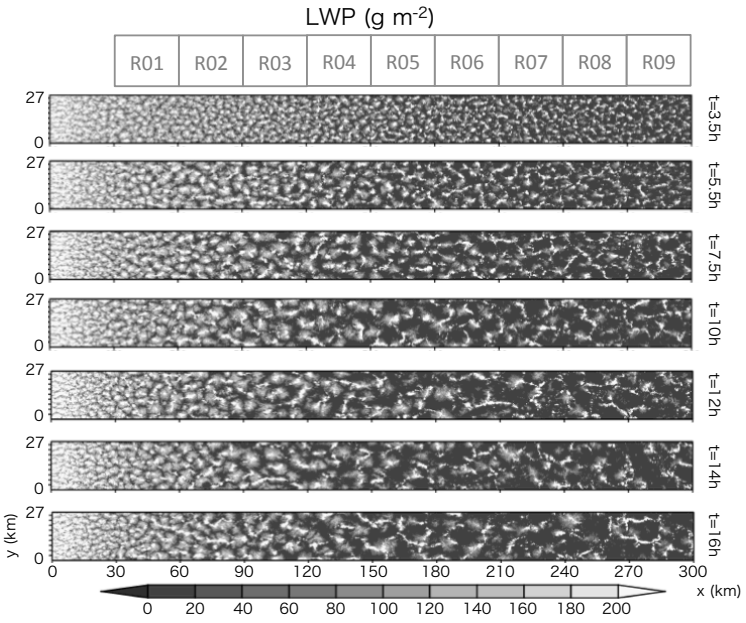
Miyamoto, Y., Y. Sato, S. Nishizawa, H. Yashiro, T. Seiki, and A. T. Noda, 2020: An energy balance model for low-level clouds based on a simulation resolving mesoscale motions. *J. Meteor. Soc. Japan*, **98**, 987-1004. https://doi.org/10.2151/jmsj.2020-051

**Plain Language Summary:** A new energy balance model is proposed to determine the cloud fraction of low-level clouds by assuming that the horizontal cloud field consists of several individual cloud cells having a similar structure. Using a high-resolution simulation dataset with a wide numerical domain, an energy budget analysis revealed that the energy injected into the domain by surface flux is approximately balanced with the energy loss due to radiation and advection due to large-scale motion. A simple model for the cloud fraction is developed from the energy conservation equation. The cloud fraction diagnosed using the model developed in this study was able to quantitatively capture the simulated cloud fraction.



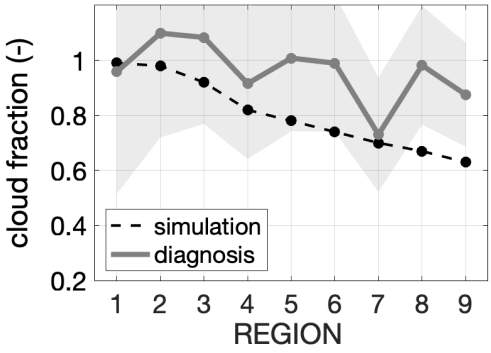




Figure 1. Horizontal cross sections of liquid water path (LWP, g $m^{-2}$) at 7 selected timesteps. The abscissa and ordinate represent the streamwise and spanwise directions, respectively, and the units are kilometers.

Figure 2. Cloud fraction estimated from the simulation (black line) and diagnosed using the developed formula (gray line). The data are temporally averaged from t = 12 to 16 h.
The gray hatched area stands for the range within one standard deviation from the mean, which are estimated using quantities spatially averaged in each subdomain.

- An energy balanced model is developed for low-level clouds by assuming that the cloud field consists of finite number of cloud cells with same structure.
- The cloud fraction diagnosed by the developed analytical model is close to that by a high-resolution simulation dataset with a wide numerical domain.