Suzuki, K., T. Iwasaki, and T. Yamazaki, 2021: Analysis of systematic error in numerical weather prediction of coastal fronts in Japan's Kanto Plain. *J. Meteor. Soc. Japan*, **99**, 27-47. https://doi.org/10.2151/jmsj.2021-002

Plain Language Summary: Coastal fronts tend to be forecast on the inland side of their actual positions by the operational Numerical Weather Prediction (NWP with a horizontal grid spacing of 5 km) model at the Japan Meteorological Agency. This study confirms a systematic NWP error through statistical validations of coastal fronts, and the numerical experiments reveal that the systematic error may be caused primarily by an underestimation of the mountain barrier surrounding the Kanto Plain in the model.

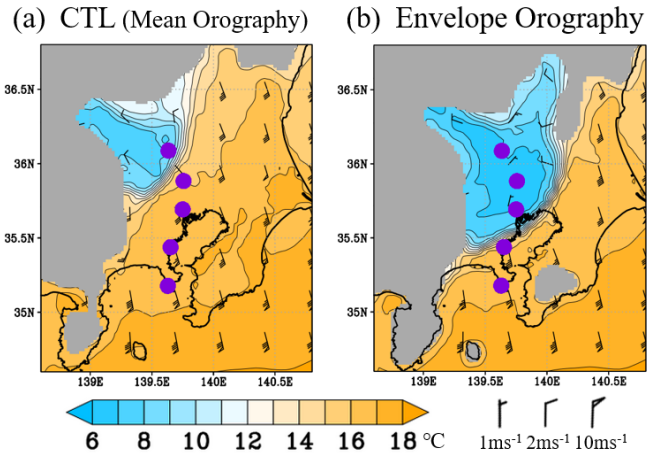

Figure 1. Simulated (5-km grid) surface temperature (shaded, contoured) and surface wind field of the CTL (mean orography) and Envelope Orography experiment at 03 JST 9 March 2018. The gray color indicates areas with an altitude of more than 200 m above the sea level.

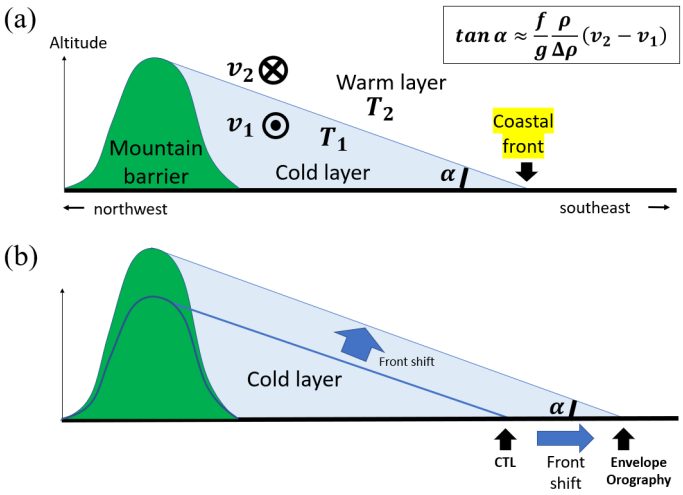

Figure 2. Schematic illustrations (vertical cross-sectional view) of (a) the Margules equation applied for coastal fronts, (b) front shifting when the mountain barrier is higher (Envelope Orography).

- The operational NWP model with a 5-km grid spacing has a systematic error, with coastal fronts being shifted consistently to the inland side of their actual positions when the forecast period exceeds 5 hours.
- The numerical experiments suggest that the northwestward distance error of coastal fronts can be eliminated almost entirely by using the envelope orography (Fig. 1). The front shifting can be reasonably explained by the Margules equation (Fig. 2).
- The northwestward distance error, averaged over the three illustrative cases, was reduced by 27% and 37% by increasing the horizontal resolution from 5 km to 2 km and 1 km, respectively.