Ono, K., and M. Inatsu, 2025: Nonlinear perturbation growth at mesoscale related to upscaling processes from a mesoscale convective system. *J. Meteor. Soc. Japan*, **103**, http://doi.org/doi:10.2151/jmsj. 2025-007.

Plain Language Summary: This study investigated the nonlinear perturbation growth associated with a mesoscale convective system. The forecast experiments were performed giving the initial perturbations with opposite signs. Nonlinearity was quantified by the extent to which the initial opposite-sign perturbed state vectors do not keep the same magnitude and opposite direction in a forecast time. We focused on the perturbation structures at different scales by using spatial filtering.

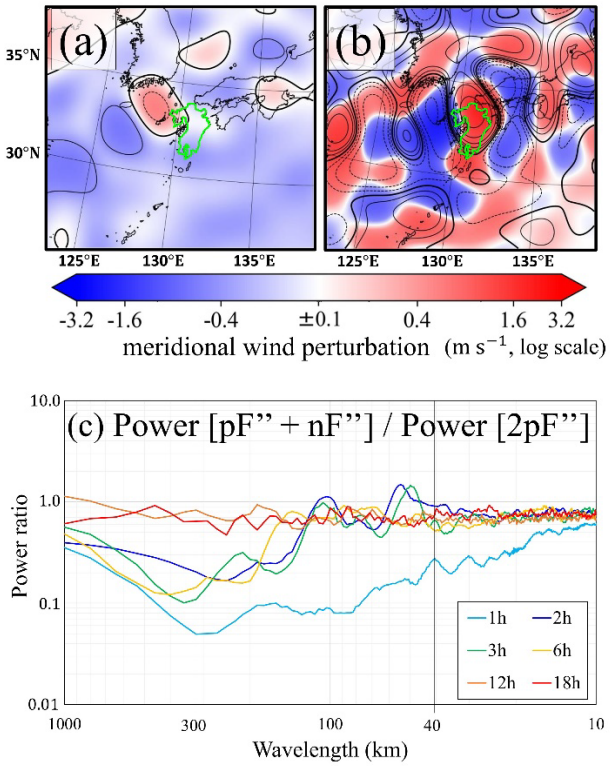

Figure 1. Low-pass-filtered meridional wind perturbation (m s^{-1}) on the 21st model level at initial time (a) and 12 h forecast lead time (b) in the positive perturbation (color shades) and the negative perturbation (contours). (c) Ratio of between the power spectra of sum of positive and negative meridional wind perturbations, indicating the nonlinearity, and positive perturbation with double amplitude at different forecast lead time.

- We confirmed that the forecast perturbations had the same-signed meso-α scale structures that expanded from the center of the rainband at 2 and 10 forecast lead times.
- These perturbations were upscaled from the gravity waves emitted from the rainbands in a few hours from the initial forecast time.
- This nonlinear perturbation growth was attributed to the moist physics in the forecasting model.