

Enomoto, T., S. Yamane, W. Ohfuchi, 2015: Simple sensitivity analysis using ensemble forecasts. *J. Meteor. Soc. Japan*, 93, 199-213.

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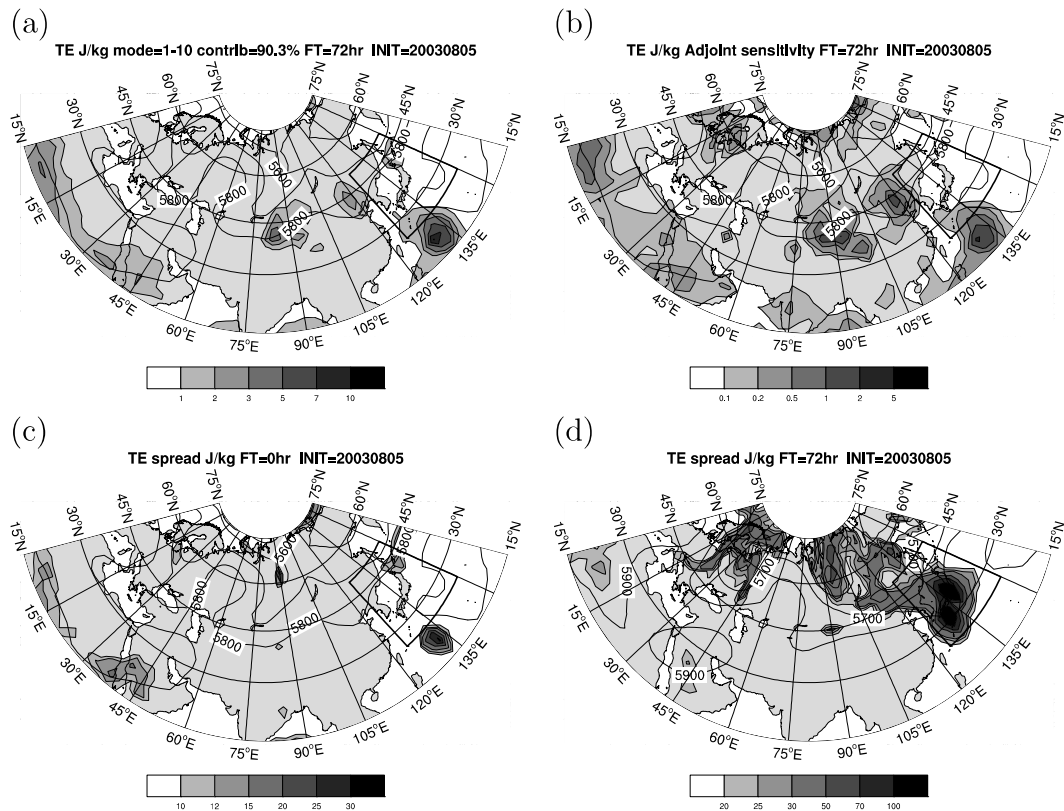


Figure 4: 72-h (a) ensemble singular-vector and (b) adjoint sensitivity to the dry total energy norm over Japan (rectangle) calculated from the JMA one-week ensemble forecast initialized at 1200 UTC on 5 August 2003. Contours represent 500-hPa height.

- Two formulations approximating singular-vector and adjoint methods are derived using an ensemble forecast to identify the sensitive initial perturbations that grow in a specified region at the verification time.
- Sensitivity analysis over Japan shows that the two methods can identify the sensitive regions more specifically than the regions with large ensemble spread for a mid-latitude cyclone in January and a tropical cyclone in August 2003 (Figure 4).
- For an August 2002 storm in Europe, the cyclone deepens a few hPa in its north-east sector with more precipitation north of the Alps more consistently with observations in a global 20-km resolution simulation perturbed with ensemble singular vector.