Assessment of satellite rainfall nowcasting based on extrapolation technique

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Background

- The National Meteorological Satellite Center (NMSC)/Korea Meteorological Agency (KMA) produce extrapolated images based on satellite data for nowcasting
- The satellite imagery prediction technique includes EXIM(Extrapolated Imagery) and MAPLE(McGill Algorithm for Precipitation Nowcasting and Lagrangian Extrapolation)
- Vector optimization was performed to improve accuracy of extrapolation of rainfall intensity using MAPLE and EXIM
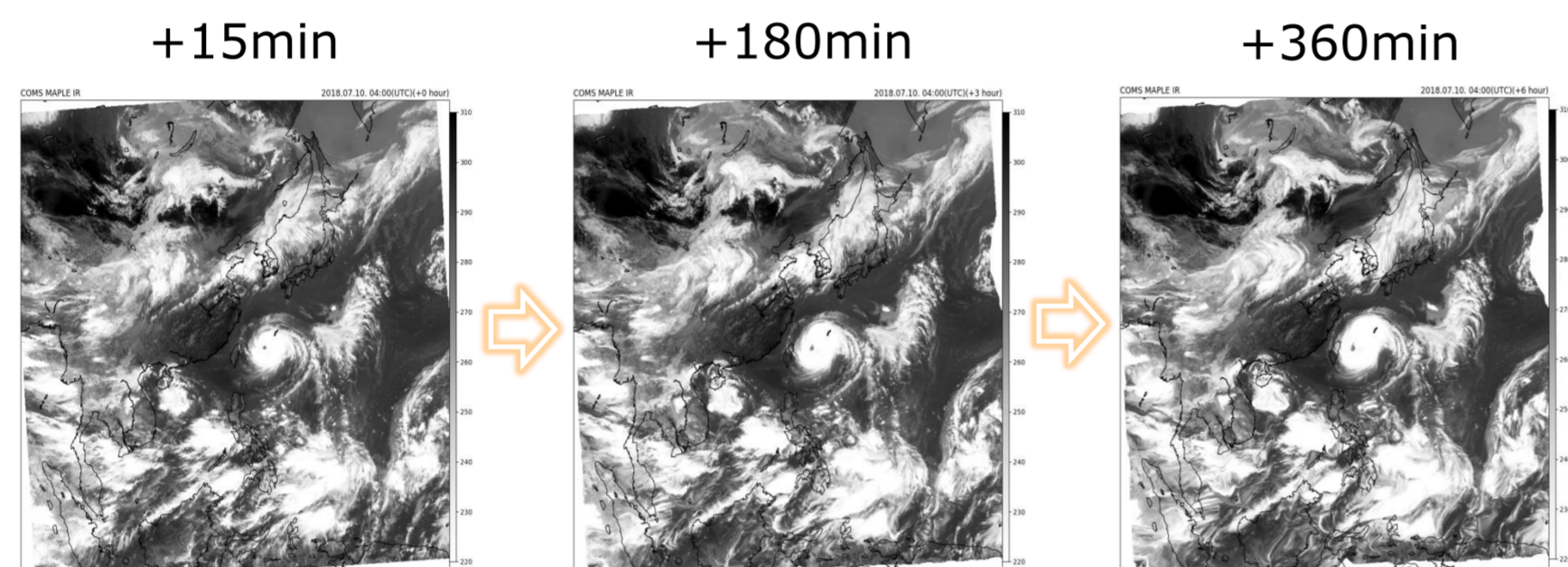
MAPLE (McGill Algorithm for Precipitation Nowcasting and Lagrangian Extrapolation)

- The motion field of a cloud is determined by the VET(Variational Echo Tracking)
- Expressing the movement of clouds through Semi-Larangian Scheme.

Variational Echo Tracking
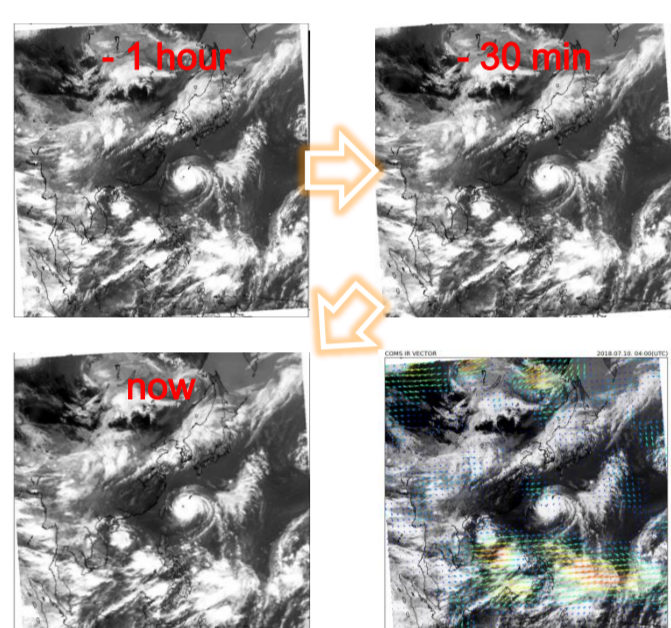
Semi Lagrangian Scheme

+15min   +180min   +360min

EXIM (Extrapolated Imagery)

- Extrapolation of the features most prominently reflected in the individual channels, and in turn to discard displacement vectors stemming from other layers
- For each pixel, extrapolate to the AMV, and for the second step, move to the AMV in the new position
- Different methods are applied depending on the type of image that extrapolates

AMV(Atmospheric motion vectors)   +60min   +180min   +360min
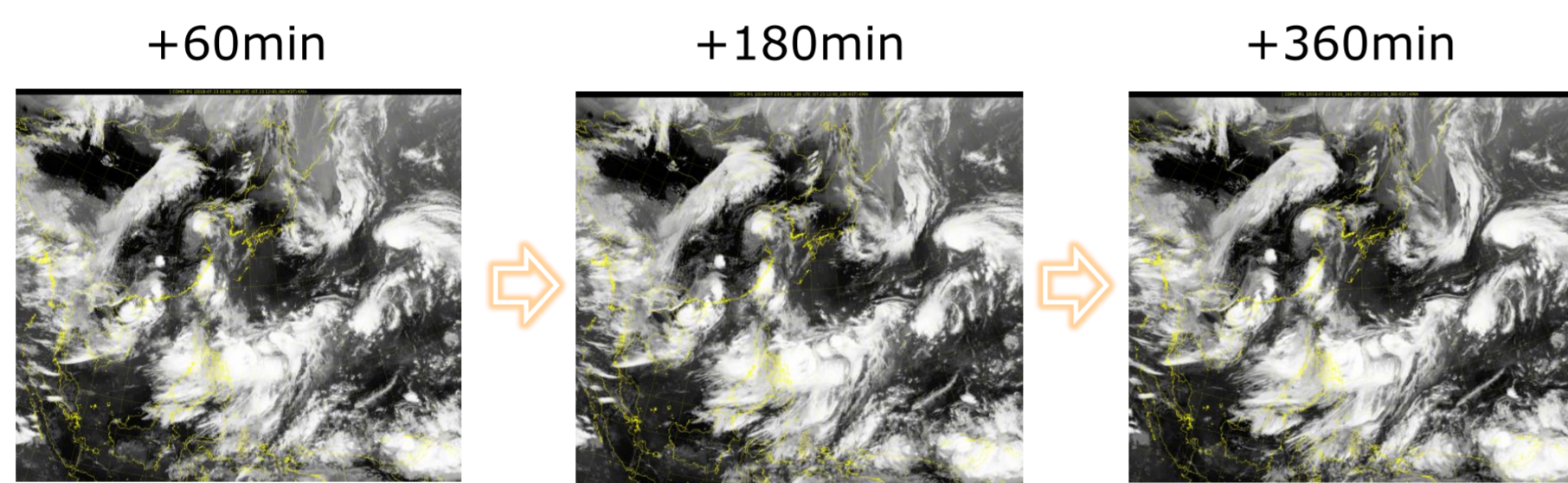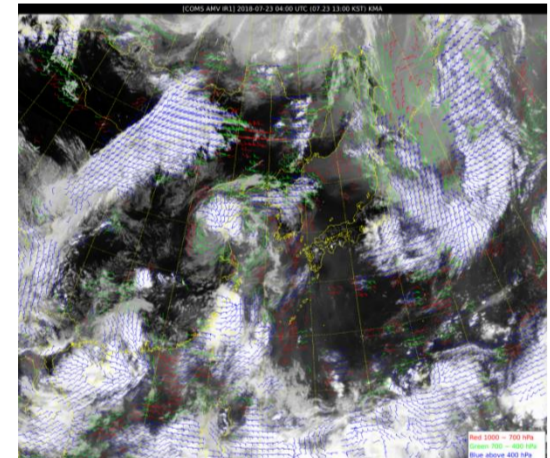
Methodology

- Both MAPLE and EXIM use vectors generated from the infrared channels to extrapolate the rainfall intensity
- In some cases, the movement of clouds and the movement of rain are different.
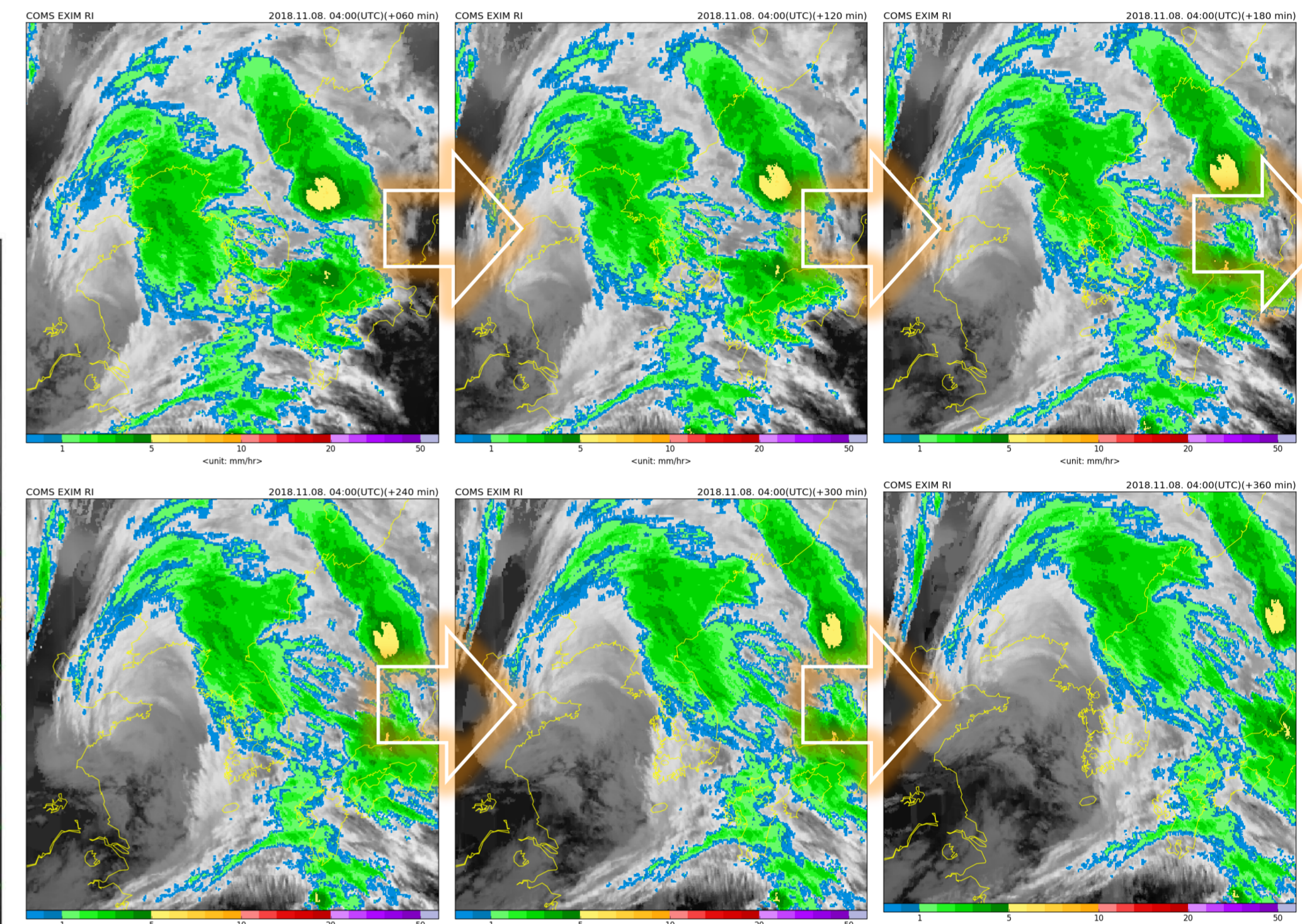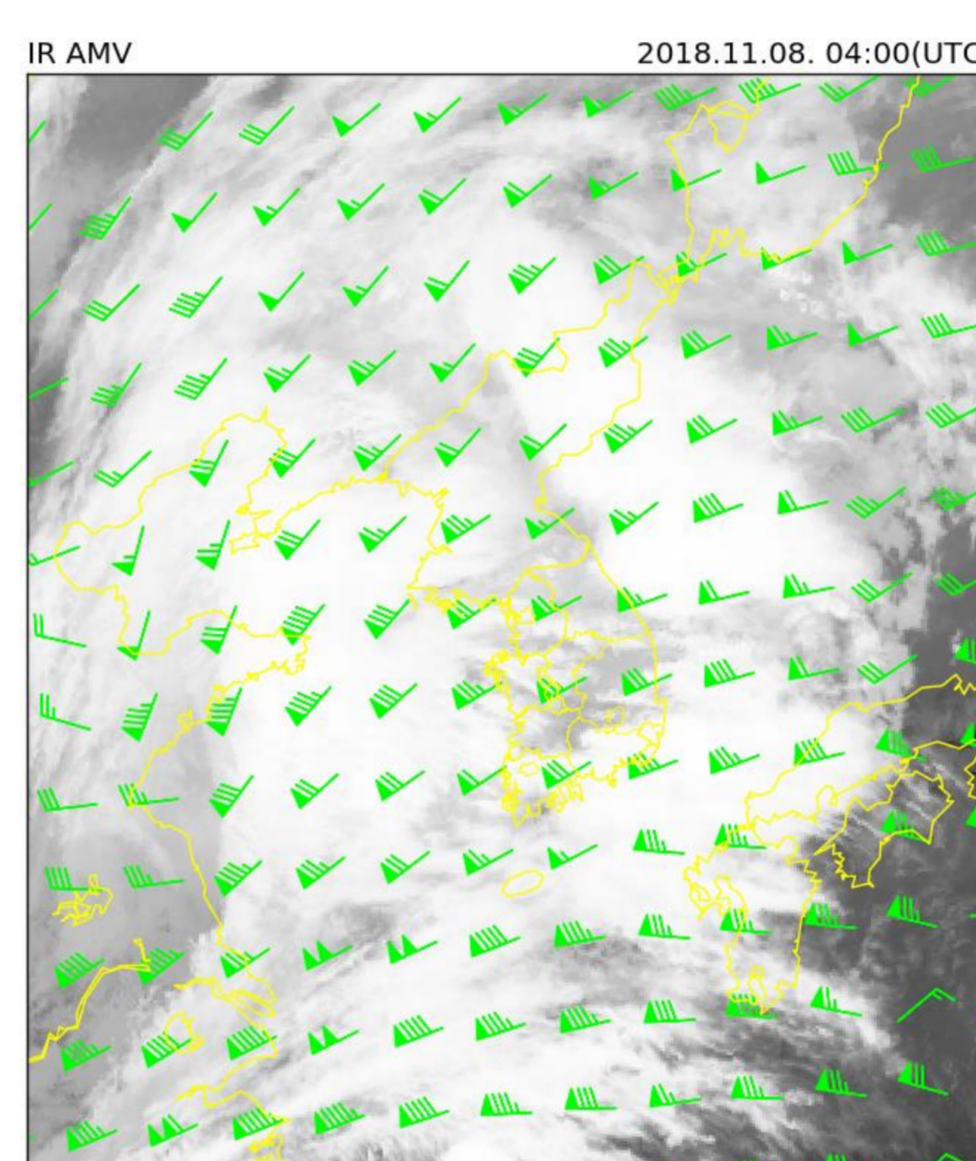- Optimize the prediction using water vapor vectors to predict the movement of precipitation.
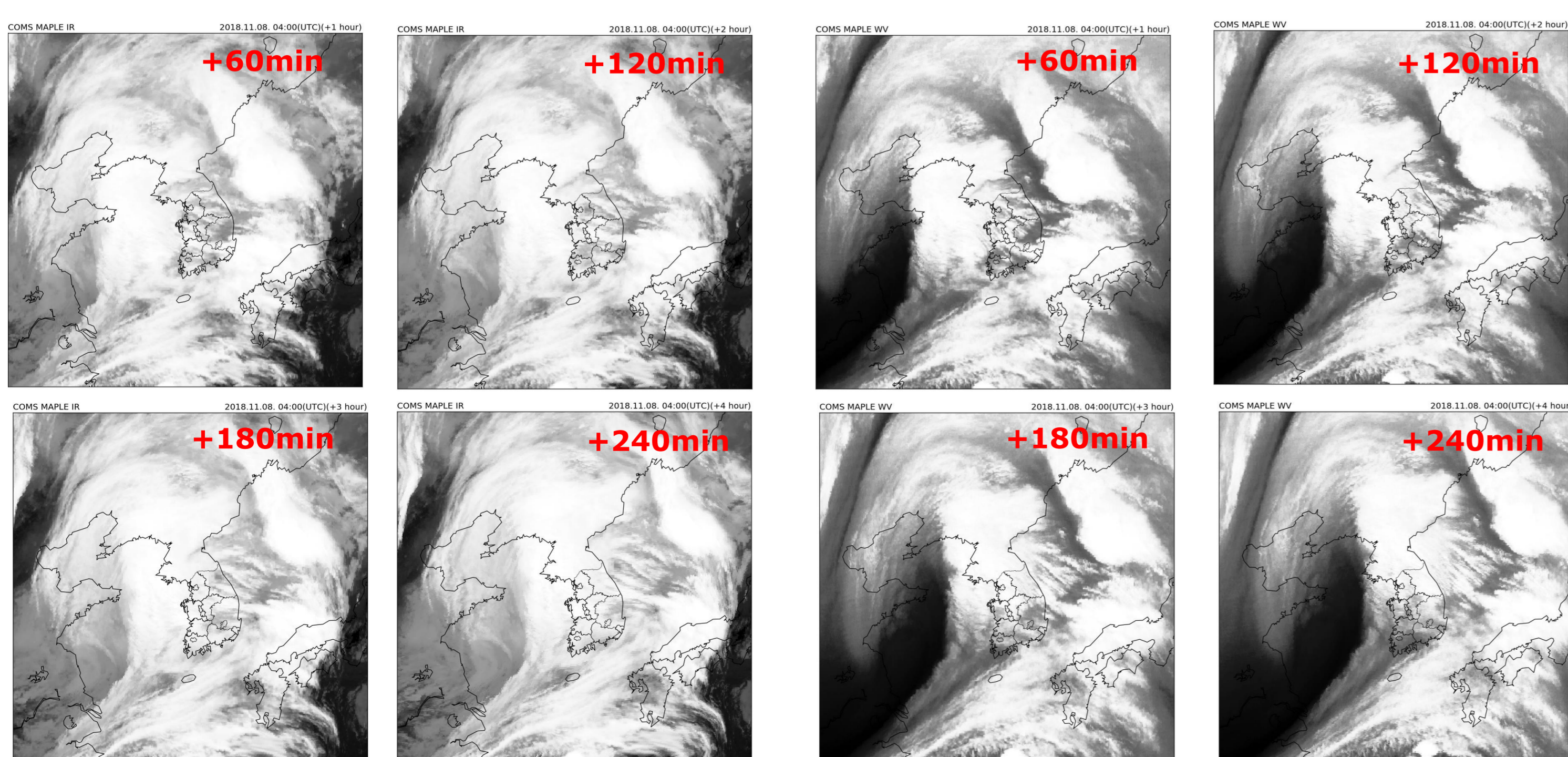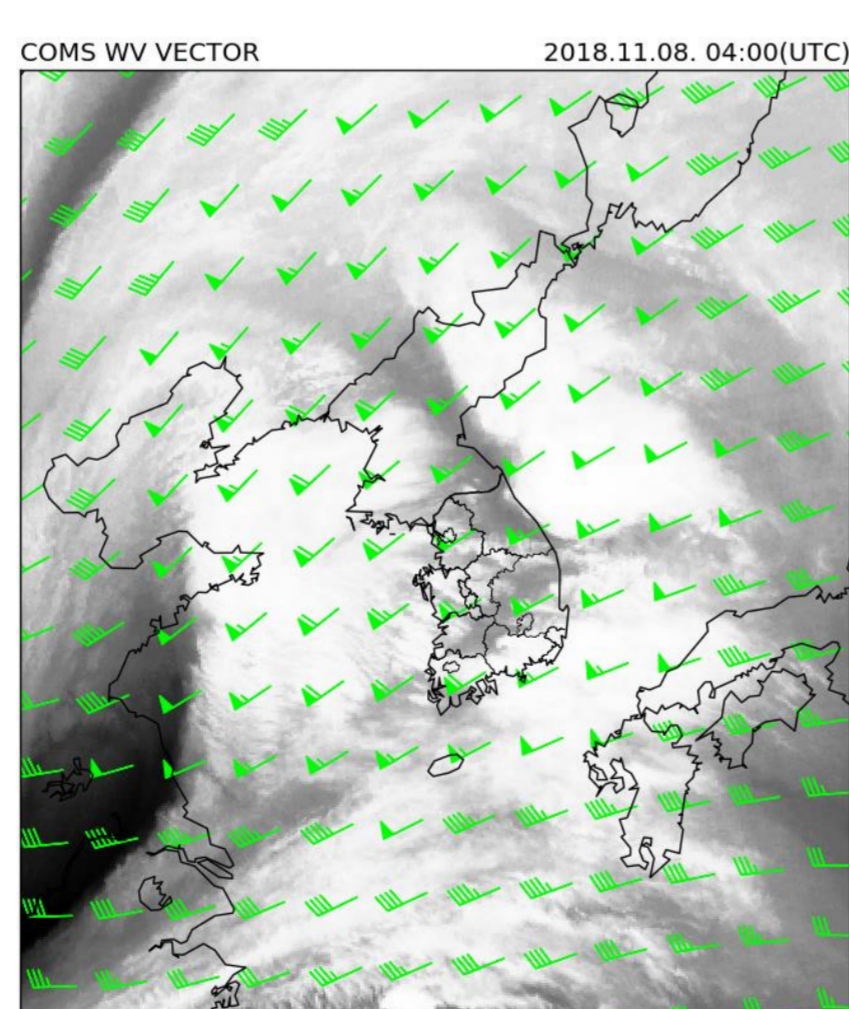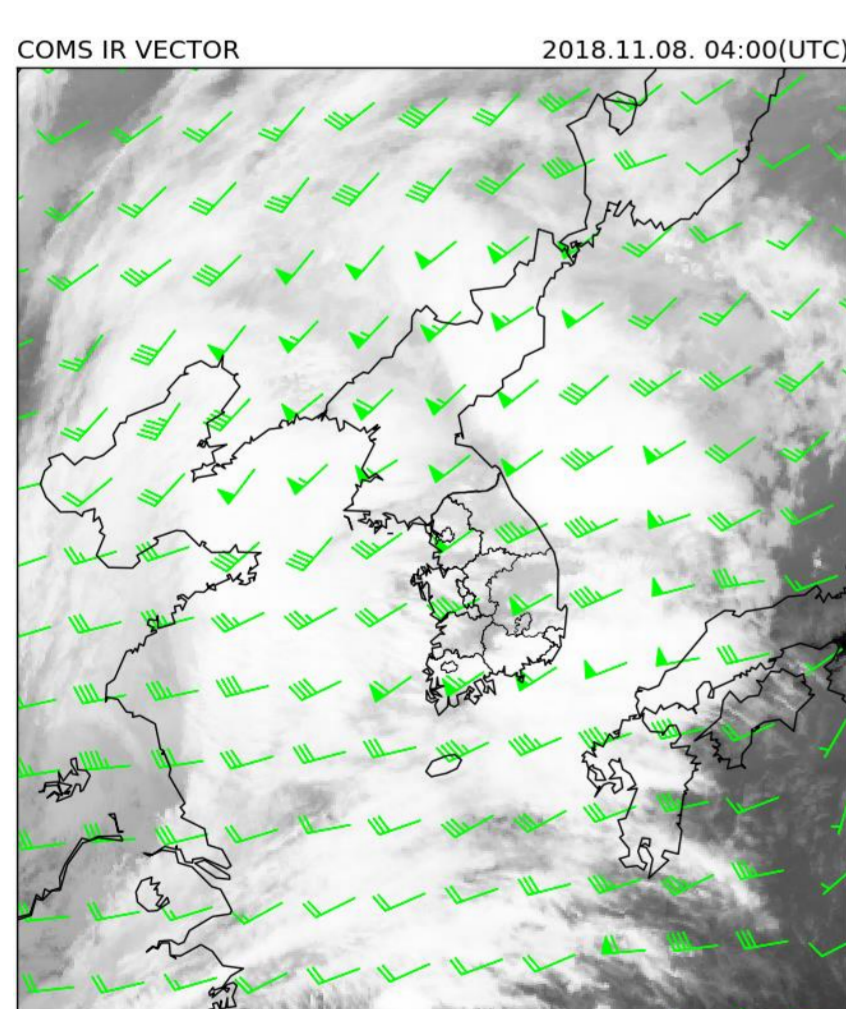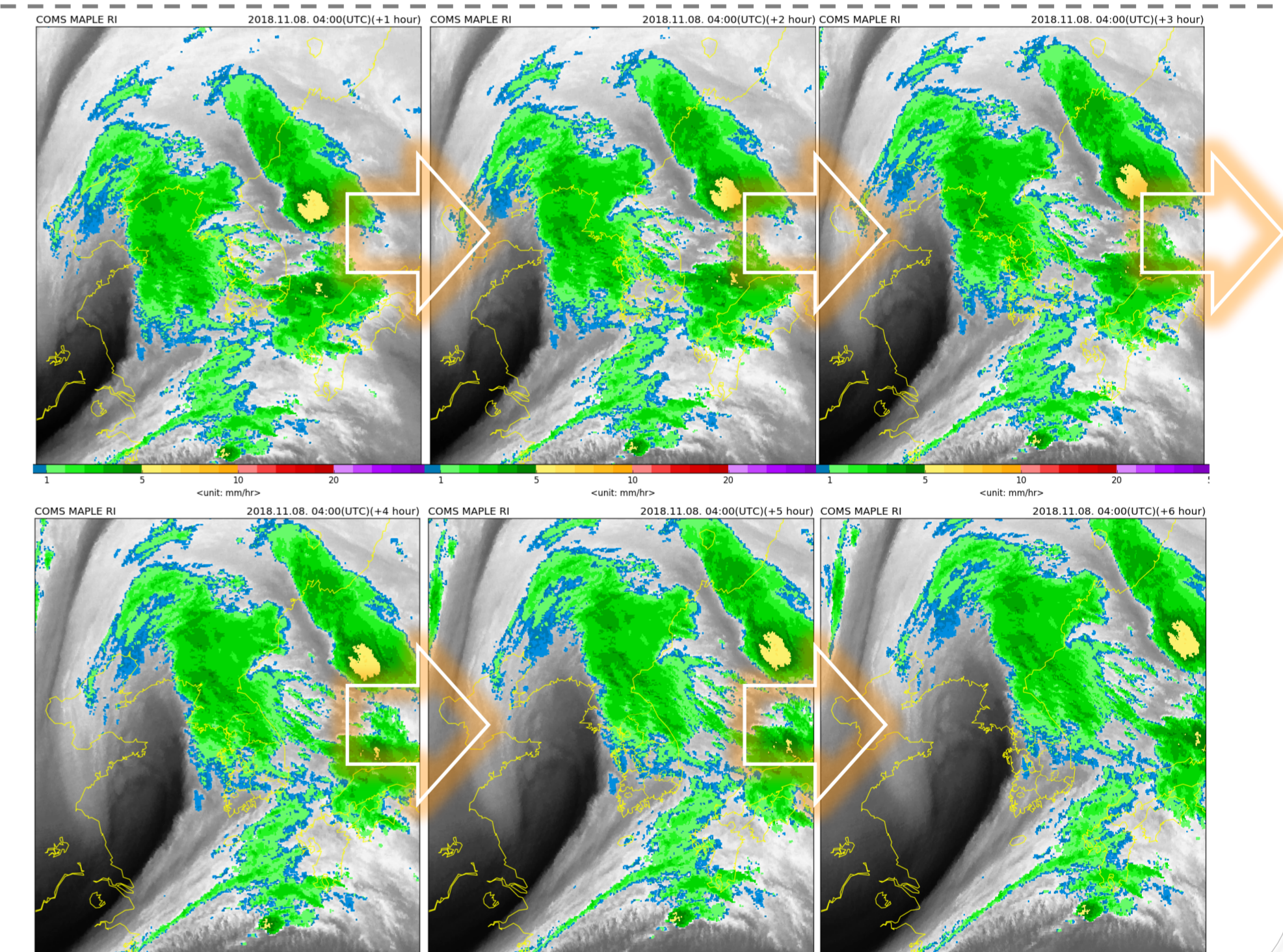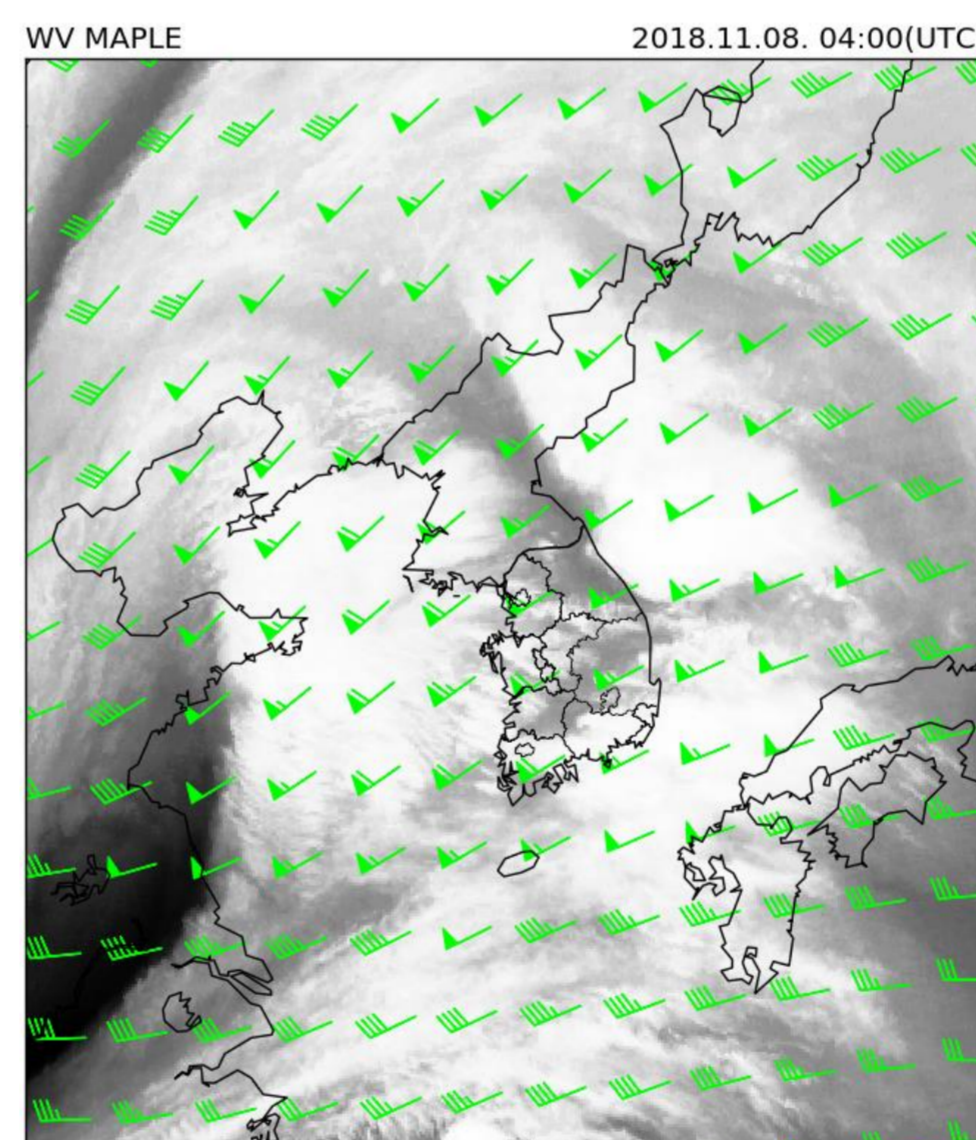

Result

IR vector MAPLE RI
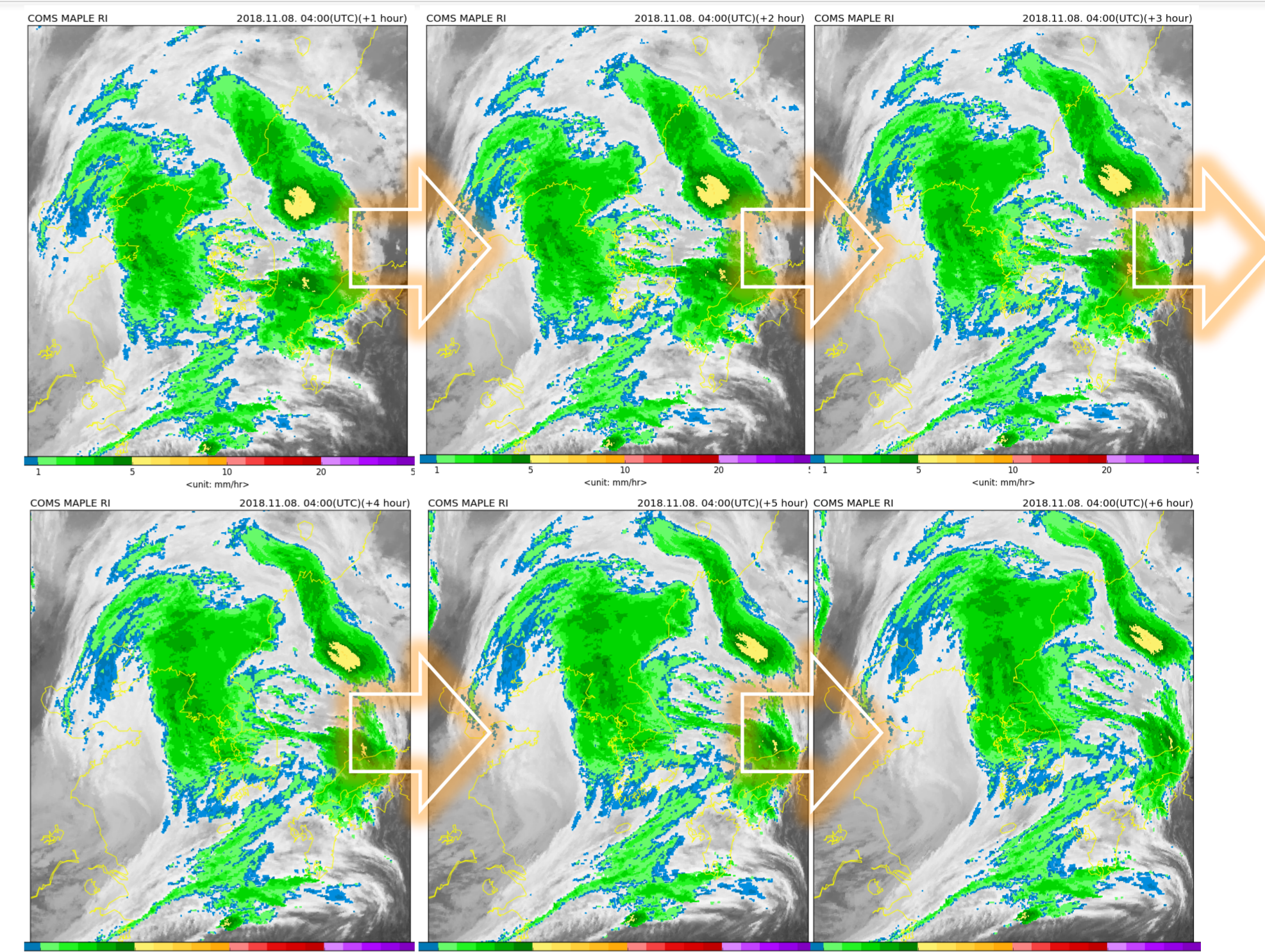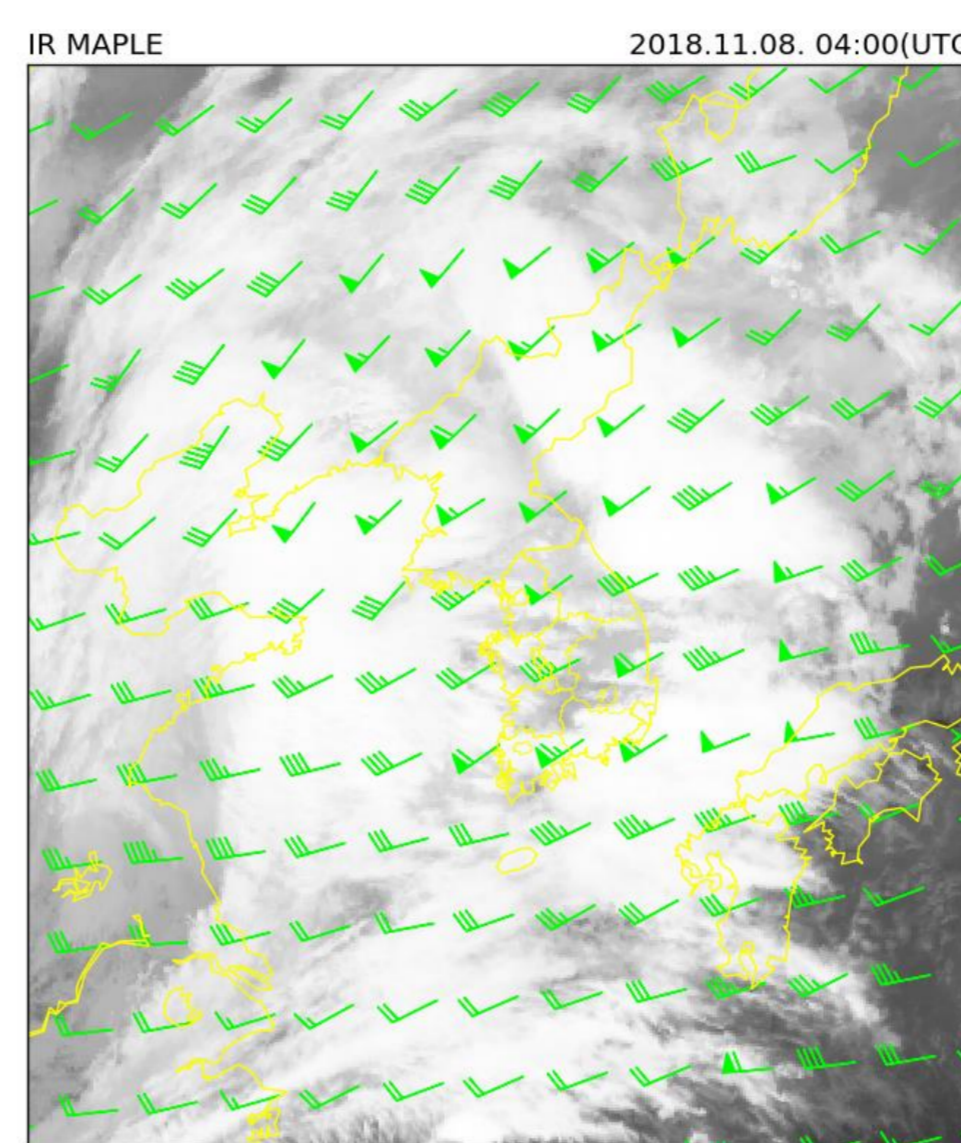
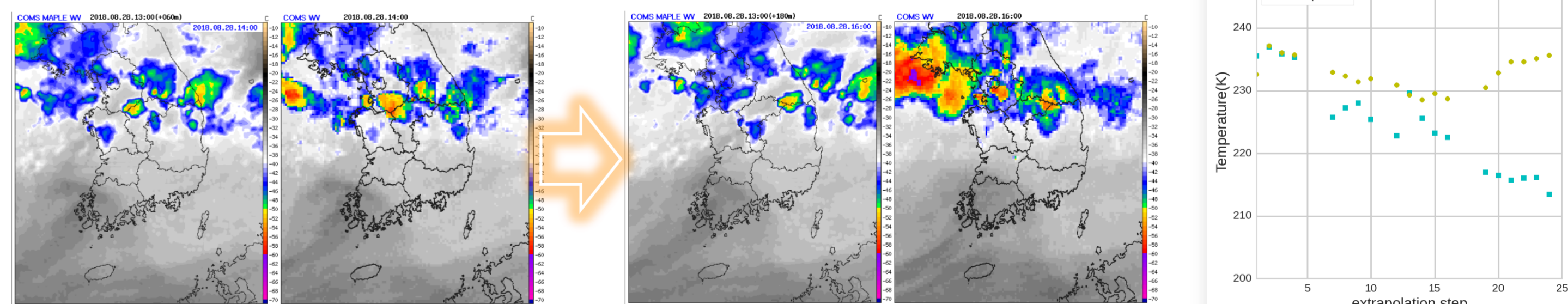

IR AMV EXIM RI

WV vector MAPLE RI

Limits to Prediction

- The extrapolation method has limitations that cannot predict the developing or dying clouds

Summary

- Since the movement of clouds and precipitation cell is different, a new method is needed to express the movement of rainfall intensity
- WV vector, not the IR vector, was used to extrapolate the rainfall intensity
- The extrapolation prediction method is difficult to predict for developing and disappearing clouds

Reference

- ZAMG/NWCSAF, 2017: Algorithm Theoretical Basis Document for the Extrapolated Imagery Processor of the NWC/GEO
- Urs Germann and Isztar Zawadzki, 2002: Scale-Dependence of the Predictability of Precipitation from Continental Radar Images. Part I: Description of the Methodology

Acknowledgement