Distribution of rice yield derived by growth model using solar radiation estimated by GMS data

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Abstract: Monitoring crop condition, growth and production estimates at the prefecture level in Japan is important for food supply. In this study, we have demonstrated the use of a process-based crop growth model for rice together with solar radiation data estimated by GMS (Geostationary Meteorological Satellite) images and meteorological data obtained by ground observation. Since the crop growth model needs solar radiation, air temperature, wind speed and humidity, we prepared their daily values. Solar radiation was estimated using visible and infra-red imagery of Geostationary Meteorological Satellite (spatial resolution is 1.25 km and observation interval 1 hour) and other meteorological values were interpolated by geographical factor analysis in 1km resolution. The model employed for estimating solar radiation was relatively simple one which describes radiation attenuation when passing through atmosphere and needs some parameters for the attenuation. These models were applied for Hokkaido, Japan from May to October 2002. Solar radiation values estimated by the model in hourly basis were integrated to daily values. Estimated solar radiation showed fairly well. Monthly RMS errors for estimated daily solar radiation were from 68 to 104 W/m2, which can be used as input data for the process-based crop growth mode. The solar radiation model, air temperature and wind speed model, and process-based crop growth modes were combined and calculated rice growth and yield. We compared the calculated values and measured values. The result showed rice yield estimate at RMS Error of 65.2 kg/10a, which is almost the same value when we calculate using measured meteorological data.