

New topographic correction method of satellite image in the season of low solar elevation

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In this study, a new topographic correction method was developed, which can be applied to satellite image in the season of low solar elevation.

At first, Minnaert method and C method were tested with the ASTER image of the mountainous area of the time when solar elevation was low to clarify problems of these methods. In advance, land surface condition was classified to six categories by using the ASTER image when solar elevation was high. As a result, Minnaert method could not correct the part where the cosine of the solar incidence angle ($\cos i$) was smaller than or equal to zero because of structural problem of correction formula. In C method, correction effect was insufficient in the part where $\cos i$ was positive. Also, overcorrections were found in the part where $\cos i$ was negative because distribution characteristics of Digital Number (DN) were different between positive part and negative part of $\cos i$. In addition, in the winter image used in this study, original DN value had elevation dependence caused by colored leaves and fallen leaves.

In order to solve these problems, DPR (Dual Partitioning Regression) method was developed. In this method, sample data were extracted from each landcover and elevation. DPR method uses inclination of the linear regression line of $\cos i$ versus original brightness D_o as the correction parameter. In this regard, regression was calculated in positive part and negative part of $\cos i$ separately. The correction formulas were derived in such a way that corrected brightness D_c became equal to original brightness D_o when $\cos i$ was 1.

Topographic correction by DPR method was performed with the image which Minnaert method and C method were applied to. As a result, the coefficient of correlation for regressions between $\cos i$ and D_c showed a very low value, less than 0.03, in all bands. In addition, a similar correction effect was seen when DPR method was applied to the area 20km east of the original area. In conclusion, it was shown that DPR method was effective as the topographic correction method of satellite image in the season of low solar elevation.