



Uncertainties of MODIS-derived phenological metrics in the pan-Arctic regions

Xinchen Lu, Siyu Wang, Xianglan Li, and Xiao Cheng

College of Global Change and Earth System Science, Beijing Normal University, Beijing, China (stevenlvrs@foxmail.com)

Sensitive to environmental conditions, the pan-Arctic regions are vulnerable and crucial in the context of climate change. Efforts have been made to use optical remote sensing from space to monitor the seasonal metrics of canopy variations of plants globally in the pan-Arctic regions. At the regions of high-latitude, the estimations based on vegetation indexes (VIs) to infer seasonal cycles, however, remain extremely challenged and rarely validated. Here, we report the uncertainties of MODIS, a widely exploited set of satellite measurements, to estimate key phenological dates (KPD) in the changing regions. Four indexes based on the normalized reflectance of Moderate Resolution Imaging Spectroradiometer measurements (MODIS) measurements (i.e. Normalized Vegetation Difference Index (NDVI), Enhanced Vegetation Index (EVI), Phenological Index (PI) and Plant Phenological Index (PPI)) were evaluated at 11 sites with eddy covariance (EC) measurements from 2000 to 2014. Our results indicated that the performances of all indexes were hampered by snow cover and soil moisture during the transition dates. NDVI and EVI showed abnormal values while PI tended to stay down around the transitions dates. The length of growing seasons estimated by four VIs could lead off a difference up to 6 weeks. While the relationships between VIs based and EC based estimations of KPD existed, they had a low overall R^2 below 0.3. Among VIs, PPI estimated metrics showed an interannual pattern that was mostly close to the EC based estimations. To have a more sounding and reliable understanding of the pan-arctic regions, more attention could be addressed with the developments of new regional specified indexes.