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Monitoring Regional Vegetation Changes in Seward Peninsula, Alaska, Using Optical Remote Sensing Data

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The vegetation at the Seward Peninsula, Alaska, has been studied and characterized by transitions from boreal forest to tundra resulting from the influences of climate change on disturbance and species composition. Most of the studies, however, focus on global scale responses, providing little information on regional vegetation changes more related to either local topography or climate patterns. Since the regional vegetation trend may change along with the variations in the gross productivity and range expansion of particular vegetation species during growing seasons, the vegetation index retrieved from optical remote sensing data is useful to monitor the vegetation transitions over long time span at the area of interest with fine spatial resolution. Landsat-5 TM and -7 ETM+ acquired during growing seasons from 1985 to 2010 over the townsite of Council in Alaska are analyzed for the temporal analysis of Normalized Difference Vegetation Index (NDVI) trends. The study area consists of three major vegetation groups of shrub, forest and tundra sites as researched by Arctic Transitions in the Land-Atmosphere System, but no detailed information on vegetation transitions are available to date. For improvements, the radiometric and atmospheric corrections are carried out converting 8-bit digital numbers to physical units, such as at-sensor radiance or exoatmospheric Top-Of-Atmosphere (TOA) reflectance at the time of each acquisition since the Landsat data need to be preprocessed yielding high-quality science data. In addition, Dark Object Subtraction (DOS) is applied to the TOA reflectance in order to minimize atmospheric effects which contaminate NDVI values where a common radiometric scale is not assumed among the multi-temporal datasets. NDVI ranging from +1 to -1 can then be simply retrieved using red and near infra-red bands of corrected Landsat data. The trend of NDVI is expected to represent the decadal variations in regional vegetation status and will be further compared with supplementary data in order to figure out relationships between observed vegetation changes and influencing factors. The outcomes will not only provide better understandings of assessing vegetation changes on regional level, but also clarify the main causes of observed NDVI trends.