Box A1: Remote sensing data: levels, availability, and use

Airborne and spaceborne crafts often carry multiple sensors that collect data at varying spatial resolutions and extents (many sensors have 'wide' mode with decreased spatial resolution but increased swath width, or extent), and those data are often used to create multiple secondary data products. For each sensor, there are multiple data levels: raw data (level 0), calibrated (e.g., geometrically, radiometrically, and atmospherically corrected; levels 1 and 2), and sometimes combined (e.g., differences or ratios of different spectral bands such as NDVI) or subjected to other image-classification techniques (e.g., land cover classifications; level 3 and higher)(Mertes 2002). The increased availability of remote-sensing data at different levels allows for their use as direct observations (levels 0 to 2), or as inputs as parameters in mechanistic or statistical models of ecosystem properties (levels 2, 3, and 4), but their availability for specific time periods generally decreases with increasing level because of the amount of processing and validation with *in situ* data required. For example, the NASA's Moderate Resolution Imaging Spectroradiometer (MODIS) sensor is carried on both the Aqua and Terra spacecrafts, which are part of a three-satellite constellation launched as part of the NASA's Earth Observing System (EOS); Aura is the third EOS spacecraft designed to monitor ozone, air quality, and climate. MODIS instruments collect raw radiance data across 36 spectral bands at spatial resolutions of 250 m, 500 m, or 1000 m (level 0), including information on data quality (Figure 2). Radiance data are then calibrated and geolocated (level 1 and 2), and then subjected to specific algorithms using data from specific spectral bands to produce multiple data products (level 3; often called secondary or derived data) every 1 to 2 days, such as total

precipitable water, snow cover, land surface temperature, and chlorophyll-a concentration (modis.dsfc.nasa.gov).

References

Mertes, L. A. K. 2002. Remote sensing of riverine landscapes. Freshwater Biology 47:799-816.