ANNEX I – CEOS Response to GCOS IP Action Item T-29

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Abstract

A costing proposal for operating and sustaining a required in-situ LAI and fAPAR validation network to support the GCOS Action Item T-29 is provided. Costs for the first year of 50 sites (corresponding to areas where LAI measurements have been previously collected) range from US$500,000 (threshold) to US$1.6 million (nominal) to US$2.0 million worst case. Costs for subsequent years, including 10 new sites per year, range from US$500,000 (threshold) to US$1.2 million (nominal) to US$1.6 million worst case.

Introduction

GCOS IP Action Item T-29 requires establishment of an in-situ LAI and fAPAR network for the purposes of validating global LAI and fAPAR products following the specifications defined by CEOS under GCOS IP Action Item T-30. These specifications require a network of 100 direct validation sites corresponding, in part, to ~50 existing but irregular in-situ monitoring sites and an addition 50 sites to improve global representativeness. This document defines the monitoring needs at each site and estimates the additional cost required to meet these needs.

Monitoring Needs

Each site should allow for a direct spatial and temporal match of in-situ measurements with LAI and fAPAR products having a maximum resolution of 1km by 1km. Ideally a 3km x 3km region should be mapped in-situ to minimize uncertainty in validation due to spatial registration errors. Additionally, matches at a daily temporal resolution should be supported. Measurements should be conducted using instruments and protocols identified as acceptable within the fAPAR and LAI validation methodology identified under Action Item T-30. Measurements and derived reference surfaces will need to be archived together with uncertainty estimates.

Current measurement technology does not enable frequent cost-effective survey of LAI or fAPAR over 1km x 1km regions. The proposed approach includes an automated daily measurement and manual monthly measurements that can be combined statistically to estimate daily LAI together with uncertainty. Each site will contain at least one automated measurement suite located within the dominant surface cover type. The automated measurements will be supplemented by (at least) monthly manual surveys during the growing season. Instrumentation and protocols for automated survey of fAPAR and manual survey of fAPAR and LAI suited to different surface cover types is available and well characterized. Instrumentation and protocols for automated survey of LAI is currently in testing phase.

Costing

All scenarios assumes purchase and life cycling (20% capital cost per year) of automated and manual equipment for measurement. The nominal scenario assumes that:

1. 80% of sites are accessible by ground transport allowing same day survey in-siti.
2. 80% have data logging and transmission facilities for automated measurement
3. 50% will not require acquisition or processing of intermediate scale imagery to upscale local measurements
4. 100% will require 6 monthly visits, on average, to cover the growing season with 5 person days to perform each visit
5. 100% will require 15 person days for data post-processing,documentation and quality control for each year

There are two alternative scenarios. The threshold case assumes only two measurements per year with no automated systems. The worst case scenario assumes the same number of measurements as the nominal case but with 50% of the sites are hard to access and 50% require new transmission equipment, and 100% require intermediate imagery.

In terms of unit costs we assume (at 2011 US$ not inflation or cost of living adjusted):

1. a person-day cost of US$200
2. automated instrumentation (such as the INRA Parameter System or a network of PAR sensors supplemented by a calibrated phenology camera) of US$15,000 as a one time cost
3. instrumentation for manual survey such as two LICOR LAI-2100 systems and two digital hemispherical camera or TRAC systems at US$10,000 as a one time costs. The worst case scenario has costs corresponding to LAI-2000 and DHP at every site.
4. post processing of data at each site at US$3000 per year
5. additional transport costs of US$1000 per visit
6. image purchase and processing costs of US$500 per visit
7. data logging and transmission costs of US$2000/year including equipment life cycle.
8. half a person year will be required for maintaining a central data base of in-situ measurements at $US 100,000 per person year including overhead
6. half a person year will be required for quality control of measurements in the central database at $US 100,000 per person year including overhead

These costs are taken from current measurement campaigns conducted by experts and by current costs of automated instrumentation and logging systems. Image costs assume availability of free or nominal cost moderate (>=10m) resolution visible/near-infrared data.