



GREENCYCLESII's Work Package 1 (WP1) contributed to the international effort towards a common benchmarking system for land surface models by providing a compilation of the available datasets for the evaluation of terrestrial biosphere models as components of Earth System models. This overview was published as part of an overview article (Luo et al. 2012), written under the umbrella of the international Land Atmosphere Benchmarking Project (iLAMB). This provided a state-of-the-art description of available data for use to evaluate the projections made within the 5th climate model intercomparison project (CMIP5).

WP1 not only assessed the usefulness of existing data sets, but also improved existing data-sets in three important domains:

Water availability is a strong control of vegetation production and the activity of soil biota, thereby affecting the structure and biogeochemical cycling of terrestrial ecosystems. WP1 developed a methodology to synergistically use the information contained in several soil moisture retrievals, based on different satellite sensors using multiple wavelength, to provide an improved estimate of the spatial and temporal variability of surface soil moisture. These data provide a novel constraint for terrestrial water cycle models, as it reduces the uncertainty in the soil moisture observations and provides a quantitative estimate of the retrieval uncertainty. These developments are now continued with the next generation of soil moisture retrieval satellite instruments: A new soil moisture retrieval scheme has been developed for ESA for the SMOS (Soil Moisture and Ocean Salinity) mission, and experiments will be performed soon at ECMWF for the assimilation of these retrievals in the land surface model.

Disturbance by fire is a key component of many ecosystems (such as Savannahs or Mediterranean shrublands), shaping the structure of these ecosystems. Fire is also plays an important role in the interannual variability of the global carbon balance. WP1 developed a new methodology to better describe current fire dynamics at the global scale by analysing satellite data at very high temporal and spatial resolution to estimate the seasonal extent of the area burnt by fire. The current methodology gives improved insight into the fire dynamics between 1981 and 1991, as well as the year 1998 and will be extended until 2011 in the near future. In a different project, WP1 assessed fire dynamics at much longer temporal time-scales by investigating differences in the fire regimes between glacial and pre-industrial conditions. This work combined process-based modelling and paleo-records of charcoal, which provides indirect evidence of past fire activity. This combination allowed us to learn more about the climatic drivers of fire at long time-scales.

Previous measurement had pointed to a larger-than-thought variability in the Atlantic Ocean's surface CO₂ concentrations and net CO₂ uptake. WP1 has contributed to the improvement of the Surface Ocean CO₂ Atlas (SOCAT) data-base, and employed a novel technique to generate a 1°x1° resolution data-set of monthly sea surface partial pressure of CO₂ for the entire Atlantic Ocean. This new dataset provides important insights into the regional patterns and trends (1998-2007) of the Atlantic Ocean net CO₂ flux, and therefore an important new constraint for ocean carbon cycle modelling.

Long time scales of the global carbon cycle were also the focus of experimental work to increase the precision and temporal resolution of the records documenting the change in atmospheric CO₂ concentrations between glacial and interglacial times. This was achieved by detailed analysis of the gas bubbles trapped in ice of the Berkner icecore, and provided a detailed look into CO₂ variations during the transition from the last glacial maximum to the beginning of the current interglacial.

This briefing statement is intended for use by Policy Makers and Journalists – if you have any questions or would like further information on the points raised above then please use contact the GCII Project Co-ordinator.