



Using satellite data to constrain terrestrial carbon cycle calculations: strengths and limitations

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The last few years has seen a tremendous increase in the capability, resolution and temporal frequency of satellite observations relevant to the terrestrial carbon cycle. There are several ways in which these data can affect carbon calculations carried out by some form of model: as a direct input, as a means to estimate a model parameter, as a way to quantify a process, and as a means to test model predictions (the last of which can lead to a model diagnostic if there is a way to attribute model-data disagreement to some well-defined aspect of the model). These approaches effectively treat the model as the primary entity and the data as ancillary information. However, potentially more powerful are data assimilation methods in which the model and data are treated on an equal footing as sources of information. Their joint contribution to estimates of carbon cycle quantities is then optimised given their respective error properties. This paper will discuss and provide examples of these different modes of model-data interaction, and investigate how limitations in our knowledge of both models and data factor into the effectiveness of this interaction.