

Integrating land, energy and water at different scales in Foreseer

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The Foreseer tool, developed at the University of Cambridge, visualises energy, water and land resources through a set of Sankey diagrams showing the flow from basic resources (e.g. coal, surface water and forested land) through transformations (e.g. fuel refining and desalination) to final services (e.g. sustenance, hygiene and transportation). Different resources have impacts on different scales, related to how far they can travel. For example, carbon emissions have global impacts, and electricity can be transported and used on a national scale. On the other hand, water used in power generation is extracted locally, and similarly the impact of biomass extends to its region of origin.

There are two related issues of scale, in the modelling and in the presentation of the model results. Models should ideally operate at the finest relevant level of detail, to capture non-homogeneous behaviour, although lack of data may be limiting. Modelling at too coarse a scale may miss important behaviour, as with the spatial variations mentioned above, or temporally when energy demand and supply must be matched in individual time-slices. On the other hand, when presenting the results, many different scales may be appropriate simultaneously to different audiences and research questions, whether a high-level aggregated view or the detailed spatial variation. For this reason we are developing an approach to interactively navigate through model results at different scales.

The results of an energy, water and land system model take the form of a mathematical graph of processes, stocks and flows. We define a hierarchical description of the relevant scales; these can include both the physical spatial and temporal scale, but also descriptions of other attributes at different levels of detail. Using these hierarchies we can aggregate and disaggregate the results and change the area of focus to suit the question at hand.