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Visualising the outputs of complex models in a landscape context

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Abstract: Increasing computing capacity and improvements in our understanding of dynamic natural systems has lead to the development of complex multi-dimensional computer models. However, as these models simulate more and more variables across multiple dimensions, the interpretation and communication of results that vary across space and time can be a significant challenge that traditional two dimensional (2D) maps and graphics alone cannot adequately address. This paper describes a set of three case study approaches and methods developed by the Victorian Department of Primary Industries to enhance the communicability of spatial dynamic data across landscapes. Our approach made use of a combination of technologies including the animation of geographical information system (GIS) outputs, three dimensional (3D) still images and the "Google Earth" digital globe.

Our first case study investigated how the temporal and spatial dispersal of locusts could be displayed in an informative fashion through the use of GIS scripting procedures to produce temporal animations. These animations provided insight into understanding the behaviour of the considered organism in relation to land-use and wind direction parameters. However, this approach showed major limitations in its capacity to communicate multiple variables simultaneously.

Our second case study made use of 3D landscape visualisation software to create realistic looking snapshots from the outputs of climate change agricultural impact models. This approach allowed the combination of a large number of variables (rainfall, crop types, and management practices) into a single visual output easily understandable to the viewer. A major limitation to this approach was, however that it provided information for a single location at a time and that the visual outputs could not be directly linked to spatially referenced information.

Our third case study, made use of a combination of animations of GIS outputs and graphics embedded within the Google Earth interface. This approach was aimed at communicating outputs from a spatialized population model of an insect under different climate change scenarios in Australia. Through the use of its time span functionality, Google Earth could successfully be used to display animations of GIS layers overlaid above its satellite and aerial imagery. This interface allowed the display of animations while providing the possibility to pan and zoom in locations of interest. Google Earth hyperlinks functionality was then used to associate additional information (automatically generated graphics and 3D imagery) to each location. This combined approach allowed us to access detailed information for specific locations of interest, while viewing animations of large scale dynamic processes. It therefore allowed us to overcome the shortcoming from case studies one and two while retaining their specific advantages.

Through this case study approach, we have shown that a combination of multiple visualisations technologies embedded within digital globes could highly enhance the capacity to display and communicate the result of complex scientific spatial models. However, large scale application of this technology appeared constrained by the need for web-accessible real-time data post processing procedures.

Keywords: *3D visualization, digital globe, spatial dynamic data, model communication.*

Abstract only