Scripts for GCBM-FLINT Course Videos

9th Slide

As I mentioned before it makes the FLINT very scalable, but it does make certain problems very difficult for it to handle.

We cannot deal with awareness of neighboring pixels so we cannot work with fire spread, and we do not really know the exact location of rule-based disturbances.

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This is a very high-level overview of what the event-driven system looks like. Basically the current pixel data is run through the spatial layers in the database and then it goes to the event sequencer and that's what is firing those life cycle events things like timing init, timing step start, timing step end and the output.

And then all the science models are subscribed.

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One of the examples of our modules is the growth module. It subscribes to three of those system events, the simulation start- loads the root biomass equation, each time a pixel is loaded, it loads dead organic matter turnover rates and the timings step is going to load or process the current growth curve.

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CBM science is implemented as modules running on the front platform. The key features are that ecosystem components biomass soil greenhouse gases are represented as carbon pools. There is a yield curve-based growth module, and the disturbances and annual processes are represented as transfers between these carbon pools.

The core module includes   
- biomass growth and mortality  
- dead organic matter and soil dynamics and   
- disturbance impacts - management activities like harvest, natural disturbances like fire and land use changes like deforestation, afforestation.

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We went through a pretty lengthy process when we developed this new model and the results are nearly identical to CBM CFS 3.

Let’s look at the main differences from CBM CFS3. forest in inventory and disturbance data come from spatial layers instead of database tables.

The location of all the disturbance events is explicit in spatial layers instead of using rules.

It gives out special as well as tabular output for pools and fluxes also it is easier to extend with new models and easier to simulate large landscapes such as the ones that have a huge number of pixels.

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Here is an example of one of the outputs that we generated using the model. The simulation does not produce this directly but there is a set of advanced python scripts that we used to produce these outputs. They are also freely available along with the ones that generate animations using the spatial output.

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Let's have a look at the actual structure of a GCBM project. We start off with some spatial data like disturbances and forest inventory data, along with a database of non-spatial modelling parameters like growth curves and disturbance m. This passes through a set of python based pre-processing tools to output data in GCBM readable format.

And the along with GCBM configuration files in json format go for GCBM simulation. It produces a set of spatial outputs as well a SQL database output.

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Talking about the data that we need for running GCBM. On the spatial side, we need At least a map of the initial forest age or the time since last disturbance and the classifiers. It is recommended to have a mean annual temperature layer which affects the decay rates and reference parameters used are almost similar to that of CBM-CFS3. An administrative, ecological boundary is also used.

In terms of non-spatial or tabular data, it requires a CBM-CFS3 archive index database which contains the library of non-spatial modelling parameters and a CBM-CFS3 styled yield table in CSV or Excel format. Using a country specific CBM-CFS3 archive index database, that is customising it according to using the modelling parameters that are more suited to your geographical region improves the results.

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Let's look at the archive index database. It contains the non spatial parameters and spatially references parameters  like the decay rates, disturbance matrices, and root biomass coefficients.

It is used in both CBM CFS3 and GCBM.

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A little more detail on the disturbance events format for GCBM.

We can take pretty much any spatial layer format but usually  on the raster side it'll be a file per year where pixel value equals to the disturbance type or file per disturbance type and year where pixel value equals to 0 or 1, bits indicating disturbed or not disturbed.

We can also take in vector layers and have any number of those layers that contain polygons of completely disturbed areas. What you see on your simulation map is what ends up getting simulated. You will need a couple of attributes in the vector layers, like what's the disturbance year or what's the type of disturbance, etc.

And these will be paired with a lookup table that maps non-standard disturbance type names in the spatial layer to actual names of disturbance types that are understood by the model.

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Getting into the structure of this training project, the standalone project is a collection of individual pre and post processing tools organised into a workflow to get people up and running with GCBM.

It does not do any sort of fancy pre-processing and is really what you see is what you get. It ingests SPATIAL layers and SIT like data and runs exactly what has been specified by the input data.

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It is designed to be portable so you can copy it anywhere and run with correct python or GDAL environment