The Laboratory of Tree-Ring Research

presents a talk by

Tyson Swetnam

(University of Arizona)

Calculating the flow of energy and water in complex terrain with high performance computing (HPC): Implications for dendroecology and dendroclimatology research.

Tuesday, October 13, 2015 - 4:00pm to 5:00pm

Room: Bannister 110

High Performance Computing (HPC) is freely available to all University of Arizona researchers. However, understanding how to develop HPC applications and workflows that go beyond current desktop computing applications are not necessarily within the purview of most earth scientists. Collaboration between computer scientists and geoscientists is now a necessity to achieve cutting edge performance and results, e.g. in the life sciences the time to sequence DNA genomes are now counted in hours instead of years because of HPC and software developed specifically for research. Here I present a HPC workflow developed by the 'ISTA 420/520: Applied Cyberinfrastructure Concepts' project-based learning course from fall semester 2014. The students (with virtually no experience in earth sciences) developed a scalable model of 'Effective Energy and Mass Transfer' (EEMT, MJ m-2 yr-1) for use by the NSF Critical Zone Observatories. The energy component is calculated from the daily direct (beam), diffuse and reflected solar irradiation of a digital elevation model (DEM) at a short time step (3 minute interval) across an entire year with topographic shading effects. The climatology component upscales to the DEM resolution the 30-year 1 kilometer (km) resolution monthly averaged DAYMET surface weather and climatological summary data product. Thousands of spatial raster files including the daily/monthly solar radiation, temperature, precipitation, vapor pressure, topographic wetness, etc. are saved to the user's project folder in the cloud. Users interested in developing climate and energy balance summaries of their study area over the Daymet 30-year period need only a DEM or set of latitude and longitude coordinates to generate the output data layers. All of the project code is available via GitHub, a tutorial on setting up your UA HPC account and executing the workflow are hosted through the iPlantCollaborative.org wiki pages. Current and future applications of the tool will be presented and suggestions for how the workflow can be improved and uses in dendrochronological research will be openly discussed.

The University of Arizona