VisIt
Current Targets

• Novel interface and easy communication between UV-CDAT and VisIt
• Provenance
• Provide Climate Science driven algorithms
  – Extreme Value Analysis
  – Peaks Over Threshold
  – Model-Based Clustering, ...
  – TECA
    • Extra Tropical Cyclone detection
    • Atmospheric River Detection, ....
Climate Science Core Needs

• Clean: customized embedded interface caters to climate science community.
• Scalable: Optimized analysis and visualization techniques.
• Diversifiable: Meet needs to varying capabilities and support of wide range of sources
  – R and Python scripting with MPI support.
• Customizable: Vary metrics of core algorithms within UV-CDAT/VisIt.
  – Visit_foreach_location, VisIt_foreach_time, VisIt_foreach_file, etc…
Addressing: Interface Needs

• Goal: Allow new UV-CDAT/VisIt capabilities to be intuitive and easy to use for the climate science community.

Integrated VisIt Client within UV-CDAT
Addressing: Interface Needs

• Loose integration with UV-CDAT
  – Rendering done within UV-CDAT, Computation done externally using local or remote resources.
• The PyQt infrastructure allows embedding, custom climate science interface, and seamless integration within UV-CDAT environment
• The VisIt embedded client provides request and response capabilities.
Goal: Provide ability to extend climate science algorithms as well as create brand new ones with support of well supported programming environments (Python/R).

Addressing: Computational Needs
Addressing: Computational Needs (1)

- Write Python or R code and embed it into VisIt’s pipeline for extension of functionality.
- Invoke optimized VisIt templates that utilize user generated execution kernels. Templates proved I/O, spatial, temporal, and windowing support.
- Create a call graph that links several kernels together allowing for rich & complex operations.
- Support for MPI in R and Python allowing users to parallelize kernels. (capable of parallelizing cdms)
Computational Needs and Use Case

- Integrating – TECA and R Code
- Parallelized and optimized for scalability and performance.

Extreme Value Analysis

Peaks Over Threshold
Use Case: Parallel Analysis of the Extremes

• Goal: Compute Extreme Daily Precipitation and Temperature.
  – Allow user to estimate the frequency and trends of extremes at many spatial locations.
  – Done in parallel within VisIt’s workflow. I/O and preprocessing in VisIt and analysis in R. The results are displayed within UV-CDAT/VisIt or written to a file.

• Impact: Ability to analyze extremes in climate model output.
  – Models produce data at many locations, over long periods of time, and often for multiple runs (ensembles)
  – Use of UV-CDAT/VisIt provides faster processing, analysis of ensembles, processing over large periods of time, and over many models.

Conclusion: Work allows analysts to understand how models characterize extremes, compare between different models, and evaluate results and performance metrics to observational data.