HECTOR

• MAGICC is the current way GCAM emissions are translated into climate changes
  – In-house C ++ version
• But it’s old code; difficult to work with; legal encumbrances unclear
• Effort underway to develop new model to fill this role
• No, the name doesn’t mean anything
Philosophy

- Separation into layers
- **Open source** and community-oriented
- Complexity only where warranted (K.I.S.S.)
- Well-documented code
- Robust framework for multiple future uses
- Minimize dependencies
  - ...this is hard
Some development notes

• Automated unit testing
  – Every section of code has a corresponding test unit
  – These are run automatically and results tabulated
  – Using googletest framework

• Builds on Mac OS X, Linux, Windows*
MODEL CORE

Atmosphere
Land
Ocean
Carbon cycle

ODE solver

Forcing calculation

Other things
(aerosols, sea level...)

Core
Data routing; Visitor handling; Main run loop
Model components

• Register themselves with core
• But are not dynamically built from input
  – (the GCAM approach)
• Can notify the core of their dependencies*
• Self-contained, but can communicate with other components
• Receive visitors
Units

• We use Boost Units for zero-overhead dimensional analysis

• Automatic unit checking and conversion
  – E.g., for $A = B + C$ the preprocessor will enforce that $B$ and $C$ can be added together, and that $A$ is proper type to accept result
  – Units automatically appear in output stream

• Has some disadvantages
Output

• As in GCAM, visitors register themselves and are routed to all model components at each timestep
• Restart visitor
• CSV visitor
  – Nicely formatted table
• Stream visitor
  – This is intended for automated post-processing, data assimilation, etc.
year,run_name,variable,value,units
1751,hectortest,atmosphere.carbonPool,598.701 C
1751,hectortest,atmosphere.ppmCO2,281.08,ppmv CO2
1751,hectortest,atmosphere.anthroEmissions,0.003,P(yr^-1 g C)
1751,hectortest,forcing.FCO2,0.0206053,W/m2
Summary

• Much of infrastructure is in place
• One-line placeholders for science code
  – Giving grossly “right” response for carbon cycle, the 800-lb gorilla
• Component infrastructure ready
  – Work underway (after a hiatus) on SLR, aerosols, etc.
• We would like to hear about uses, concerns, wish lists