Discussion included an experimental design for high resolution/short term and long term model runs that will contribute to the development of benchmark scenarios for IPCC AR5. This section describes an experimental design and scenarios short (e.g., 30-50 years) and longer term (80-100+ years) future simulations. Initial conditions and spinup runs for the Atmosphere-Ocean General Circulation Models (AOGCMs), coupled carbon cycle-climate Earth System Models (ESMs) and Earth System Models of Intermediate Complexity (EMICs) are also considered.

1. Near-term model runs (2005-2030/2050)

This experiment will include newer, higher resolution AOGCMs (roughly _ to 1 degree – even higher possible) that will run from 1950-2005 to both initialize for the future and evaluate recent historical fluxes and climate. Experimental design will consist of:

a) Single GHG concentration scenario, at least a 10 member ensemble. This experiment will consist of simple chemistry and active aerosols, dynamic vegetation (no migration) no carbon cycle. New IAI scenarios to be published this fall will have ca 50% higher emissions and run through ca 2030. The median of short-term scenarios tends to be higher than the median for the longe- term scenarios. This is because in the long-term scenarios, outcomes towards end of century are considered whereas short-term scenarios explore model trends such as current construction of power plant trends, currency trends, etc.. The long-range transport community, including IGAC, AIMES and AC&C could provide an international analogue to WGCM tp develop and analyze emission scenarios for IPCC. There will be a workshop, week of 7 August, 2006 in Boulder, CO to discuss this.

b) Three additional single member experiments with e.g., different aerosols, low, medium and high to be included.

c) Possible geoengineering experiments for mitigation on short term timescale would have a big effect on climate!

2. Long-term model runs (2100 +)

Longer-term runs provide an opportunity to contribute a policy perspective on avoiding the consequences of climate change. In addition, experiments would provide a basis for evaluating the feedbacks and contributions of the carbon cycle to the climate system. The experimental design supported by this group mandates that WG1 and WG3 be staggered in time. The long-term simulations would be with lower resolution AOGCM and ESM's (roughly 2^o) with a pre-industrial spinup including a 20th century forced experiment that consists of natural and anthropogenic emissions (including at least a 10 member ensemble). Two, possibly three greenhouse gas (GHG) and aerosol concentration scenarios to be supplied by WG3: (1) a reference (e.g., A2-type), (2) stablization (e.g., B1-type); and possibly (3) mid-range scenario to provide a swath of possible outcomes. At least one ensemble member for each scenario would be considered, and the models would include as core, the terrestrial and ocean carbon cycle. Biogeography and successional processes as implemented, chemistry and aerosols would be prescribed to 2100 and stabilized after 2100 until 2300.

The first two experiments are considered 'core' for all groups to participate in, with a third, optional experiment:

Experiment 1: An AOGCM or ESM-type model runs with time series of specified emission concentrations provided by WG3. The carbon cycle model produces a time-series of CO_2 fluxes that are saved. Note: – the CO_2 fluxes do not enter the atmosphere to change climate system response to specified concentration time series. The diagnosed fluxes from this experiment (e.g., land/ocean CO_2) are returned to WG3 to where inverse calculations of the diagnosed fluxes are used to derive mitigation policies to achieve derived emissions. The rate of change of CO_2 which is prescribed is $dCO_2/dt = F_{emissions} - F_{o\text{-}a} - F_{l\text{-}a}$, or, the change in CO_2 with time = emission fluxes minus the ocean-atmosphere and land-atmosphere carbon fluxes. This experiment prescribes the change in CO_2 with time and the emission fluxes are diagnosed through the ocean and land/atmosphere fluxes. The scenarios group would also provide prescribed concentrations and emissions for other gasses, including aerosols that would be interactive within the models.

Experiment 2: For this experiment, atmospheric $CO_2$is fixed for the radiation code in the model only. This is an uncoupled simulation with no climate change occurring, therefore, temperature will remain about the same. The purpose of this experiment is to compare the implied emissions between Experiment 1 and 2 which is essentially the carbon cycle feedback on permissible emissions (emissions consistent with a given concentrations scenario). The CO_2 concentrations from Experiment 1 are still really important; the impact of carbon cycle emissions on stabilization at a given level provides WG3 with options to explore what to do to stabilize. The derived emissions will be noisy, and WG3 will have to fit, or smooth the time series emission pathways. This experiment will allow comparing emissions on the size of the carbon cycle feedback.

Experiment 3: In order to derive the magnitude of a carbon cycle and climate feedback from the modeling perspective, the implied emissions from Experiment 2 can be run with full carbon cycle in Experiment 1.

These experiments are designed to be community-coordinated. This experimental design allows an AOGCM to diagnose the feedback from Experiments 1 and 2, and Experiment 3 explores whether there are differences in climate change for a given scenario. If a modeling group only has an AOGCM, climate change is still an outcome, widening the participation. This experimental design also provides consistent analyses across models such that when IPCC meets for AR5, chapter 10 will not have to document caveats of model-specific inputs.

As mentioned earlier, comparing the implied emissions between Experiment 1 and 2 provides the policy community the carbon cycle feedback on permissible emissions. The impacts group (WG2) will require additional runs, and it is anticipated that there will be groups willing to do an additional scenario in the middle of the representative A1 or B1 on a volunteer basis, providing the impacts group with a finer mesh of outcomes. The real challenge will be how to narrow the options. High and low scenarios would be "core" with in intermediate scenario run as an option. Again, for this experimental design to work, WG1 and WG3 **must** be staggered.