AC4 FY15 Information Sheet

Nitrogen cycle improvements in the GFDL Earth System Models

BACKGROUND

Anthropogenic activities have profoundly perturbed the natural nitrogen cycle. Present-day anthropogenic sources of reactive nitrogen (Nr) exceed natural terrestrial production. Major sources of anthropogenic Nr to the atmosphere result from fertilizer use and other agricultural activities, fossil fuel combustion, and biomass burning. Emissions of nitrogen oxides (NO_x), ammonia (NH_3) and nitrous oxide (N_2O) have increased by factors of two to three since 1850. NO_x is an important precursor for tropospheric ozone and, together with ammonia (NH_3), leads to the production of aerosol particles. These aerosols impact climate by scattering solar radiation, modifying cloud microphysics, and perturbing photochemical oxidant production. Nitrous oxide (N_2O) is a potent greenhouse gas and is currently the leading stratospheric ozone depleting substance. Anthropogenic activities have also increased the source of Nr to estuarine and marine systems, both directly and through the deposition of nitrogen-containing gases, with large consequences for water quality, eutrophication and the carbon cycle.

Modeling and model development is crucial to NOAA's mission to respond to the societal need to better predict and project future climate change. Recognizing the substantial effects of nitrogen cycle perturbation on climate, NOAA's Geophysical Fluid Dynamics Laboratory's (GFDL) has been working to evolve global climate models into Earth System Models to account for interactions (e.g. land use, emissions, fire, chemistry, ocean acidification) between human activities, ecosystems and climate. This comprehensive examination of the nitrogen cycle representation offers an opportunity for research to guide future development of Earth System models. Past efforts have demonstrated that the most persistent and vexing problems in how global models represent key processes are best tackled by bringing together field experimentalists and remote sensing experts, process modelers, and global-scale modelers together in research teams.

PRIORITIES

To advance Earth System models, in FY15 the AC4 program is soliciting research proposals for a research team focused on improving the representation of the nitrogen cycle in GFDL's Earth System Models. Proposals are expected to address processes associated with one or more of the following:

1) Improved characterization of Nr cycling between the atmosphere and the land and/or ocean on diurnal to decadal timescales, particularly focusing on the impacts of agricultural activities
2) Role of biomass and fossil fuel burning in Nr cycling
3) Formation of nitrate aerosols

DETAILS

Proposals solicited by this call should focus on the improvement of NOAA's Earth System model at GFDL by testing and evaluating the impact of improved process models when embedded in the global models. Considering the process research areas identified above, proposed ESPT should focus on those processes that have a mature observational and theoretical base, and scope proposed research so that

significant progress can be made over the duration of the project on improving their representation in the Earth System models. As appropriate, proposed projects should leverage existing modeling experiments, such as coordinated multi-model experiments performed as part of CMIP5 and/or planned field campaigns.

APPLICANTS

Each proposal must involve co-PIs/co-Is from NOAA/GFDL, and should bring together model developers, process modelers/theoreticians, and observational scientists to collaborate and systematically address the identified process and assess model fidelity. A strong management plan must be included in the Project Description. The plan should clearly delineate responsibilities among the collaborating institutions and set milestones for implementing and testing improved process representations in the target Earth System model(s).

PROJECT DURATION

Project duration should be 3 years or less, depending on the activities that are being proposed. Project costs may be up to $500k/year.

SUBMISSION DETAILS

Computational resources on NOAA's high-performance computing platforms are available for research in the priority areas above. Proposers who choose to request additional computational allocations on NOAA's platforms should include in their proposal a request describing the computational resources and data storage required, as well as a description of the logistics for porting their model to the NOAA platforms for incorporation into the GFDL Earth System Models. (The request form for computational resources can be found at http://cpo.noaa.gov/sites/cpo/Documents/word/MAPP_FY15_HPC_Request_Form.docx) Questions regarding the use of NOAA's high-performance computing platforms should be sent to Brian Gross (Brian.Gross@noaa.gov), GFDL Deputy Director. Questions regarding the scope of ongoing scientific efforts in nitrogen cycle modeling at GFDL should be directed to Larry Horowitz (larry.horowitz@noaa.gov). Other questions should be directed to AC4 Program Managers (Monika Kopacz and Kenneth Mooney). PIs are strongly encouraged to submit Letters of Intent following the guidance in the Federal Funding Opportunity. Letters of Intent should be emailed to AC4 program managers (Monika.Kopacz@noaa.gov and Kenneth.Mooney@noaa.gov)