Forecasting, Monitoring, and Analyzing Boreal Fire and Pyroconvection During ARCTAS

P.I. Michael Fromm
Co-I: Brian Stocks

Abstract

There is a growing consensus among atmospheric scientists that boreal forest fires directly impact the Arctic environment on a regular basis. The importance of this is reflected by the inclusion within the endorsed IPY POLARCAT (Polar Study using Aircraft, Remote Sensing, Surface Measurements and Models, of Climate, Chemistry, Aerosols, and Transport) Project of a Sub-Project dealing with boreal fire effects on the Arctic. Recent studies show that intense forest fires and extreme convection often result in the development of pyrocumulonimbus (pyroCb) that loft smoke into the upper troposphere and lower stratosphere (UTLS). These deep injections greatly increase the likelihood of long-range smoke transport and perturbed chemistry. Scientists agree that smoke in the UTLS may have important implications for the radiative energy budget in the polar region, that soot deposition from fires may lead to enhanced melting of sea ice and glaciers, and that the chemical impact of fire emissions at high altitudes is unknown.

With strong evidence that climate change is underway at northern latitudes, resulting in more frequent and severe boreal fires, a coordinated investigation into boreal fire dynamics, smoke transport, physical and chemical smoke properties, and potential impacts on the Arctic environment is called for. This proposal is for support of investigators on an international, interdisciplinary IPY project. We propose to support all fire-related ARCTAS and POLARCAT projects. One project in particular involves the ARCTAS deployment of instrumented aircraft in Canada or USA in summer 2008. Our support will entail the analysis of ground and satellite data used to monitor fires, pyroconvection, and downwind smoke transport, providing validation with aircraft measurements. In addition we will assist with meteorological forecasting for mission planning. This international collaboration will produce an enhanced understanding of boreal fire dynamics, the mechanisms of emissions transport, impacts on the Arctic, and the role that satellite monitoring will provide.