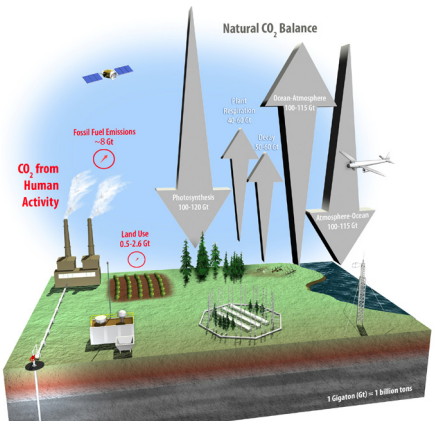
SAND2011-1167P

Design data-gathering and analysis systems to enable the U.S. to sign a global climate treaty

The 2009 United Nations Climate Change Conference was held in Copenhagen, Denmark, from 7–18 December 2009 to try and forge a global treaty to govern greenhouse gas (GHG) emissions at the international level. One of the reasons this summit failed to achieve the hoped-for results was the lack of an accredited system for monitoring and measuring GHG emissions. Also lacking was a means for reliably distinguishing between natural and man-made GHG emissions.

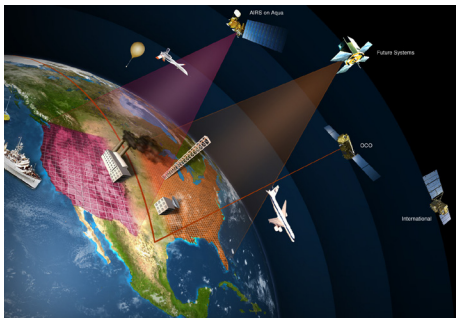
Without the ability to track, accurately measure, and reliably determine GHG emission sources, no country was or likely will be willing to agree to international treaty obligations. A scientifically robust GHG information system (GHGIS) would combine ground-based and space-based observations, carbon-cycle modeling, GHG inventories, meta-analysis, and an extensive data integration and distribution system, to provide information about sources, sinks, and fluxes of GHGs at policy-relevant temporal and spatial scales to allow policy makers to enter into and assess compliance with international agreements to limit emissions and enhance GHG sinks.

In the U.S., DOE national laboratories are partnering with many entities including NASA, NOAA, USDA, and several major academic institutions are undertaking a scoping study to determine GHGIS' technical requirements. ECIS' monitoring and sensing activity is developing data gathering and analysis systems and sensing technologies that will work in concert with those systems to



Carbon dioxide undergoes a complex series of exchanges between elements of the natural atmosphere and biosphere and human activities. We must understand and be able to accurately and reliably track these exchanges in order to meaningfully assess compliance with any future climate-change treaty.

- enable GHG emission treaty verification,
- refine representations of clouds and aerosols in climate models,
- make credible attributions of GHG emission sources, and
- measure atmospheric carbon and GHG emissions for carbon cycle and terrestrial carbon studies.



A network of ground-, air-, and space-based sensors will collect GHG emissions data to provide GHGIS with the information necessary to reliably report on climate-treaty compliance.

To this GHGIS effort, Sandia brings an extensive technology base for remote and *in situ* monitoring and sensing (satellite sensing, data systems and integration, sensors); new technologies developed or in development for GHG measurements (atmospheric and terrestrial mobile lab, new sensor development programs); a strong track record and current funding as ARM Program contributor (North Slope of Alaska Facilities); and Sandia has a lead role in the existing GHGIS partnership.

The eventual measurement system will most likely be primarily satellite based because key, major GHG emitters are expected to resist *in situ* measurements for verification. Detection, attribution, and quantification of man-made emissions must occur in the presence of natural sources and must be credible to contribute to verifying international treaties. Such a GHGIS must

- meet specifications in precision, accuracy, spatial resolution, and reporting frequency;
- meet data quality control and quantified uncertainty standards;
- integrate measurements from space, air, land, and sea with bottom-up inventory data, utility and transportation data, and data gathered from U.S. government and international sources; and
- cope with denied territory and the possibility that self-reporting may be in error.

Data must be reconciled and provide input to computer simulations that capture sources, sinks, and model transport in the atmosphere, land, and oceans; carbon-cycle activity; and differentiate natural and anthropogenic emissions.

For more information, contact:
Mark Ivey, 505-284-9092, mdivey@sandia.gov

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