Brief Description of ISAM

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The current version of ISAM consists of several sub-models including a terrestrial biosphere-ocean carbon cycle model and 2D (latitude and height) models for chemical transport, radiative forcing, and climate. Connections to the economic and social sciences have been achieved through Pacific Northwest National Laboratory (PNNL)'s MiniCAM model. In this study we use a reduced form version of our ISAM for future emission scenario analysis, as described by Jain et al. (1994a) and Jain and Hayhoe (2002). The reduced-form ISAM model estimates the relationship between the time-dependent rate of GHG and aerosol emissions and quantitative features of climate including GHG concentrations, Equivalent Effective Stratospheric Chlorine (EESC) and ozone, global temperature and sea level. The reduced form ISAM comprises:

Carbon Cycle. ISAM's global carbon cycle component simulates CO_2 exchange between the atmosphere, carbon reservoirs in the terrestrial biosphere, and the ocean column and mixed layer (Jain *et al.*, 1994a, 1995, 1996; Kheshgi *et al.*, 1996, 1999a)

Methane Cycle. In its reduced form as used in this study, atmospheric CH_4 concentrations are calculated by simulating the main atmospheric chemical processes influencing the global concentrations of CH_4, CO, and OH, using a global CH_4-CO-OH cycle model (Jain et al., 1994b; Kheshgi et al., 1999b)

Other GHGs. In its reduced form, ISAM past and future atmospheric concentrations for N2O and halocarbons are calculated by a mass balance model as described by Bach and Jain (1990)

Climate Model. ISAM calculates temperature and sea level changes based on a reduced-form energy-balance climate model of the type used in the 1990 IPCC assessment (Harvey et al., 1997)). The climate component of ISAM calculates the perturbations in radiative forcings from CO_2 and other GHGs based on updated seasonal and latitudinal GHG radiative forcing analyses (Jain *et al*., 2000).

References

Bach, W. and **Jain**, **A.K. (**1990) CFC greenhouse potential of scenarios possible under the Montreal Protocol, ***Intl. J. Climatology***, **10**, pp 439-450.

Jain, A.K., Kheshgi, H.S. & Wuebbles, D.J. (1994a) Integrated Science Model for Assessment of Climate Change Model. presented at and published in the proceedings of ***Air and Waste Management Association's 87th Annual Meeting***, Cincinnati, Ohio, June 19-24, 1994.

Jain, A.K. & Bach, W. (1994b) The effectiveness of measures to reduce the man-made greenhouse effect: the application of a climate-policy-model. ***Theoretical and Applied Climatology*** 49: 103-118.

Jain, A.K., Kheshgi, H.S., Hoffert, M.I. & Wuebbles, D.J. (1995) Distribution of Radiocarbon as a Test of Global Carbon Cycle Models, ***Global Biogeochemical Cycles*** 9: 153-166.

Jain, A. K., Kheshgi, H.S. & Wuebbles, D.J. (1996) A globally Aggregated Reconstruction of Cycles of Carbon and its Isotopes. ***Tellus***, 48B, 583-600.

Jain, A.K., Briegleb,, B. P., Minschwaner, K., Wuebbles, D. J. (2000) Radiative forcings and global warming potentials of thirty-nine greenhouse gases, ***J. Geophys. Res.*** 105, 20,773-20,790.

Jain, A.K., K.A.S. Hayhoe, (2002) Global air pollution problems, **In** ***Handbook of Atmospheric Sciences, Vol.2: Problems, Tools and Applications***, C. N. Hewitt and A. V. Jackson (eds.), Blackwell Science Ltd, Oxford, UK (in press).

Kheshgi, H.S., **Jain, A.K.** & Wuebbles, D.J. (1996) Accounting for the Missing Sink with the CO_2 Fertilization Effect. ***Climatic Change***, 33, 31-62.

Kheshgi, H. S., **A.K. Jain**, and D. J. Wuebbles, (1999a) The global carbon budget and its uncertainty derived from carbon dioxide and carbon isotopes, ***J. Geophy. Res***., .104, 31,127-31,144.

Kheshgi, H.S.,**Jain**, **A. K.,** Kotamarthi, R., Wuebbles, D.J. (1999b) Future atmospheric methane concentrations in the context of the stabilization of greenhouse gas concentrations, *J. Geophy. Res* 104: 19,183-19,190.