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Nota di contenuto	Research Strategies for the U.S. Global Change Research Program -- Copyright -- Preface -- Contents -- Summary of Recommendations -- INTEGRATED MODELING OF THE EARTH SYSTEM -- FOCUSED STUDIES TO IMPROVE OUR UNDERSTANDING OF GLOBAL CHANGE -- Earth System History and Modeling -- Human Sources of Global Change -- Water-Energy-Vegetation Interactions -- Terrestrial Trace Gas and Nutrient Fluxes -- Biogeochemical Dynamics in the Ocean -- DOCUMENTING GLOBAL CHANGE -- REFERENCES -- 1 Introduction -- THE U.S. GLOBAL CHANGE RESEARCH PROGRAM -- INTERNATIONAL PROGRAMS: IGBP AND WCRP -- OBJECTIVES AND ORGANIZATION OF THIS REPORT -- REFERENCES -- 2 Integrated Modeling of the Earth System -- OVERVIEW -- ATMOSPHERE-TERRESTRIAL SUBSYSTEM -- A Modeling Strategy: Prognosis for Progress -- Research Priorities -- Summary -- PHYSICAL-CHEMICAL INTERACTIONS IN THE ATMOSPHERE -- A Modeling Strategy: Prognosis for Progress -- Research Priorities

-- Summary -- ATMOSPHERE-OCEAN SUBSYSTEM -- Uncoupled Models -- Coupled Models -- A Modeling Strategy: Prognosis for Progress -- Bottom-Up: A Focus on Key Processes -- Key Processes: Small Scales -- Limiting Processes: Mesoscales -- Limiting Processes: Basin and Global Scales -- Top-Down: A Focus on Phenomena -- Research Priorities -- Summary -- CRITICAL MODEL TESTS -- The Challenge and Critical Tests -- The Interface Models -- Atmosphere-Terrestrial Subsystem -- Physical-Chemical Interactions in the Atmosphere -- Atmosphere-Ocean Subsystem -- INFRASTRUCTURE -- REFERENCES -- 3 Earth System History and Modeling -- OVERVIEW -- Contribution of Geologic Studies to Global Change -- Specific Research Initiatives -- Priorities -- Themes of the Proposed Research -- Implementation of the Research Plan -- HOLOCENE HIGH-RESOLUTION ENVIRONMENTAL RECONSTRUCTIONS -- The Last 1,000 to 2,000 Years -- Global Network of Environmental Change. Observational Needs. -- Modeling Needs -- Little Ice Age -- Observational Needs -- Modeling Needs -- Regional Process Studies -- Observational Needs -- Modeling Needs -- Earlier Holocene Millennial-Scale Fluctuations -- Observational Needs -- Modeling Needs -- GLACIAL-INTERGLACIAL CYCLES -- The Last 40,000 Years -- Abrupt Changes -- Observational Needs -- Modeling Needs -- Resolving Model-Data Discrepancies over the Last 20,000 Years -- Observational Needs -- Modeling Needs -- The Last Glacial Cycle (Last 130,000 Years) -- Global Carbon Cycle -- Observational Needs -- Modeling Needs -- The Previous Interglacial -- Observational Needs -- Modeling Needs -- Regional Variations in Climate over a Glacial Cycle -- Observational Needs -- The Last Few Glacial-Interglacial Cycles (Last 500,000 Years) -- Observational Needs -- Modeling Needs -- SYSTEM RESPONSES TO LARGE CHANGES IN FORCING -- Environments of Extreme Warm Periods -- Observational Needs -- Modeling Needs -- Climate-Biosphere Connections During Abrupt Changes -- Observational Needs -- Modeling Needs -- CRITICAL PROGRAM ELEMENTS -- Sample Acquisition -- Environmental Calibration -- Correlation of Records -- Data Management -- INTERNATIONAL COOPERATION -- REFERENCES -- 4 Human Sources of Global Change -- OVERVIEW -- Background -- Priority Recommendations -- THE RESEARCH PROGRAM -- INDUSTRIAL METABOLISM -- Integration and Synthesis -- Process Studies and New Data -- The Intensity of Energy and Materials Use -- The Dynamics of Industrial and Technological Change -- Regional Evolution of Industrial Metabolism -- LAND TRANSFORMATIONS -- Integration and Synthesis -- Global Agriculture Model -- Land Cover Projections for the Twenty-first Century -- Process Studies -- Fertilization -- Biomass Burning -- Livestock Development -- Data Needs. Land Use, Land Cover, or Land Capability/Population Density Geographic Information System -- Land Tenure and Size of Holdings -- Regional Case Studies and Research Centers -- INTEGRATIVE STUDIES ACROSS LAND USE AND INDUSTRY -- Global Model of Greenhouse Gas Emissions -- Earth Systems Information Flow Diagram for Human Interactions -- Driving Forces: Population, Economy, Technology, and Institutions -- IMPLEMENTATION REQUIREMENTS -- Related Institutional Efforts on Human Interactions with Global Change -- Investigator-Initiated Research -- Education and Training -- Data Preparation and Dissemination -- THE STEPS BEYOND -- NOTES -- REFERENCES -- 5 Water-Energy-Vegetation Interactions -- OVERVIEW -- DATA NEEDS AND EXPERIMENTS -- Global Data Needs -- Long-Term Monitoring -- Integrated Monitoring and Process Studies -- Experiments -- Integrated Ecosystem Experiments -- Field Campaigns

-- Simulated and Actual Impact Studies -- Fundamental Research and Laboratory Work -- Remote Sensing -- Ecological Process Studies -- Hydrology -- Instrument Development -- MODELING -- Intermodel Transfer Packages -- Phenological Descriptions for LSPs -- Hydrological Models -- Surface/Planetary Boundary Layer Models -- Ecosystem Structure Models -- Radiative Transfer/Plant Physiology Models -- Soil Genesis Models -- Sensitivity Analyses -- Summary -- INFRASTRUCTURE -- Operational Observations -- Satellite Data Processing -- Centers for Research and Monitoring -- Education -- Interagency and International Coordination -- REFERENCES -- 6 Terrestrial Trace Gas and Nutrient Fluxes -- OVERVIEW -- Problem Definition -- General Approach -- RESEARCH NEEDS -- Trace Gases -- Carbon Dioxide -- Research Priorities -- Methane -- Research Priorities -- Volatile Organic Compounds -- Research Priorities -- Sulfur -- Research Priorities -- Tropospheric Ozone -- Research Priorities.

Carbon Monoxide -- Research Priorities -- Nitrous Oxide and Reactive Nitrogen Compounds -- Research Priorities -- Nutrient and Material Fluxes -- Fluxes Across Terrestrial Systems -- Research Priorities -- Fluxes from Terrestrial to Coastal Marine Systems -- Research Priorities -- METHODS AND INSTRUMENTS -- Models -- Instrumentation for Measuring Fluxes -- CROSS-CUTTING ISSUES -- REFERENCES -- 7 Biogeochemical Dynamics in the Ocean -- OVERVIEW -- STATUS OF EXISTING EFFORTS -- Biogeochemical Fluxes -- Ocean-Atmosphere Interface -- Oceanic Ecosystem Response to Climatic Change -- Physical Processes -- Tropical Ocean-Atmosphere Interactions -- Global Ocean Circulation -- Precipitation over the Oceans -- Polar Processes -- STATUS OF MODELING AND MONITORING EFFORTS -- The Need for Modeling -- The Need for Monitoring -- RECOMMENDATIONS FOR ENHANCED SUPPORT, NEW INITIATIVES, AND RESEARCH PROGRAMS -- REFERENCES -- 8 Documenting Global Change -- OVERVIEW -- MEASUREMENT STRATEGY -- Monitoring Requirements -- Global Synthesis -- Process Studies -- Earth System History and Modeling -- Human Sources of Global Change -- Water-Energy-Vegetation Interactions -- Terrestrial Trace Gas and Nutrient Fluxes -- Biogeochemical Dynamics in the Ocean -- Existing and Planned Observing Systems -- Space Observing System -- Large-Scale Field and Process Studies -- Surface Observation Networks -- International Coordination -- INFORMATION AND DATA MANAGEMENT -- Data System Requirements -- Kinds of Data Needed -- Functions of a Data and Information System -- Creating a New System -- Scientific Involvement -- Data Directories -- Data Submission -- Quality Assurance and Documentation -- Cooperation and Sharing -- REFERENCES -- Appendixes -- Appendix A List of Participants in the Workshop on Human Interactions with Global Change.

Appendix B A Selective Literature Review on the Human Sources of Global Environmental Change -- 1 Integrative Modeling -- 1.1 Impacts of World Development on Selected Characteristics of the Atmosphere: An Integrative Approach (Darmstadter et al.,... -- Data -- Process -- Synthesis -- 1.2 Long-Term Global Energy and CO₂ Model (Edmonds and Reilly, 1983) -- Data -- Process -- Synthesis -- 1.3 Policy Options for Stabilizing Global Climate, U.S. Environmental Protection Agency (Lashof and Tirpak, 1989)... -- Data -- Process -- Synthesis -- 1.4 Future Environments for Europe: Some Implications of Alternative Development Paths (Stigliani et al., 1989a,b)... -- Data -- Process -- Synthesis -- 1.5 Project Proposal: Strategies for Environmentally Sound Development: An Input-Output Analysis (Duchin, 1989c)... -- 2 Industrial Metabolism: Transformation of Materials and Energy -- 2.1

Materials Balance Studies -- 2.1.1 The Hudson-Raritan Study (Ayres et al., 1988 -- Ayres and Rod, 1986) -- Data -- Process -- Synthesis -- 2.1.2 Other Studies -- 2.2 Trends in Material Intensity and Energy Intensity -- 2.2.1 Materials, Affluence, and Industrial Energy Use (Williams et al., 1987) -- Data -- Process -- 2.2.2 "Dematerialization" (Herman et al., 1989) -- Data -- Process -- 2.2.3 "Energy Use, Technological Change, and Productive Efficiency: An Economic-Historical Interpret ... -- Data -- Process -- 2.2.4 Energy for a Sustainable World (Goldemberg et al., 1987, 1988) -- Data -- Process -- Synthesis -- 2.2.5 Toward a New Iron Age (Gordon et al., 1987) -- Data -- Process -- Estimates of demand -- Synthesis -- 2.3 Studies of Long Waves (Marchetti, 1983, 1988 -- Marchetti and Nakicenovic, 1979 -- Nakicenovic, 1988) -- Data -- Process -- Synthesis -- 2.4 Global Energy Modeling -- 2.4.1 The TEA/ORAU Model (Edmonds and Reilly, 1983) -- Data -- Process -- Synthesis. 2.4.2 Paths of Energy and Carbon Dioxide Emissions (Nordhaus and Yohe, 1983).
