



Role of remotely sensed observations and computational systems in support of decision-making in developing and fragile states

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***Workshop on Space Technology Applications for Socio-Economic Benefits
Istanbul, 14-17 September 2010***





- Post-war growth of U.S scientific enterprise
- Success of air quality regulations
- Complexity and coupled systems
- Advances in remote sensing technology
- Development planning in the 21st century
 - The challenge for policy maker and scientist
 - Decision-making science
 - Role of public-private partnerships

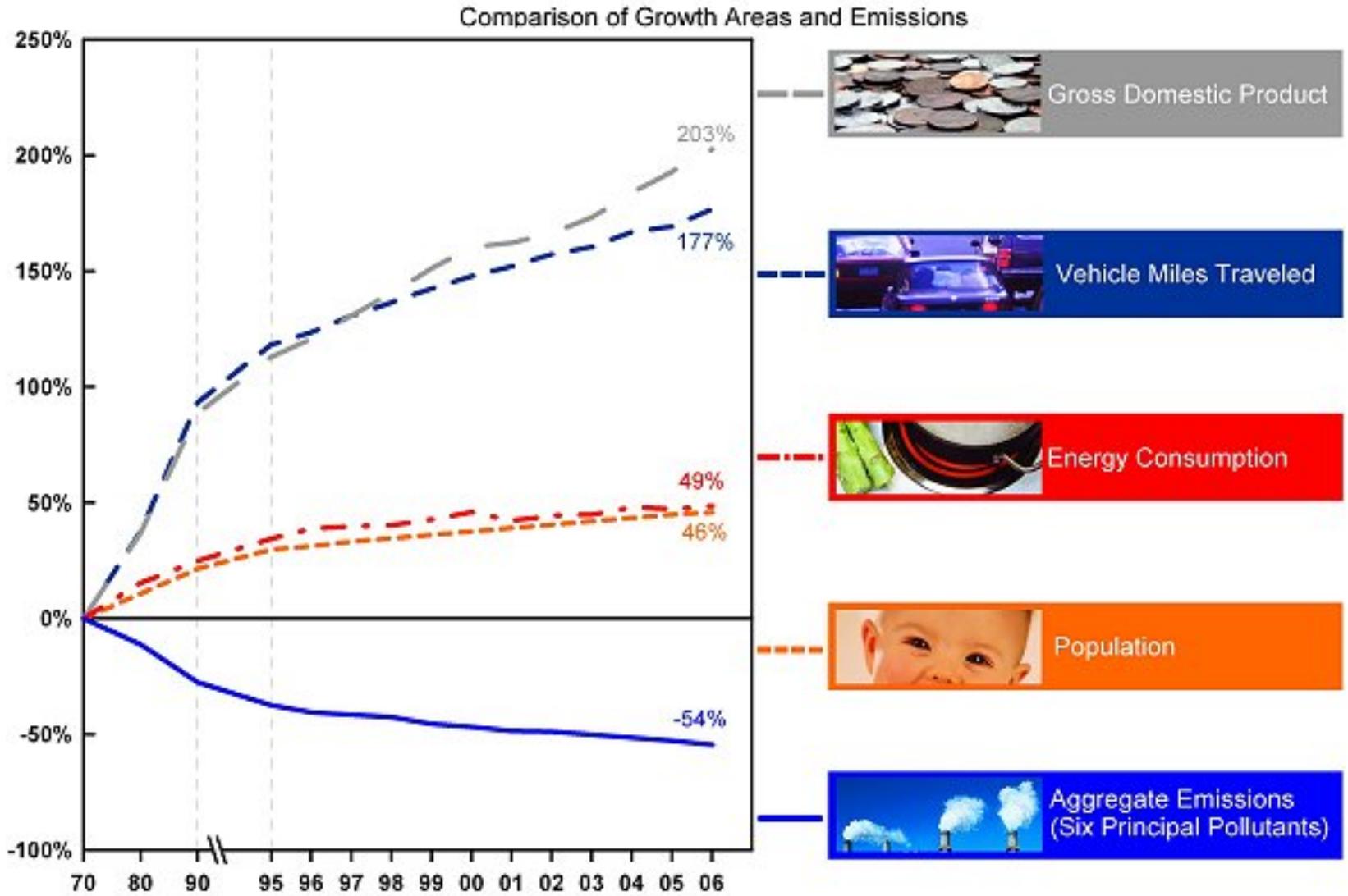


Post-war growth of science in U.S



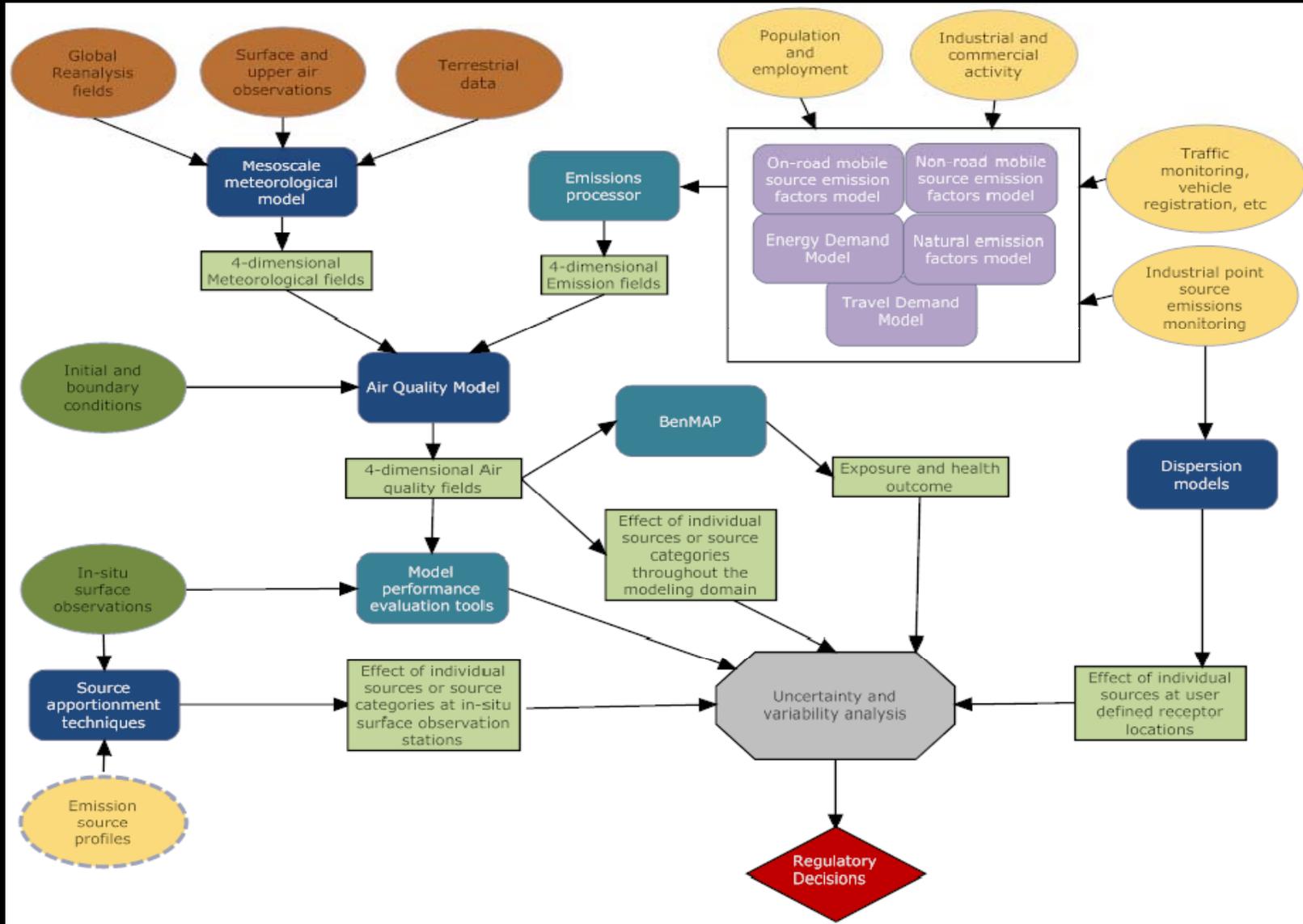
- Educated by the experience of the Second World War, U.S. policy makers fully embraced science as a way to ensure continued national prosperity. Two reports commissioned by President Roosevelt and Truman set the direction
 - “Science The Endless Frontier” by Vannevar Bush, Director of the Office of Scientific Research and Development, July 1945
 - “Steelman Report” authored by President's (Truman) Scientific Research Board (PSRB), August 1947
- After 5-years of debate, President Truman signed Public Law 507, May 10, 1950 establishing the National Science Foundation
- Between 1945-50, Navy, Army and Air force create their own research programs in support their missions
- 1957 launch of Sputnik led to creation of DARPA (trans-service military agency) and NASA
- Pollution concerns led to the establishment of US EPA
- Energy crisis of the 70’s led to the creation of Department of Energy

Success of air quality regulations





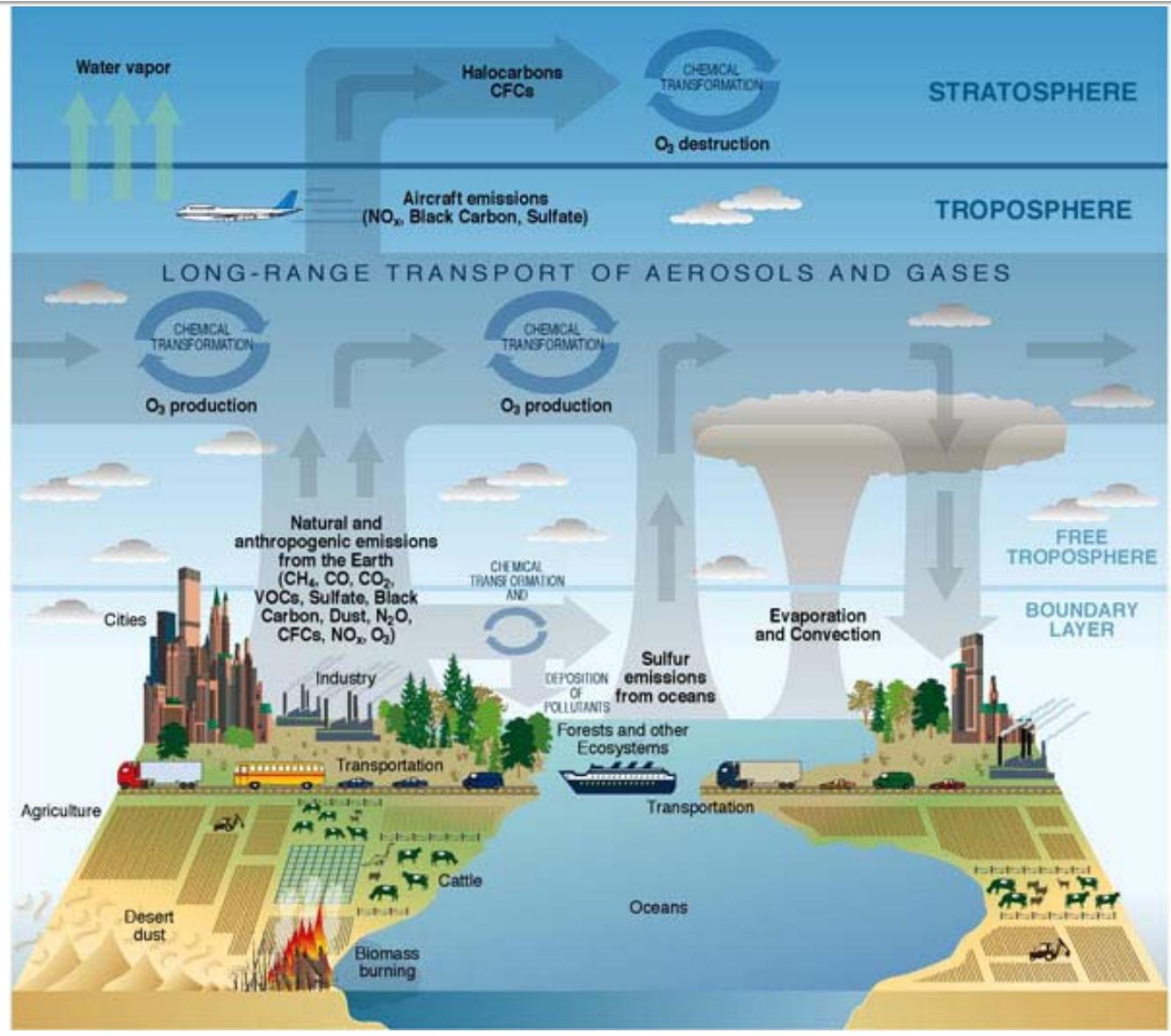
Decision support systems





NASA's Earth Observing System





If you piled sand, grain by grain, until it made cone about the size of your fist, how would you know when the tiny pyramid would have little avalanche?

- Observation: After an initial period during which the sand pile became a little cone, the stack organized itself into instability
 - Where instability (in this case) is defined as a state in which adding just a single grain of sand could trigger a large avalanche – or nothing at all
- Hypothesis: Complex behavior in nature reflects the tendency of large systems to evolve into a poised ‘critical’ state, way out of balance, where minor disturbances may lead to events of all sizes
- Examples: Earthquakes, forest fires, stock market crash, extinction of species

- Newtonian reductionism: Behavior of component systems are first understood individually, and then added up to understand and predict the behavior of a system as a whole
 - Aristotle's "illumination through aggregation"
 - Analogous to growth of science within federal agencies
 - Suitable to the study of *linear-systems*
 - Properties and/or fundamental behavior of component systems *do not change* as a consequence of the interaction of other component system
 - Since most of our human and natural systems that we are dealing with are *non-linear*, the reductionist approach causes us to focus on single issues, and in doing so we miss crucial details that can inform us about solutions that are more 'organic' to the system



The world in 2010....and beyond



- Human development indicators have shown improvement over the last 30 years. However,
 - 1 billion people lack clean drinking water; 1.6 billion lack electricity; 3 billion lack adequate sanitation; a quarter of all children in developing countries suffer from malnutrition
- World population expected to reach 9.0 billion by 2050; 80 percent of this increase will be in developing countries; By then, 75 percent of total world population will live in urban areas; slum population will reach 2 billion
- Changes in climate will place an additional strain on human-systems (housing, water, agriculture, transportation, energy) in developing countries
 - The poorest 3 billion most vulnerable to changes in climate
- The inability of nation-states to provide basic services to its citizen has the potential to cause social unrest, jeopardizing the economic gains of the past 30 years



The challenge for policy makers, scientists, academicians and business in the developed world



How to create healthier and wealthier societies around the world with limited resources

- Ensure immediate adoption of existing technology
 - Remote sensing technology is at times the only source of reliable information in developing countries
 - Models provide the only mechanism through which the relative effectiveness of various policy actions is evaluated
- Greater emphasis on scientific-evidence (versus organizational opinion) in development planning decisions at multi-lateral development aid institutions
 - Bring together small teams of engineers, physical, and social scientists in a problem solving environment
 - Coordinated public-private sector investment in scientific tools and technology development
 - While high risk, most innovation happens at the intersection of fields (*Judy Estrin in Closing the Innovation Gap*)
- Above all, train and inspire individuals, and people who get excited by: “that tickling are you kidding me feeling? as you try something a bit nuts only to discover that it works wonderfully” (*Niels Bohr*)



Public-private sector institutions – A key to sustainable development planning



- Create and sustain in the developing world multi-disciplinary institutions that enjoy the confidence of local stakeholders
 - Facilitate articulation of a “future” that stakeholders want
 - A development planning process that is democratized, inclusive, vertically and laterally integrated across sectors
 - A development strategy with clear metric of success, timely deliverables, and an independent monitoring mechanism
- Discourage the tendency to create organizational structures that are mirror images of institutions in developed countries (the Google dilemma)
 - At times, western institutions created decades ago in response to a societal challenge have not kept pace with technological developments primarily due to regulatory/political constraints
- Globalize local solutions



While knowledge can help humanity develop smart. We should remember..



If man is not to do more harm than good in his effort to improve the social order, he will have to learn that in this, as in all other fields where essential complexity of an organized kind prevails, he cannot acquire the full knowledge which would make mastery of the events possible. He will therefore have to use what knowledge he can achieve, not to shape the results as the craftsman shapes his handiwork, but rather to cultivate a growth by providing the appropriate environment, in the manner in which the gardener does this for his plants.
(Friedrich August von Hayek, December 11, 1971)