The Business Case for the Global Observing System

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A well conceived business case is critical to the success of any enterprise. The purpose of this paper is to present considerations for establishing the business case for the global observing system. Fully developing and then "working" such a plan will provide direction and focus. It will lead naturally to the business plan components which outline the resource requirements, marketing decisions, financial projections, production demands and personnel needs. This generates a "family" of plans including technical, financial, governance and management.

A business plan should be written from three perspectives: that of the provider, the user, and the investor (private or government). Thus it can be used to prioritize issues, provide products, gain advocacy and rationalize investment. It can also be used to seek additional capital for an existing product line. In essence, the global observing systems can be thought of as technology investment that must be justified. The business case makes it relevant and focuses on the user requirements.

Critical to any business plan is the clear description of the mission, the market, and the return on investment. We are drawing upon the collective experience of the authors, all of whom have been associated with some aspect of observing systems thus, we are presenting a "case studies" approach in which valuable lessons are shown for multiple regions and multiple market segments.

Clarifying the Mission

The mission statement of the observing system has been evolving over the past decades. Originally spurred by the scientific community as a tool for answering the pressing research questions in oceanography, meteorology and geosciences, the mission has expanded to the application of the knowledge for the benefit of societies. At the World Summit on Sustainable Development in Johannesburg South Africa in August 2002, commitments were made to improve societies, economies and environments of the world through the focus of technology, intellect and resources on the "informed" management of water, agriculture, health, transport, energy etc. The commitment came jointly from the governments as well as the industrial side. The two groups committed to partnerships to lead the nations—both developing and developed—into sustainability, following on to the UNCED vision and the Montreal Protocol. The G8 meeting in June 2003 reiterated the commitment of the use of the observing system not only to increase the understanding of the earth system but also to apply that information for the common good (Cooperative Action on Science and Technology for Sustainable Development). Most recently, The Earth Observation Summit held on July 31, 2003 in Washington D.C., solidified that commitment in a multinational Declaration. While the technology identification and integration plan are being formulated with data procedures, action plans, and blueprints, the most significant outcome of these three events was the conveyance of a common mission. Governments commit resources because they believe it will develop their societies and economies as well as preserve the environment. They anticipate that the new information will enable their ministries to govern with greater knowledge and decreased risk. They need to solve "real" problems of poverty, disease and famine. In essence, they conveyed the multiple mission nature for the observing system. The challenge comes in appropriately configuring the observing system to meet the multiple facets of that mission.

Understanding the Markets

With the mission statement defined, the next step is to understand the multiple nature of the markets, which necessarily guides the regional designs that maximize benefits to the user. There are distinct customer bases or markets: the research and educational markets that "improve the understanding and increase knowledge", the government services market and business markets that "foster development" through sound policy decisions and through the increased efficiency, reliability, safety and revenue production of economies.

It is also important to understand the levels of "maturity" of the markets. The research community is clearly the most "ready" to use the data that emanate from the observing system, primarily because scientists were "at the table" during the design phase, and they have the ability to tailor the products for their optimal assimilation. Natural resource managers in government (Federal and state) institutions have information needs for stock assessment, wetlands and beach management, which have driven the Federal and state expenditures in the observations. Their environmental needs have been a primary driver for past for the investment, and existing management tools are used to ingest the data. New data can fuel ecosystem-based management or adaptive management practices provided that new data management tools are developed.

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The least mature markets for the observing system information may turn out to be the most avid "customers" for the information. These include major sectors of the economy, notably the energy industry, recreation and tourism, financial services, intermodal transport, and health. Because the management and planning needs of these industries are often not understood, the requirements for the information product is less well defined. Since the environmental information (real time, backcast or forecast) is often one of a number of variables (i.e. economic) that go into a business model (coupled model), the impact of new environmental information on model output is often more difficult to assess (i.e. how an improved weather forecast improves the skill of a revenue projection model or business forecast, which allows the optimal dispatch of electricity to a grid). The relevance of the information product is less well established. In addition, there is a need for awareness-raising and capability building in those sectors to adequately use the new information once it is generated.

Understanding the Market Requirements

Research and Education Industry

The research community, the "educational market" or "sector" primarily drives the need for the information that is the foundation for the scientific understanding underpinning the ability to predict future states of the planet's physical and biological systems. This sector has very thoroughly examined its information requirements, prioritized its issues, defined the optimal configuration of the observing system to meet these needs, procured the initial financial investment for several pilot systems and is now in the process of implementing plans to initiate the construction of the integrated observatory network through integrating and focusing emerging technological capabilities and intellectual resources (i.e. OOI and other related efforts). The key to progress made on this effort is the focusing of the effort on the primary end-use customer- the research community. It is not the intention here to summarize or reiterate the information needs and design priorities, but to present this in the business case sense where the academic community represents a sector "user" or customer with specific goals and requirements.

Government Policy and Services Industry

Enabling the governments of the world to better serve their own nations should be a major priority for the observing system design. Public health and safety concerns are the key driver for many of the government services, and will be the biggest beneficiaries of the new information. Most nations have meteorological and hydrological services, ocean services, agricultural services, housing and social services, natural resources management services, trade and development services, and defense services that deliver the valuable environmental information to enable their populations to make informed decisions. Thus the governments themselves are a provider of the services and a user of the services and represent a forceful market driver of the information. For example, all countries recognize the importance of enhancing the observation system, improving assimilation methods, refining models so as to increase the skill of meteorological forecasting. It is universally recognized as a critical service for the optimal functioning of society. Enumerating the government markets for this information and ensuring the optimal uptake is a global goal for those countries investing capital in the system.

Many observing system "pilots" have been initiated which provide smaller regionally based systems to provide information for commercial and policy use. While originally initiated by the research community, primarily with research dollars, much of the demonstrated value of these efforts has come from the improved management of coastal resources, maritime trade and fisheries. Recent activities have centered on inventorying these projects, standardizing their measurement approaches and data output, and merging or networking their efforts to meet the regional needs of the nation. The drivers in this case are more than scientific understanding and span into multi-use customers in the policy and marketplace arena, particularly for maritime commerce and resource management.

Energy Sector Operations/Decisions Requiring Weather, Climate and Ocean Information

Oil and Gas Exploration, Development and Production Operations

- Accurate surveying and precise drilling for oil and gas reservoirs
- Safe construction and installation of equipment
- Optimizing offshore production operations
- Forecasting production loads
- Efficient demanning of platforms
- Uninterrupted communications for information transfer
- Safe subsea completion and operation planning
- Platform design, maintenance, servicing, and evacuation plans
- Platform emissions reduction and monitoring
- Spill response risk management
- Environmental impact of offshore operations
- Outyear platform and drilling specifications
- Tanker safety and route planning
- Offshore pipeline laying safety & failure risk management

Refining and Transport Operations

- Minimizing risk to refining operations
- Reducing emissions from refining operations
- Planning refinery production processes
- Preventing spills from oil tankers offloading
- Forecasting seasonal demand in the heating oil and gasoline market
- Managing inventory levels and rate setting
- Developing and expanding pipeline infrastructure
- Pipeline throughput and dispatch management
- Planning inventory levels and movement
- Optimizing the advanced purchase of natural gas
- Planning natural gas supply and delivery strategies
- Setting delivery rates for end users

Renewable Energy Operations

- Optimizing wind energy siting and design of new wind generating capacity
- Optimizing planting, growing and harvesting operations of biomass crops
- Siting and developing solar energy
- Siting a hydropower plant
- Forecasting environmental impacts of hydropower
- Conclusions and recommendations 75
- Load planning with environmental variability
- Forecasting availability of water resources
- Regional water management strategies
- Seasonal and interannual fuel switching management strategies

Electricity Generation, Transmission And Distribution

- Planning the purchase, transportation and choice of fuel
- Environmental monitoring of fuel-specific emissions
- Energy load demand forecasting
- Outage risk management
- Siting and designing utility grid extensions
- Regional grid management/demand side management
- Transmission & distribution lines failure risk management
- Surge prediction risk management
- Energy pricing/financial markets
- Managing risk (energy liabilities) due to weather-related demand instability
- Forecasting sales and earnings
- Providing customer and billing service
- Residential vs. commercial usage planning

Global Management

- World energy protocol development
- Defining and meeting emissions targets
- Tracking and reporting of emissions/ emissions trading
- Development of climate change mitigation regulation and treaties
- Measuring and modeling impacts of energy emissions on climate
- Compliance monitoring and verification of emission reductions
- Forecasting changing energy trends due to global change
- Planning remediation strategies such as carbon capture and sequestration
- Destabilization of economies by weather, climate, and ocean hazards
- Association of energy activities and human health issues
- Cross-boundary energy liability issues

While the market as been relatively well established for the management of natural resources, coastal zones, and fisheries, it is less well understood for the other sectors of the economy such as of energy, water, recreation and tourism, financial services sector and the health industry. While it is not within the scope of this limited article to go into detail, we can summarize below the breadth of and impact of the utilization of the environmental information in the operations and strategic planning of the major business sectors for the global economy. It is this "demand-pull" for observing system information that will help in guiding the design and operating requirements for the integrated system as was demonstrated for European industries in several studies (Flemming et al., 1999; Altalo et al., 2003).

Energy Industry

In the energy industry, environmental information needs include temperature, humidity, cloud cover, wind speed, direction, sea level, lake level forecasts, sea breeze, maritime flows, marine layer thickness and inland penetration, fog, radiation, air quality, wave height, current speed, and turbidity. All of these parameters are used in the operations and planning of the energy value chain. The scales of the information used range from time series analysis of historical data bases, real time information, hour ahead, day ahead, out to 11 days ahead (grid operation) to seasonal predictions of temperature and rainfall, out to 15 and 30-year projections for climate conditions of drought and sea level change. The business areas using the information are oil and gas, exploration, production refining, transport, generation, fuel mix choice (fossil vs. renewables), transmission, distribution, grid management, end user procurement strategies, power pricing, power marketing strategies and compliance reporting. Specific tactical decisions associated with these operations include platform logistics (ship scheduling, routing, construction design), capacity (loading weights), storage plans, pipeline flow management, generation unit commitment, load forecasting, revenue projections, statewide fuel pricing, transaction and event planning, workload planning. Strategic planning decisions associated with the industry usually revolve around infrastructure and policy and include generation (including wind and hydro) asset siting (in projected demand areas and distribution utility (electricity, gas and steam) infrastructure (pipelines, transmission lines, storage capacity, substation planning). There are decision support systems for most of the operations, usually in the form of decision model software, which have the environmental variable and appropriate lead-time as input parameters to the model (e.g. electricity load forecast models). This "codifies" the need for the information in a specific format. For example, several commercial load forecasting packages (AANNSTLF, NOSTRADAMUS, RER Metrix) use real time, historical and forecast environmental data as some of the input variables, along with market prices and population demand.

Recreation and Tourism

The recreation and tourism industry is a diverse trillion dollar global industry which could gain maximum benefits from the incorporation of the new information from observing systems into its tactical operations and strategic planning. This complex sector, which includes the travel industry (including cruiselines, aviation and surface transport), visitor attractions (natural and man made parks), recreational fishing and boating, the accommodations sector (with associated food services, transportation) has environmental information needs for both the long range strategic planning for Federal, state and local developers, for commercial resort and port construction, but also the shorter term tactical operations of the hotel management and public and private facilities operators. Environmental information used by this sector include temperature, humidity, heating degree days, cooling degree days, precipitation (rain, ice, snow), wind speed and direction, cloud cover, sea/lake level, wave height, current speed, red tide occurrence, turbidity. The strategic decisions influenced by environmental variables are investment decisions, finance and budgeting, siting of hotel and resort development, design and landscaping, construction and property maintenance. Tactical decisions include engineering and facilities management, risk assessment, public relations, marketing, communications, regulatory compliance reporting, seasonal financial planning, building energy management,

The industry has decision support systems incorporating business models which input environmental parameters that impact the decision process. Examples of statistical models which are used by the accommodation sector and include environmental forecast information are: Revenue per available room (RevPar) and ProfPar; Occupancy rates; Occupancy percentage; Average Daily Rates (ADR); Comparative Operating Rates (COR); Gross Operating Profit (% before fees); Economic Impact Assessment including Financial rate of Return (FRR) and Economic Rate of Return (ERR).

The Financial Services Sector (FSS)

The financial services sector underpins virtually all other private (and to a large extent, public) sectors and organizations. Services range from insurance, and asset management to pension funds and commodities trading. However, one of the underlying concerns and drivers for information is the assessment and limitation of risks to equity across the whole sector. To achieve this a number of instruments have been devised to assess and control risk which rely upon environmental information in the determination of the magnitude of risk. With over $3.5 trillion of the U.S. economy at risk due to weather (i.e. natural hazards), (US DOC), additional information for better decision making in the identification and quantification of risk, as well as in the structuring and execution of a solution is essential. From the companies' point of view, environmental risk is the uncertainty in their cash flow and earnings due to environmental volatility. Information from the observing systems used by the FSS include historical data and forecasts of weather, climate and ocean variables including temperature, humidity, precipitation, sea level, lake level, flood forecasts, ice, seabreeze, wave height, wind vectors, fog, and swell.

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Health Services Sector

Temporal climate and weather relationships between health and injury are already well established, such as influenza outbreaks during winter months and hay fever in spring and early summer: injuries such as falls are more prevalent during the winter. Falls are the leading cause of occupational injuries in the United States. They are also the cause of 15% of all disabling conditions. Health care workload may be forecast on varying timescales. For example, respiratory admissions have a long lead-time, so can be forecast up to 10 days ahead, whereas trauma has a quick response to weather changes-up to 6–12 hours in cases of freezing rain or ice storms-which can increase workload by 800%.

Improved meteorological forecast and health data input into decision support systems for health care providers may include parameters such as: current status of each hospital, admission rates, bed occupancy, breakdown of bed occupancy by health issue, weekly infectious disease report from the Centers for Disease Control and Prevention (CDC). The output would allow for advance planning including forecast of health provider workload; ambulance workloads, emergency room operational centers; and hospital admissions. This would result in improved patient and staff scheduling. Some pilots being run in the United Kingdom have indicated significant hospital savings from use of this information (UK Met Office).

In addition, government facilities are requiring better meteorological predictions in the decision process for facilities management. For example, some Air Force bases have tracked costs associated with personnel injuries and work loss with icing conditions on the base. They are now using the information to weight decisions as to the cost effectiveness of future base closures when icing events are predicted. Similar issues were recently faced by the U.S. Navy fleet upon the approach of Hurricane Isabel. The decision made to deploy the fleet was made on safety concerns.

Estimating the Value of Observing System Information

While it is impressive that so many of the commercial enterprises are using or preparing to use weather, climate and ocean information in the management and strategic planning of the industry it is important to define what the value of the information is to the user. There are several approaches which have been used to establish the value of observing system information. One approach is taken in, Powell and Colgan (2001) This effort has identified a number of benefits that can be expected to flow from the data generated by this regional system. Direct user-oriented observation data will be used directly by boaters, swimmers, surfers, commercial and recreational fishing, as well as the Coast Guard in search and rescue operations. Marine transportation will also be improved through better routing of ships. Processed versions of the data, generally in the form of nowcasts and forecasts, will produce more accurate output of applied models such as for oil spill response and permit more efficient and lower cost oil spill clean up as well as contributing to improved search and rescue. Both can result in substantial reductions in the costs of property damaged and lives lost in search and rescue operations and in environmental damage in oil spills. The study suggests that annual benefits from the GOMOOS system could be $30 million, compared with a $3 million annual cost. Research is currently under way to extend this type of analysis to other regional observing systems, both currently operating and under development. The results should demonstrate both the cost effectiveness of many of these systems, and help guide the development of the systems in order to provide the information of the highest economic value.

Another approach to estimating value is the "industry trials" approach (Altalo et al., 2003a) which has been used over the past five years to "beta test" the new information in the ongoing operational models of many business sectors of the economy. For example in recent benchmarking and information performance trials in the energy industry of the Northeast US (Altalo et al., 2003 b) , it was estimated that a 1-degree improvement in the day ahead temperature forecast error or a 50% improvement in the 2–4 day lead time forecast could represent savings of $20–25 million/yr to a regional transmission organization, and approximately $2million to a large urban electrical utility. Incorporation of additional observing system parameters such as sea breeze forecasts into the load forecast, could eliminate potential event driven errors in the forecast and possibly save an additional 8% of the load costs per event., providing savings of up to $10M. Scaling up to the entire U.S.

Weather, Climate, and Ocean Sensitive Recreation and Tourism Operations

Property: Hotels, Resorts, and Accommodations

- Determining rack rate and discount rates
- Maximizing RevPar
- Gaining optimal occupancy
- Setting budgets
- Determining reservation/cancellation policies
- Obtaining insurance/decide on level of self-insurance
- Purchasing equipment
- Selecting suppliers
- Attracting visitors
- Sending out press releases countering weather misinformation
- Deciding where to site a new development or acquisition
- Determining and complying with building regulations
- Deciding on building materials
- Maintaining buildings
- Planting and maintenance of landscape
- Regulatory compliance
- Determining energy loadings
- Maintaining comfort levels
- Fine tuning engineering systems
- Setting mechanical/electrical engineering specifications
- Applying agri-products
- Formulating internal environmental policies
- Ensuring health and safety of staff and guests
- Identifying risks to life, property, equity, reputation
- Managing and mitigating risk
- Formulating emergency preparedness measures
- Planning daily guest activities
- Whether or not to discount (offload stock)

Insurance

- Deciding if a property is 'insurable'
- Determining premiums
- Determining deductions
- Inspecting properties
- Issuing 'Cat Alerts'
- Ensuring under-exposure of total potential liability

Sports Events

- Submitting bids to host events/conferences/conventions/expositions
- Selecting venue for event (e.g., indoors, outdoors, region, state, city)
- Scheduling of events (year, months, day, time)
- Snowmaking
- Open or close the ski lift
- Turning on underground pitch heating

Maritime and Cruise Industry

- Seasonal/yearly schedules
- Expansion into new areas
- Route planning
- Safety
- Pricing
- Vessel maintenance
- Port to go to
- Guest activities
- Compliance with regulations

Aviation

- 'Go' or 'No Go' decisions
- Preparing aircraft for takeoff
- Preparing aircraft for landing
- How much fuel to load
- Route planning
- De-icing requirements
- Ensuring safety
- Tying down aircraft
- Moving light aircraft to shelter

Emergency Management

- Formulation of emergency plans
- Mitigation measures
- Provisions (issuance of warnings, supplies, services, etc.)

Global Concerns

- Greenhouse gas emissions
- Safeguarding reputation risk
- Participating in hotel industry environmental initiatives (e.g., IHEI, etc.)
- Globalization and harmonization across group regions (e.g., hotel groups)
- Recession of economies in visitor source areas
- Cross border liability issues
- Shareholder/stakeholder pressure
- Consumer pressure

Northeast region, the savings from improved meteorological data could be $75–100M for the Independent Systems Operators and $30–60M/yr for the regional electric distribution companies.

In the same study, an end-user energy procurement strategy was examined to illustrate the effect that incorporating environmental information could have on the "smart" buying of fuel for state facilities such as state university systems. The study indicated, that for SUNY which is the largest buyer of fuel in the state ($146M/yr expenditure), optimal use of historical, real time and forecasted meteorological and hydrological information could save the system $10–18 M/yr in energy expenditures. If the same savings could be recognized by other major energy users, NY state consumers would save an additional $80M, and the entire Northeast up to $135M.

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Formulating the Long Term Investment Strategy

As in any technological development, they key to the success of the program lies in a comprehensive and defensible business model including a well formulated investment strategy. This includes more than the pricing strategy which is often mistaken for the financial investment plan. The target market assessment and analysis is used to determine the return on investment and thus it is important to prepare the potential users for the delivery of the products. In fact, in many cases, the ministers of several nations are asking for just such an analysis to defend their initial investments in the observing system. The financial plan for the operational system will include cash flow analyses and balance sheets for each phase of the project and a risk analysis for each of the phases. Studies such as the ones above are beginning to show the real value of the observing system information product such that a realistic return on investment (ROI) can be estimated.

In the earth observing system, there are many potential players to bring to the table in terms of investment strategies. Not only do the governments have a role, but since the public private partnership may play a significant role, all parties must be at the table at the onset. The partners may consist of foundations, intergovernmental organizations, economic development, and aid agencies, national science agencies, the private sector, local banks and venture capitalists. The role of the investors is expected to change with risk and maturity of the project. Many governments are assessing their appropriate level of funding for the out-years if the product aids the public good. Engaging all of the potential investors at the outset in the initial investment strategy planning process will allow sufficient time for the out-year investors to acquire the pre-agreed upon resources.

Business process and strategic planning expertise is critical to develop detailed and defensible financial and business plans and strategies for all the phases of the earth observing systems lifecycle, based upon cost and spend plans derived from reliable pricing of all of the observing components and operations. The financial investment strategies need to include an understanding of the systems engineering costs of the "provider" industry as well as knowledge management needs and costs of the "user" industry.

Engaging and Preparing the Business User Community

The identification of information components directly impacted by the Integrated Earth Observing System as outlined in the Observing System Summit Declaration, is highly applicable to the findings of this paper. The need for information generation, information integration, decision support systems, and assimilation is of equal importance to the design and development of the observing system structure. It is critical to the overall success of the observing system that this aspect be developed in concert with and with equal diligence as with the system architecture. In essence, the system which the nations have committed to develop is a global environmental information system of which the integrated global observing system is a critical element.

From our findings with the stakeholders needs assessment, there is an urgent need to develop awareness-raising of the value of the observing system products in business decisions. There are multiple ways of approaching this. One is through engaging the business councils and business alliances in formalized discussions. The second is through the establishment of course curriculum in the business schools and schools of management for "managing with environmental information" as opposed to "environmental management". The third is through a series of pilots or "trials" in which new information products can undergo a performance review of how they enhance the output of critical decisions of the policy makers and the industry. In addition, there is a need to formalize the alliances with the industry through business partnerships such as has been done in the BPOS Program (Business Partners for Observing Systems) of the Intergovernmental Oceanographic Commission (www.ioc.unesco.org). This can help ensure that the potential recipients of the information understand how to optimally use the information once it is provided.

Lessons Learned

Reviewing the lessons learned from the pilot observing system can yield a valuable market perspective on the future design of an observing system that will be used for in decision making for economies and societies. Among the findings are the following:

- Partner locally: use of the regional advisory councils was found to be critical in the leveraging of resources and support in the Gulf of Alaska Ecosystem Monitoring (GEM) pilot study
- Convene a multi-sector governance board representing users: the Gulf of Maine case study found that broad board membership provides a wide array of stakeholders with direct input into system design and direction. The feedback in many cases has facilitated development of specific products that target well-defined need.
- Engage/educate the user community: ask users what they do, not what they want. Identify their decision support system which may range from complex software and decision trees to simple "gut feelings". GoMOOS experience with developing a web-based user interface for mariners raised issues such as: (1) many don't have Internet access—NOAA dial-a-buoy was the solution for some of these users; and (2) many like to do their own forecasts because they don't trust or can't use (because of incompatible formats).
- Prepare a requirements document: market surveys based on data-type often are not valuable, largely because there's little experience with actual data products. This doesn't mean there isn't need. Rather, it means that a different kind of market survey needs to be undertaken by individuals with extensive domain knowledge that will be used to develop a requirement.
- Design to requirements: if you want the information to be readily utilized, configure the system to meet a clearly defined set of requirements. Just as the academic community can design a research observing system that is "tailored" and optimized to research needs, so too must the business and policy needs be addressed by optimizing the design to answer pressing management issues. The multiple markets must be addressed simultaneously in the design phase.
- Perform to metrics: you must be able to gauge the success of the observing system, not only in the systems engineering sense—that is , how well does it operate or function from the builders' point of view—but in the information management sense—how well does it answer the needs of the user.
- Define government vs. private sector roles: the respective roles in the design, construction, testing, data/information delivery, operations, management, and upgrade of the system is critical to the success of the system. These must be examined with ALL partners present in development of the strategic.
- Prepare an investment strategy: the most important role definition may be in the long term investment strategy, whereby true "capital' partnerships may be developed. Many models exist for the financial investment strategy. Integrating existing pilots might be considered in business terms as mergers and acquisitions and might be set up as such.
- Tailor the governance models for the region: in some regions of the country or of the world, certain organizational models simply are not traditionally used and therefore will not perform optimally (i.e., Coops and non-profit organizational models). Know the local business environment.

The research community as well can benefit from the semantic content necessary to merge data products from multiple regions.

Financial Services Sector Operations/ Decisions Requiring Weather, Climate and Ocean Information

Investment
- Company/stock rating
- Asset/investment management
- Real estate/property risk analysis
- Equity research
- Liability assessment
- Fund earning forecasts
- Line of credit approvals
- Hedging strategies
- Setting bond rates

Trading
- Commodities buy/sell advising
- Commodities pricing
- Emissions trading pricing/strategic planning
- Carbon trading pricing/strategic planning
- Weather futures buy/sell/pricing

Insurance
- Premium/deductible rate setting
- Setting liability limits
- Claims assessment
- Catastrophe bonds buy/sell
- Pricing model re-evaluation
- Setting exclusion clauses in contracts
- Withdrawal from high risk coverage

- Prepare the business community to assimilate the observing system information in the decision process of businesses: this may entail working with the business associations and business schools in the area as opposed to the traditional arts and sciences or engineering departments of universities.
- Prepare the provider community to consider the policy and business user in the preparation of the product. In GoMOOS' experience, many users have little more than a browser or a cell phone, and many do not have the background, tools, or time to analyze data on their own computers. The research community as well can benefit from the semantic content necessary to merge data products from multiple regions. In fact, the scientific modeling community has used this approach to their advantage by developing and adopting the Climate-Forecast (CF) standard that provides the necessary content for practical use of data-transport software (i.e., OPeNDAP) and formats (such as NetCDF).

Conclusions

In conclusion, this is a pivotal time for the designers as well as the users of the information from the global observing systems that is so critical to both increase our understanding of the earth system processes and their impacts upon societies, as well as to improve the decision making process of policy makers and industry executives. Understanding the interacting roles of research, education, governments and business is important. The research, market and policy drivers are clearly there. Governments want to improve the conditions of their nations so that all peoples can share the benefits that technology can afford them. We must recognize that the global observing system is a powerful tool in the alleviation of poverty and in the development of an acceptable standard of living for all people. If we keep this vision in mind as we develop the "business case" and create the metrics which have societal criteria included side by side with the engineering criteria, the "effectiveness" of the Earth Observing System will be optimized.

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