Earth System Prediction Capability (ESPC)

Daniel Eleuterio

19 July 2012

ESPC Overview

Introduction

ESPC is an **Interagency collaboration** between DoD (Navy, Air Force), NOAA, DoE, NASA, and NSF for coordination of research to operations for an earth system analysis and prediction capability.

It does not replace or take precedence over Agency requirements or resource decisions but rather seeks to improve communication and synergy, especially in the area of global medium range environmental forecasting at the challenging timescales of the **weather to climate interface**.

Thrusts

Common **prediction requirements and forecast model standards** that enable agencies to improve leverage and collaboration.

A **national research agenda** that will improve earth system projections and predictions from days to decades.

Cooperative five-year **demonstration projects** to inform S&T and R&D efforts.

Integration of atmosphere-ocean-land-ice and space predictions into a **fully coupled global prediction** capability.

Charter

Goals (2010)

… establish and maintain a multi-agency initiative that provides leadership and coordination to meet broad, but specific, agency mission requirements and interests for an earth system analysis and prediction/projection framework to support global forecasts from hours to decades at appropriate horizontal and vertical resolutions.

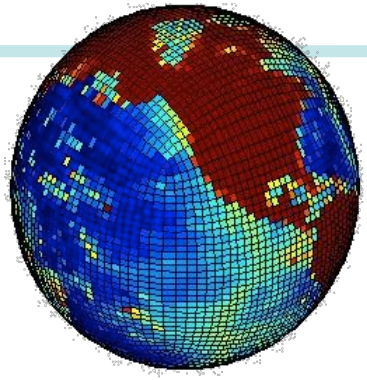
1. A national approach to an earth system numerical prediction capability providing advanced data assimilation, improved numerical model physics and increased computational efficiencies;

2. A common set of requirements and standards that enable agencies to meet their own mission requirements while providing improved leverage and collaboration where these missions can be mutually supportive;

3. A mechanism to develop a national research agenda that will improve earth system projections and predictions from days to decades; and

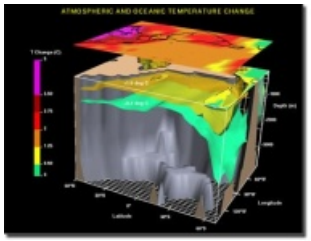
4. A cooperative set of demonstrations to inform future research and development efforts encompassing Federal, private and academic organizations.

Approach



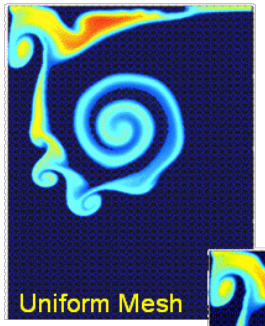
Seek Sources of Predictability through:

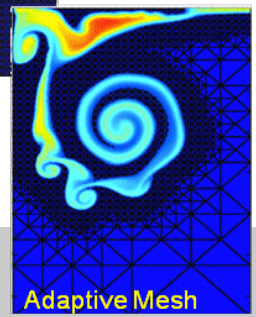
Improved Model Physics
- Coupled global modeling
- Improved resolution & parameterization



Improved Initial Value Problem through
- Joint observational retrievals
- New hybrid DA approaches

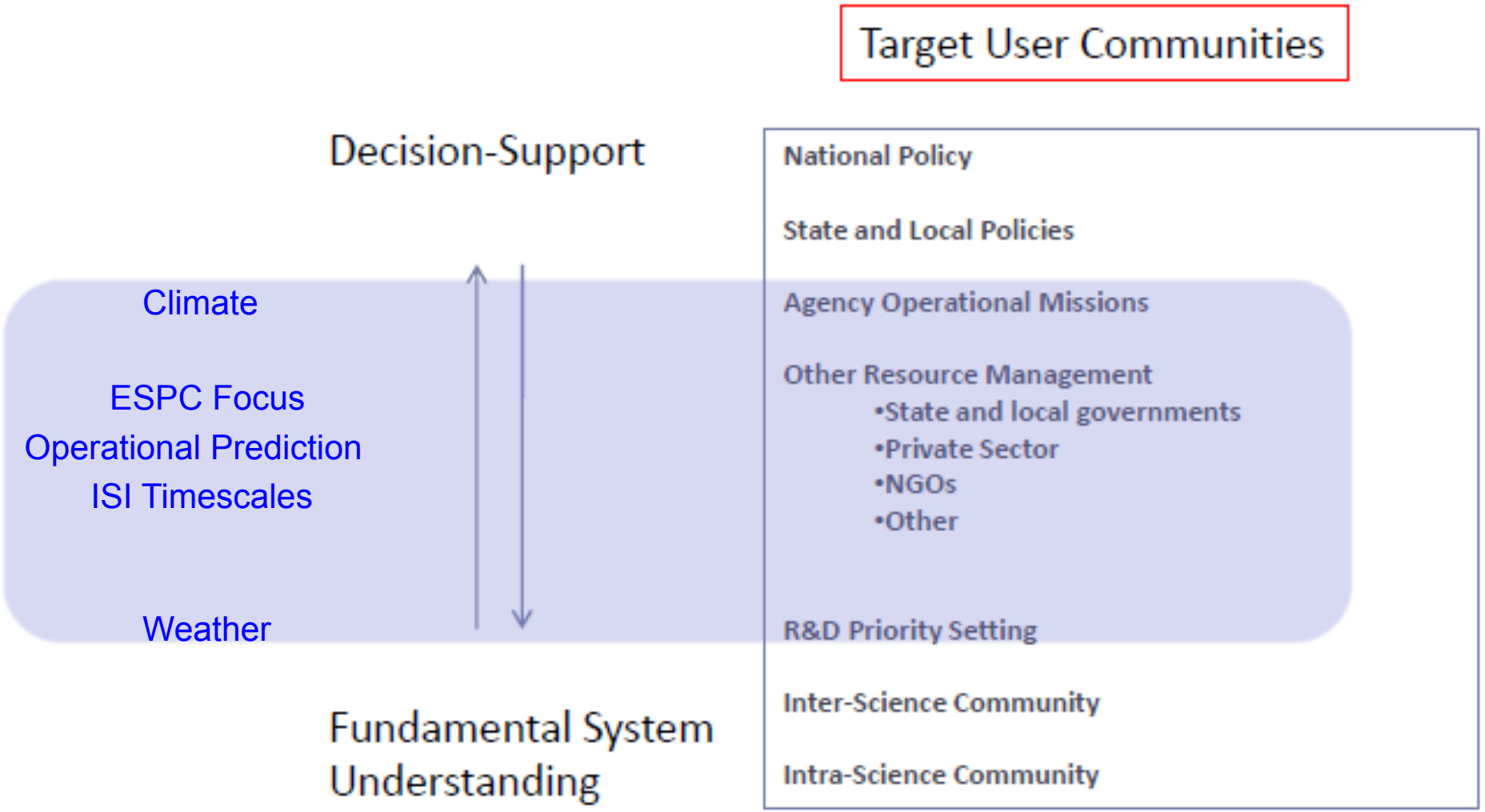
Increased Forecast Information through
- Stochastic prediction and post-model processing
- National Multi-model ensembles
- Seamless prediction





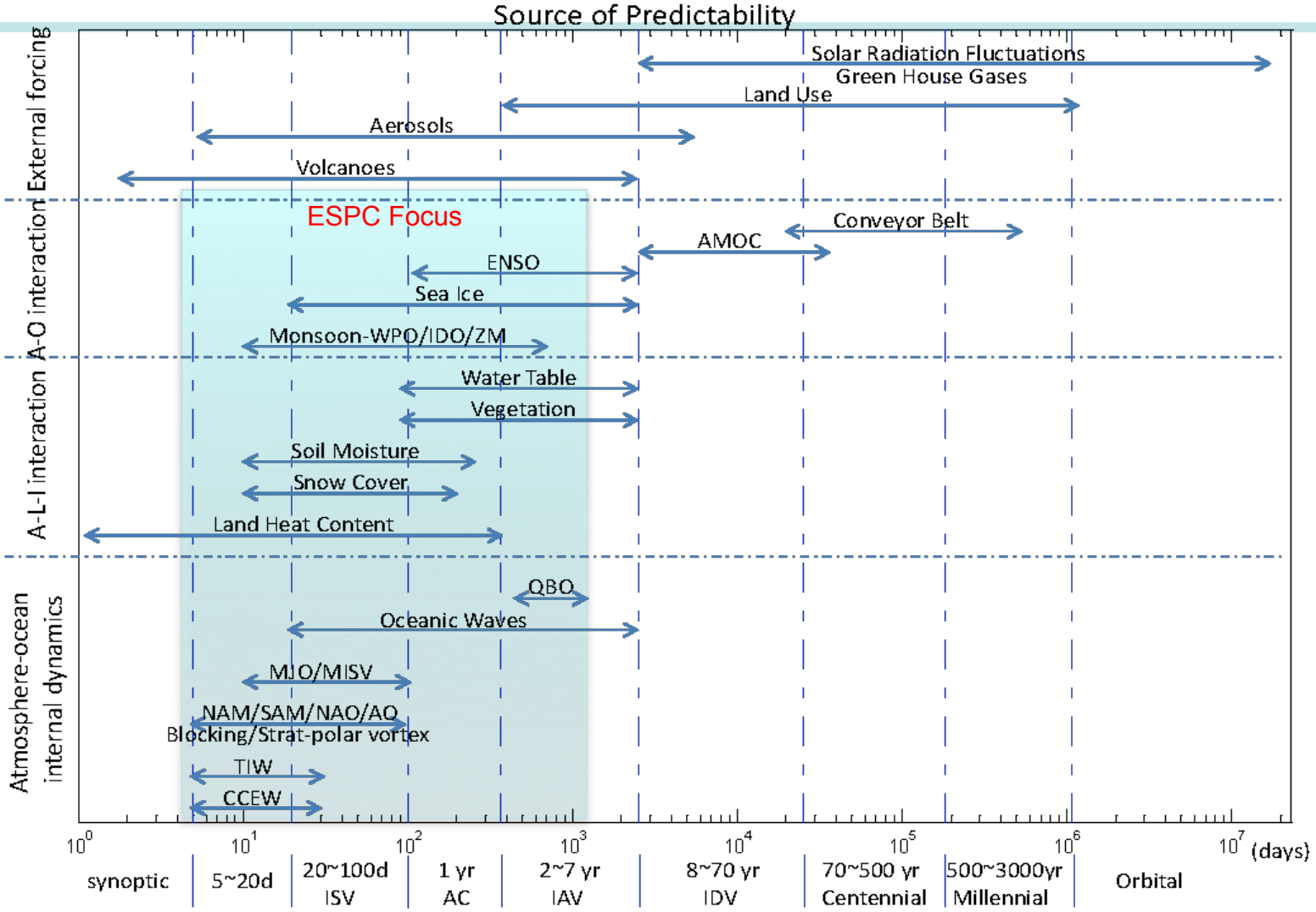
Increased System Resolution affordably through
- Efficient Computational Architectures
- Efficient Numerics/ Discretization

Initial ESPC Focus: R2O and O2R at ISI Timescales



United States Global Change Research Program

Seeking Sources of Extended Range Predictability and (by IOC) Operational Prediction



Assessment of Intraseasonal to Interannual Climate Prediction and Predictability, 2010, THE NATIONAL ACADEMIES PRESS • 500 Fifth Street, N.W. • Washington, DC 20001

ESPC Demonstrations
Workshop Results

Interim Science Steering Group (ISSG) Workshop 21-23 March, 2012

- Attended by scientists (ISSG), Operational Forecast Center representatives (for requirements mapping), Agency program managers (for cooperative resourcing of underlying research)

Outcomes:

- Lead Scientist/Coordinator for each Demonstration identified
- Agency reps, Modeling Center reps and Science Team agreed that the ***most needed and most scientifically feasible forecast timescales are in the 10-day to 1-2 year range based on our current and near term understanding and capability (ISI Timescales)***
- Linkages between climate research (USGCRP, US CLIVAR, etc.) and ESPC were identified for follow-on coordination within each Demonstration Science Team.
- Next ESPC Science Workshop planned for Nov 2012

ESPC Demonstrations

- Extreme Weather Events: Predictability of Blocking Events and High Impact Weather at Lead Times of 1-6 Weeks (Stan Benjamin, ESRL)

- Seasonal Tropical Cyclone Threat: Predictability of Tropical Cyclone Likelihood, Mean Track, and Intensity from Weekly to Seasonal Timescales (Melinda Peng, NRL MRY)

- Arctic Sea Ice Extent and Seasonal Ice Free Dates: Predictability from Weekly to Seasonal Timescales (Phil Jones, LANL)

- Coastal Seas: Predictability of Circulation, Hypoxia, and Harmful Algal Blooms at Lead Times of 1-6 Weeks (Gregg Jacobs, NRL SSC)

- Open Ocean: Predictability of the Atlantic Meridional Overturning Circulation (AMOC) from Monthly to Decadal Timescales for Improved Weather and Climate Forecasts (Jim Richman, NRL SSC)

Decadal Prediction
(Additional Thrust)

The technical approaches for the five Demonstrations are more focused on exploiting sources of extended range predictability and quantifying/ validating uncertainty at intermediate timescales in the weather prediction to climate projection continuum (i.e. they do not account for future changes in the background forcing).

Decadal to multi-decadal prediction issue is more complex and more focused on the scientific underpinnings and limits of predictability

- Physical – solar variability, aerosols, volcanic, albedo, glacial and sea ice melt, ocean circulation and acidification, desertification…
- Biogeochemical – ocean microbial, migrations including human, plant and animal….
- Societal – deforestation, agriculture, urbanization, industrial…
- Political – carbon limits, economic cycles, policy, water resources, warfare, …

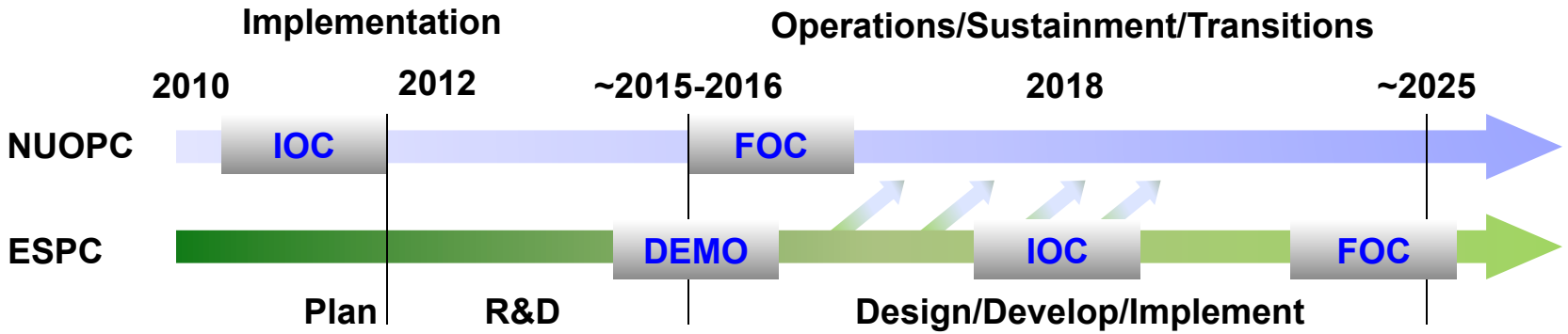
National and International efforts already are addressing decadal prediction.

ESPC will develop plans for an additional thrust in defining “operational” capability at these timescales

- Assess availability and reliability of information against Inter-Agency requirements for Informed Decisions at 5-30 year timescales
- Define format and mechanism for operational product generation, validation, and distribution.

Proposal is for ESPC to support a committee approach, possibly National Academy study or formalized user/scientist advisory group to address this more fully.

Timeline and Transition Strategy



NUOPC

- Implement operational, global, multi-model atmospheric ensemble system
- Develop common NUOPC research agenda and lead common model architecture (CMA)
- Transition ESPC accomplishments/advancements

ESPC

- Focus on next generation system, integrated earth system prediction at extending ranges
- Develop common ESPC research agenda and support common model architecture (CMA) enhancements for ESPC systems
- Coordinate interagency R&D efforts, engaging multiple federal, private and academic organizations towards extended range prediction at intermediate timescales beyond current operational forecast ranges through leverage of weather and climate communities

QUESTIONS?