US post-THORPEX Legacy Program*

DRAFT Version 2 (pre-USTEC meeting)
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* Program name TBD
Summary of June 5-6 Planning Meeting

• Summary of THORPEX, successes, challenges
• Introduction to WMO/WWRP Legacy Projects
• Service, Agency, Participant priorities
• Participants identified critical gaps in progress, common scientific challenges and research priorities in the context of the new Legacy projects
• Next step: to develop a coordinated community program plan for US research
• These slides offer an initial structure to begin planning the new US program, and the community is invited to contribute to the plan.
Program Name (TBD)

Consider minutes-to-seasonal prediction, high-impact weather, spanning predictability through to forecasting and socio-economic impacts. Name needs to be short.

Mission

“To promote cooperative research to understand, evaluate, and improve the skill and socio-economic value of forecasts of high-impact weather events across the Nation, on time scales of minutes to seasonal.”
Goals

• Determine and address US needs over next decade
  – Socio-economic and environmental needs
  – Agency interests
  – US community research priorities and talent

• Determine scientific opportunities highlighted in the 3 international legacy projects that map on to interests of US community and agencies, including science that cuts across the legacy projects

• Prepare a coordinated effort to collaborate and communicate results with performance metrics

• Devise a cohesive yet far-reaching, fiscally responsible plan driven by short-term and long-term benefits
WMO/WWRP International Legacy Projects

- HIW
- PPP
- S2S

- Tropics
- Poles

- Minutes
- 2 weeks
- Seasonal
WMO/WWRP International Legacy Projects

• Polar Prediction Project (PPP)
  http://polarprediction.net/

• Subseasonal to Seasonal Prediction (S2S)
  http://www.wmo.int/pages/prog/arep/wwrp/new/S2S_project_main_page.html

• High-Impact Weather (HIWeather)

• All three legacy projects focus on aspects of prediction of high-impact weather
  ➢ One atmosphere, all spatial / temporal scales connected
  ➢ Subjects of Legacy projects overlap
Examples of connections between Legacy projects

- S2S prediction of polar weather
- Polar effects (e.g. from ice) on S2S predictions at all latitudes
- S2S prediction of flooding events and other HIWeather hazards
- Effects of HIWeather events (e.g. repeated flooding) on S2S predictions
- HIWeather hazards, risk and communication issues in polar regions
- Polar effects on HIWeather events
US Plan in context of International Legacy Projects

- **US research plan can integrate elements from all 3 international projects**
  - Focus on subset of research issues specified in the 3 international documents for which US community can speak for
    - Community experts in each area to define research priorities
    - Develop linkages in parallel as these priorities are identified
  - Prediction priorities lie geographically both within and outside the US, can be global problems, mapped onto interests of US agencies
  - Identify tasks that a large group of scientists all deem important, that a coordinated effort can achieve that improves upon small groups of PI’s
    - Scientific collaborations
    - Data management and archival of observational and model/ensemble data

- **Create mechanisms to integrate collaborations with international partners on legacy projects**
  - Articulate US benefits but think more broadly
  - How will the US contribute to international efforts, and how will international collaborations and activities benefit the US goals?
5 hazards have been proposed as anchors for collaborative international research activities:

- Urban Flooding
- Wildfires
- Localized Extreme Wind
- Disruptive Winter Weather
- Urban Heat and Air Quality
Hazards: Proposed US Foci

• Priorities identified at US Planning Meeting
  – **Water** (all flooding, surge, ice etc.) (PPP, S2S, HIWeather)
  – **Heat waves** (S2S, HIWeather)
  – **Winter weather** (PPP, S2S, HIWeather)
  – **Extreme Wind** (PPP, S2S, HIWeather)

• Activities seamlessly span space and time scales
  – Minutes to seasonal
  – Micro-scale to planetary scale

• Develop planning process around these priorities
• Additional areas matching agency interests may be identified
Research Thrusts

• The primary goals that were identified fall into 4 broad and overlapping research thrusts:
  – Predictability and Processes
    • Process-oriented, multi-scale predictability studies
  – Modeling and Assimilation
    • Coupled high-resolution modeling and assimilation for NWP foundation; ensemble science and prediction
  – Use and Evaluation of Forecasts
    • New forecast products, methods to evaluate forecasts and assessments of value to users
  – Risk, Impact and Communication
    • Communication to and from users and decision makers
Cross-Cutting Activities

• The following activities cut across the aforementioned research thrust areas:
  – Creative use of Observations
    • New observing networks
    • Better utilization of existing observations
  – Uncertainty
    • Assessments of uncertainty in predictions and communications
  – Testbeds and Virtual Field Campaigns
    • Where the rubber meets the road
    • Operational models as community models
  – Data Management
    • Dedicated data management and support desk essential
Next slide

• In each box: summary of activities suggested at June 2014 Planning Meeting, arranged by research thrust and cross-cutting activity

• Activities are common across all of PPP, S2S and HIWeather (and interfaces between)

• Several activities belong to more than one box

• Slides at end (background): selected activities specific to each of PPP, S2S and HIWeather.
<table>
<thead>
<tr>
<th>ALL</th>
<th>Predictability and Processes</th>
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<td>Testbeds and Virtual Field</td>
<td>Predictability and process studies in virtual global and regional field experiments, real-time and retrospective. Precipitating regimes.</td>
<td>Testbed for coordinated developmental testing. Operational models/DA for community use. ESPC, NUOPC, NMME. NOAA Testbeds. OSSE.</td>
<td>Provide large set of case studies for HIW and S2S, including Arctic (PPP). Event-based verification. Evaluate if impacts are being reduced.</td>
<td>Test information needed to personalize risk. Examine propagation of forecast/warning/risk. Predict user impact for different forecasts. WRN</td>
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Operational linkages: R2O and O2R

• Where the rubber meets the road
• Two-way interface
  – Successful research activities and products that demonstrate a quantitative benefit for operations are considered for operational use
  – Researchers are provided with infrastructure, access and sufficient support to use operational models and products
• Many activities listed on the previous slides are considered in the context of R2O and O2R
Next Steps: Key Science Questions

• Following the establishment of priorities that were proposed at the Planning Meeting, the next step will be for the US community to develop a coherent series of nationally focused science questions that span across the legacy projects.

• These will be developed through the next year.
Next Steps: Key Practical Questions

• How to establish metrics for success?
  – NOAA’s HFIP has clearly established metrics and targets, offers their community a focus

• How to coordinate existing and new projects?
  – Currently, a large number of individual relevant projects and products

• How to dedicate resources: infrastructure and personnel support?
  – Support for operational models currently poor

• How to foster direct science-SERA collaborations?
• How to handle cross-cutting projects across agencies?
• How to link (and lead?) international collaborations?
Connection to Agency Programs and Priorities

- **NSF**
  - Priority: US community to organize to provide priorities and a cutting-edge science plan
  - Programs: HAZARDS SEES / PREEVENT
  - Potential to support virtual field campaigns

- **NOAA**
  - Priority: research that can benefit operations
  - R2O and O2R (including Research to Operations project)
  - Programs:
    - Weather Ready Nation – Ambassador program
    - HIWPP (High-Impact Weather Prediction Project)
  - Testbeds and Proving Grounds

- **NASA**
  - Priority: Creative use of satellite and earth venture data for assimilation and verification, e.g. from GPM (Global Precipitation Mission) satellite, Global Hawk unmanned aircraft
  - Programs: MAP (Modeling, Analysis and Prediction)

- **ONR**
  - Priority: prediction capability for Naval interests
  - Relevant Directed Research Initiatives (DRIs): Arctic, Coupled Modeling, Tropical Cyclone Intensity

- **Multi-agency**
  - Earth System Prediction Capability (ESPC)
  - National Multi-Model Ensemble (NMME)

- **Other agencies?**
Timeline for developing US plan

- July 3 2014 – draft sent to USTSSC, workshop participants
- July 15 2014 – USTEC Meeting
- August 18 2014 – revised draft presented at WWOSC Town Hall. Community feedback sought
- Second half of 2014 – organizational arrangements
  - Interagency management / executive committee composed of people who have authority to oversee funding lines
  - Science committee composed of “go-to” experts in each area
- Second half of 2014 – Experts in US community (research, agencies, users) define priorities
- Second half of 2014 – draft science plan
- First half of 2015 – follow-on meetings
- Mid-2015 – finalize science plan
Background slides
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<td>Uncertainty</td>
<td>Which regimes are more (vs less) predictable? What are the limits? Stochastic forcing and variability of processes.</td>
<td>Ensemble generation methods. Define prediction products such as heatwaves, info from probabilistic forecasts.</td>
<td>Exploit operational forecasts (NMME). Multi-models. Intraseasonal tropical variability knowledge transfer into operations.</td>
<td>Quantify + communicate uncertainty (and nature) beyond medium-range. Behavioral response.</td>
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<td>Assess questions above over concentrated period of interest, e.g. anomalously high precipitation regime with HIWeather cases.</td>
<td>Framework to facilitate international collaborations, via S2S database, coordinated experiments etc. NOAA Testbeds.</td>
<td>Next phase of YOTC: virtual global field experiments. Effort to link to ESPC, NUOPC, CLIVAR.</td>
<td>Design impact-relevant measures to complement present physical-dynamical metrics.</td>
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