Was THORPEX a Success and What’s Next?

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www.wmo.int/wwrp
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Did THORPEX Accelerate the Improvement in NWP Skill?

Anomaly correlation of 500hPa height forecasts

- Northern hemisphere
- Southern hemisphere

(WMO OMM)

(ECMWF)
Did THORPEX Accelerate Improvements in NWP Skill?

- Yes, significantly through contributing to the development of the North American Ensemble Forecast System (NAEFS).

Predictive skill “has been improved by 1–2 forecast days in the second week” relative to either national ensemble system --- e.g., Candille (2009)
Did THORPEX Accelerate Improvements in NWP Skill?

- Yes, through many small contributions such as
  - Correction of albedo in Antarctic in ECMWF model through CONCORDIASI observations
  - TIGGE comparisons were motivation for work on specific physics packages within the ECMWF model
  - Improved exploitation of satellite data in polar regions through THORPEX IPY
  - Development of new polar prediction systems in Canada and Norway
  - Lar’s data assimilation example from yesterday
  - Understanding and modification of target, etc
Did THORPEX Accelerate Improvements in NWP Skill?

**VERIFICATION vs RADIOSONDES: Monthly Means**

**AMERICA 200909 - 201208**

**RMSE/EQM, 00+12Z, P120H,GZ 500 hPa**

The graph shows the verification against radiosondes for AMERICA from 200909 to 201208. The RMSE/EQM for 00+12Z, P120H, GZ 500 hPa is depicted over time, with different markers representing different models. The graph indicates trends and improvements in NWP skill over the period.
Looks good, but let’s wait until winter.....
<table>
<thead>
<tr>
<th>Program</th>
<th>Count</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOGA COARE*</td>
<td>593</td>
<td>1st 10 years, 989 to date</td>
</tr>
<tr>
<td>WWRP*</td>
<td>367</td>
<td>Since 2004, includes major projects</td>
</tr>
<tr>
<td>GARP*</td>
<td>360</td>
<td>1st 10 years, 1954 total</td>
</tr>
<tr>
<td>WCRP*</td>
<td>334</td>
<td>Since 2004, does not include a search for specific projects</td>
</tr>
<tr>
<td>THORPEX*</td>
<td>164</td>
<td>Since 2004, does not include a search for specific projects</td>
</tr>
<tr>
<td>AMMA**</td>
<td>147</td>
<td></td>
</tr>
<tr>
<td>IHOP 2002*</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>FASTEX*</td>
<td>106</td>
<td></td>
</tr>
<tr>
<td>WWRP*</td>
<td>64</td>
<td>Since 2004, does not include specific projects</td>
</tr>
<tr>
<td>TIGGE*</td>
<td>54</td>
<td>Very early stage</td>
</tr>
<tr>
<td>T-PARC*</td>
<td>53</td>
<td>Early stage</td>
</tr>
<tr>
<td>Winter Storms Recon</td>
<td>44</td>
<td>Since 2004</td>
</tr>
<tr>
<td>USWRP</td>
<td>40</td>
<td>Since 2004, does not include major projects, but 14 of these papers are planning documents and workshop reports</td>
</tr>
<tr>
<td>HFIP/HFIPS</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>YOTC*</td>
<td>24</td>
<td>Very early stage</td>
</tr>
<tr>
<td>CONCORDIASI**</td>
<td>7</td>
<td>Extremely early stage</td>
</tr>
<tr>
<td>A-TREC*</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>WWRP and THORPEX SERA</td>
<td>3</td>
<td>Underestimation?</td>
</tr>
</tbody>
</table>

* = Significant publications abroad  
** = Majority of papers abroad  
Early stages – publication numbers still peaking, data sets only several years old
What about the paper count?

- Caution, projects have different degree of branding and “you can’t just count or weigh them” to determine their impact, but I will equate them for this INFORMAL argument.

- THORPEX has made a significant impact on our field, esp considering it was a new effort (seek ways to continue ongoing work).

- THORPEX and WWRP were never able to mobilize a large societal research component.

- International programs/projects seem to make a large impact relative to domestic efforts (why -- leverage national investment, more challenging research topics, more attractive to researchers??)

- Even realizing observational process studies come out of a different pot of funding for NSF, efforts such as TIGGE, YOTC appear particularly cost effective.
Concordiasi 2010

Stratospheric balloons in the polar vortex

ECMWF Potential Vorticity maps

LMD/IPSL & CNES
CONCORDIASI
Driftsondes

Dropsonde map

Sea-ice limit mid-November
What’s next? ---- Research themes

- Consider a theme centered and actually led by social science and applications research

  - Risk, decision making, mitigation strategies associated with disasters, extremes and high impact events
Cost continue to rise at a staggering rate: A seven fold increase in costs have taken place from 1997 to 2007. 2800 events per decade in the 1990s (ICSU 2008)! 

Source: OFDA/CRED International Disaster Database
Research themes

- Consider a theme centered and actually led by social science and applications research

  - Risk, decision making, mitigation strategies associated with disasters, extremes and high impact events

  - The economics of high impact weather (e.g., motivated in part by the Lazo “$485 Billion” study)
What's next -- what about the future?

- Agencies need to realize that many of these THORPEX efforts (e.g., TIGGE, data assimilation and predictability research, YOTC, CONCORDIASI, T-PARC) will continue for many years with high productivity.
- Some efforts do not even require agency support (e.g., educational impacts, undergraduate projects).
What's next -- what about the future?

- Consider another research theme clearly centered around the weather-climate interface (e.g., seamless prediction, medium range to seasonal or longer, impacts of climate variation on weather systems - polar example).

- Series of BAMS articles
- WWRP/THORPEX-WCRP planning documents
- Hoskin's recent paper in QJRMS

Figure 16: Same as Fig. 15 but for SAL (left column) and Tropical storm (right column) environments.
What’s next -- what about the future?

- Another grand challenge is motivated by the movement to non-hydrostatic prediction systems and coupled modeling (weather—hydrology—.....to --- human systems)

- Need for predictability research and the characterization of uncertainty through the modeling system
Thank You