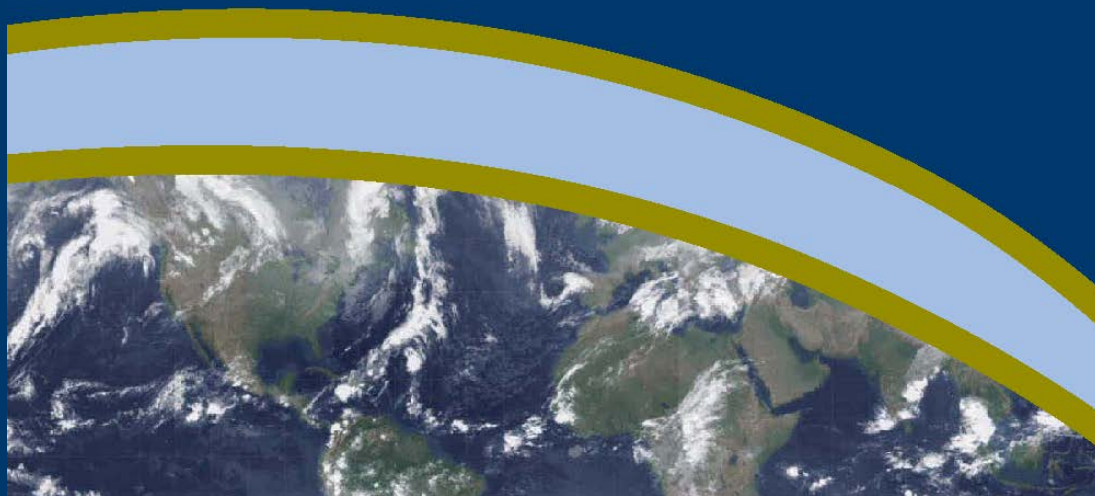




TARGETED OBSERVATIONS FOR IMPROVING NUMERICAL WEATHER PREDICTION: AN OVERVIEW



Document available on

[http://www.wmo.ch/pages/prog/arep/wwrp/new/
documents/THORPEX No 15.pdf](http://www.wmo.ch/pages/prog/arep/wwrp/new/documents/THORPEX_No_15.pdf)

LIST OF CONTRIBUTORS

Sharanya J. Majumdar^{*}, RSMAS, University of Miami, Miami, FL, USA

Sim D. Aberson, Hurricane Research Division, NOAA/AOML, Miami, FL, USA

Craig H. Bishop, Naval Research Laboratory, Monterey, CA, USA

Carla Cardinali, European Centre for Medium-Range Weather Forecasts, Reading, UK

Jim Caughey, World Meteorological Organization, Geneva, Switzerland

Alexis Doerenbecher, CNRM/GAME (Météo-France and CNRS), Toulouse, France

Pierre Gauthier, UQAM, Montreal, QC, Canada

Ronald Gelaro, NASA Goddard Space Flight Center, Greenbelt, MD, USA

Thomas M. Hamill, Physical Sciences Division, NOAA/ESRL, Boulder, CO, USA

Rolf H. Langland, Naval Research Laboratory, Monterey, CA, USA

Andrew C. Lorenc, United Kingdom Meteorological Office, Exeter, United Kingdom

Tetsuo Nakazawa, World Meteorological Organization, Geneva, Switzerland

Florence Rabier, CNRM/GAME (Météo-France and CNRS), Toulouse, France

Carolyn A. Reynolds, Naval Research Laboratory, Monterey, CA, USA

Roger Saunders, United Kingdom Meteorological Office, Exeter, United Kingdom

Yucheng Song, Environmental Modeling Center, NOAA/NCEP, Camp Springs, MD, USA

Zoltan Toth, Global Systems Division, NOAA/ESRL, Boulder, CO, USA

Christopher Velden, CIMSS / University of Wisconsin, Madison, WI, USA

Martin Weissmann, Meteorologisches Institut, Ludwig-Maximilians-Universität, Munich, Germany

Chun-Chieh Wu, National Taiwan University, Taipei, Taiwan

Conclusions I

- Observations primarily targeted to attempt to improve short-range (1-3 day) forecasts.
- From OSEs:
 - Extratropics: value of targeted data small but positive on average, needs further evaluation
 - Tropical cyclones: track forecasts mostly beneficial statistically
- Benefit differs from model to model.
- Range of aircraft a limiting constraint.
- Targeted satellite data shows promise.

Conclusions II

- Adjoint-based evaluations
 - Only 50-54% of observations (targeted or otherwise) specifically act to improve the forecast
 - Large numbers of observations with relatively small individual impact provide a larger cumulative benefit than small numbers of obs
- Impact of any group of observations depends on (a) errors in prior forecast, (b) errors in observations, (c) DA and forecast methods.

Conclusions III

- Sensitivity methods
 - Extratropics: Observations in sensitive areas are more valuable than those deployed randomly.
 - Tropical Cyclones: not yet determined.
- *Recognize that forecast skill is improving due to improved resolution, observations, DA, physics. Hence, the average marginal impact of an individual observing system is decreasing.*
- Open question: **what is the overall cost-effectiveness of targeted observations?**

Recommendations

1. Explore utility for targeting **existing** observations (e.g. selected satellite data)
2. Improve understanding and quantification of the **socio-economic value** of observations.
3. More emphasis on **science** of targeting.
4. Improve basis for quantitatively predicting **forecast error variance reduction**. Current techniques have a linear inference.
5. Keep **evaluating** regular field programs in multiple NWP systems.

Thoughts for the future

- Global observational network design
 - Use targeting strategies to **adaptively select / thin satellite data** for assimilation?
- Regional targeted observations
 - Potential with **rapidly adaptable observational resources**, quick response time necessary.
 - Need rapidly updated models and ensembles, more **continuous, serial targeting** than has been done on synoptic scales?

Proposed BAMS Review Article

- Plan to submit in 2013
- Needs a substantial rewrite to suit a broad BAMS audience (“readability”)
- “Poster child” figure?
- Write in context of THORPEX legacy?