NSF Perspectives on R2O/O2R

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NSF Mandate

- NSF's mission is to fund basic science research.
- From the founding legislation:

  Mission: "***to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes.***"
- NSF supports fundamental, interdisciplinary, high-risk, and potentially transformative research in science and engineering, and the education of the next generation of the STEM workforce to continue this transformation.

Fundamental Research

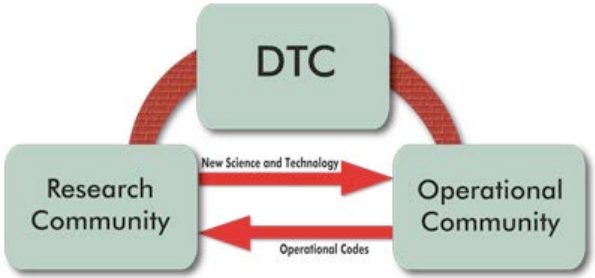
- Basic research in solar and geospace physics is critical for progress on space weather specification and forecasting capabilities.

- Space Weather is a highly immature science; understanding of very many of the fundamental physical processes and interactions are rudimentary at best.
  Thus investment in basic GS research is essential to the continuing progress and success of space weather forecasting.

R2O/O2R for Space Weather

- The focus of the community is largely on R2O for models given the youth of the science.
- O2R is important for a healthy and vibrant space weather enterprise.
- The establishment of an O2R center as presented would help strengthen the links between the scientific and the operational communities.
- This would create a pathway for joint NSF-NOAA-NASA-DOD targeted research programs with the dual and connected purpose of enhancing physical understanding and improving operations.

R2O/O2R experience from Atmospheric Science Perspective



- Development Testbed Center
  dtcenter.org at NCAR and NOAA/GSD
- Activities at DTC
  - "…serves as a bridge between research and operations to facilitate the activities of both halves of the NWP community in pursuit of their own objectives ."
  (since 2004, originally focused on WRF)
- Focusing on the need for development and testing of a global modeling framework for NWP
- Funded by
  NOAA, Air Force, NSF
- Total Center Funding ~$5M?

NSF Support of Space Weather Research

- Targeted Research Programs
  - SHINE, GEM, CEDAR
  - Collaborative Space Weather Modeling (CCMC)
- Distributed Networks
  - AMPERE, COSMIC
  - Ground based (GNSS receivers, magnetometers, radars)
  - But, we are poorly positioned to connect distributed array data to operational models (not enough data, not enough DA).
- See Carrie Black's talk tomorrow for details

NSF can support O2R through joint funding of research projects

- Can fund projects that overlap with or are motivated by O2R.
- Can potentially co-fund projects with NOAA, DOD, and NASA that have components such as:
  - New observations that lead to operational improvements
  - Data assimilation and data fusion techniques
  - New physical understanding that leads to operational model improvements
  - Code optimization, efficiencies, and robustness

Broader Impacts

- The community needs to do a MUCH better job communicating about the importance and impacts of basic geoscience research.
- Science results that lead to operational improvements is a broader impact.
- The SWAP and the science that led to it is a BI!
- Grassroots engagement to train students, forecasters, the public, etc. on scientifically sound use of tools.
- Establishing new collaborations with operations staff

Conclusions

- We need better and more observations of SW signals in real time, and we need to better connect those obs to models (DA).
- The SWAP is important, and a great opportunity to highlight the importance of sound geospace science.
- NSF is enthusiastic about the challenge!