AMPS UPDATE – JUNE 2021

Workshop on Antarctic Meteorology and Climate

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Antarctic Mesoscale Prediction System

- Real-time, experimental NWP system serving primarily the needs of forecasters for the U.S. Antarctic Program (USAP)
- Funded by the NSF Office of Polar Programs (OPP)
  - AMPS computing funded by NSF OPP and supported by NCAR’s Computational and Information Systems Laboratory (CISL) via a special allocation for NCAR’s computing resources
- Based on NCAR’s Weather Research and Forecasting (WRF) model
  - Using adaptations from OSU/BPCRC Polar WRF effort
  - Testing NCAR’s Model for Prediction Across Scales (MPAS)
- Twice-daily forecast runs since September 2000
- Real-time NWP graphics, text, and GRIB openly available through the AMPS web page
  - https://www2.mmm.ucar.edu/rt/amps
AMPS Grids – 24-km and 8-km

Run out to 120 hours (5 days) forecast time
AMPS Grids – 2.67-km and 0.89-km

Run out to 39 hours forecast time
AMPS Grids – 2.67-km

Run out to 39 hours forecast time
| Change of strategy for AMPS long-term archive | Continued AMPS efforts in cloud computing |
AMPS Long-Term Archive Updates

- **AMPS Long-term Archive**
  - A 20-year archive of AMPS forecasts
    - Not a reanalysis
    - Spans the MM5 era (2001-2008) and the WRF era (2006-present)
  - Used for:
    - Case studies
    - Short-term climate studies
    - Antarctic NWP studies
    - Weather (forecast) statistics for arbitrary sites
AMPS Long-term Archive

• AMPS archive moves from NCAR’s tape storage to disk
  
  − NCAR decommissioning its tape archive system, moving all users to disk storage
  − Significant reduction in archival storage capacity at NCAR, and for AMPS
AMPS Long-term Archive

- AMPS strategy to reduce data volume of AMPS archive
  - No longer archive full AMPS model output files for the long term
    - Rolling archive of the most recent three to six months of full model output
  - Principal archive data set going forward is our GRIB conversion of model output
    - Selected fields, selected levels
    - Lossy compression
  - All archived AMPS model output from 2000 to present converted to GRIB
    - 1 PB volume of data reduced to 150 TB
    - Thanks to Matt Lazzara for urging us to keep the MM5-era forecasts (2001-2008)
  - Graphics and textual products (as seen on the AMPS web page) archived
AMPS Long-term Archive

• Access to AMPS archive
  – External to NCAR
    • For users external to the NCAR computing environment, access to the AMPS forecast archive will be through the Climate Data Gateway (née the Earth System Grid portal)
      – Thanks to CISL for supporting access to AMPS archive
      – https://www.earthsystemgrid.org/project/amps.html
    • Climate Data Gateway access to the new AMPS archive is not quite finalized
      – Aiming for availability later this summer
  – Internal NCAR access
    • For users within NCAR's computing environment, direct access to the AMPS campaign storage directories
    • Query Kevin Manning and Jordan Powers for directories, path names, and help
AMPS in the cloud

- Maintain AMPS availability through downtime of NCAR’s supercomputers or computing facility
  - Planned maintenance
  - Unplanned outages
- CISL (NCAR’s computing lab) looks at AMPS as an interesting “use case” for NCAR computing needs
  - Non-trivial compute needs
  - Real-time needs → high priority for computing
- Cloud providers see NWP as a growth sector for their business
  - They’ve been eager to work with NCAR and AMPS
- Access to NCAR’s computing expertise has been extremely helpful
  - CISL scientists and engineers have much experience in computing, needs of NWP, mindset of weather scientists and modelers
AMPS in the cloud

- **Benefits**
  - Redundancy and resiliency, with access to compute resources of different cloud providers (AWS, Google, Azure, etc.)
  - Wide variety of hardware available (CPUs, GPUs, interconnect, etc.)
  - Latest hardware often available
    - Not stuck with a 5-6 year update cycle of “on-prem” supercomputer
  - Can be cost-effective
AMPS in the cloud

• Challenges
  - Off-site computing means that our local NCAR data storage is not available
    ● Data we may want for AMPS initialization
    ● Data we may want to keep from an off-site AMPS run
  - Stability
    ● Moving target – hardware and software may be upgraded with little or no warning
    ● Frequent testing is advised to insure that our cloud implementations will work when needed
  - Need to maintain additional implementations of AMPS
    ● Simplified AMPS run:
      - No AMPS ensemble
      - No AMPS data assimilation step
      - No one-way nests
AMPS in the cloud

• Current status
  - AMPS running on two different core types (Rescale) and an on-demand compute provider (Penguin)
  - Rescale AMS 2021 Annual Meeting presentation
  - Convenient command-line launch from local machines