

THE AMPS YOPP-SH SOP DATA IMPACT STUDY

Jordan G. Powers¹ and David H. Bromwich²

¹Mesoscale and Microscale Meteorology Laboratory
National Center for Atmospheric Research
Boulder, Colorado, USA

²Department of Geography and Byrd Polar and Climate Research
Center
The Ohio State University
Columbus, Ohio , USA

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YOPP-SH SOP Data Impact Study

– Collaboration: The Ohio State University BPCRC & Polar Meteorology Group and NCAR

– Support: NSF



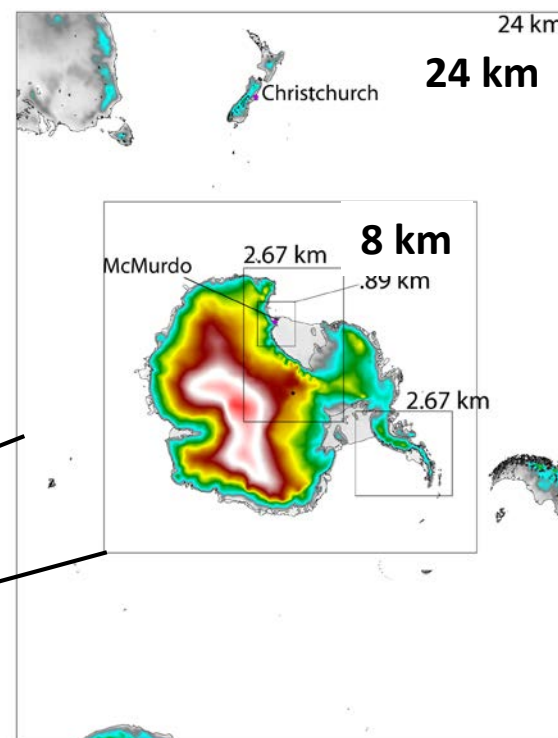
Byrd Polar and Climate Research Center
Polar Meteorology Group
The Ohio State University



- **Methodology: Analyze forecasts using SOP data with varying data assimilation approaches**
- AMPS: Antarctic Mesoscale Prediction System
 - Main model: WRF
 - Primary grids for YOPP-SH simulations: *

*24-km

*8-km



YOPP-SH SOP DATA IMPACT STUDY

- **Goal 1: Determine effects on model forecasts of enhanced southern hemisphere observations**
 - Do the SOP obs improve forecasts? Over individual forecast events or subseasonal periods?
 - Demonstrate potential value of maintaining additional Southern Hemisphere high-latitude obs
- **Goal 2: Explore variations in data assimilation for WRF in AMPS for forecast improvement**
 - Can different data assimilation approaches for WRF yield AMPS forecast improvements?
 - Advance the Polar Prediction Project (PPP) goal of improving polar NWP

- **Background: Current AMPS Setup**

- **AMPS Ensemble WRF Forecasts**

- 15-member WRF ensemble (24-km/8-km grids only)

- (i) Provides ensemble guidance for USAP forecasters

- (ii) Generates background error information for the data assimilation for the main WRF forecasts

- Member backgrounds: NCEP **Global Ensemble Forecast System (GEFS)**

- **AMPS Main WRF Forecasts:** Backgrounds from NCEP **GFS** (Global Forecast System) analyses

- Note: YOPP-SH experiments— Cycled WRF forecasts for backgrounds

- **Approach:** WRF Antarctic forecasts (i) assimilating different data and (ii) applying different DA procedures

- **Experiment Variations**

1) Observations Ingested

(a) **STD** obs (standard AMPS operational)

STD obs: AWS, SYNOP, METAR, ships and buoys, radiosondes, aircraft obs, satellite winds, GPS radio occultations, satellite radiances

(b) **STD obs + SOP obs**

2) Data Assimilation (DA) Procedures Used

- Variation of the background error (BE) covariance inputs to the data assimilation package

DA Procedure Experiments

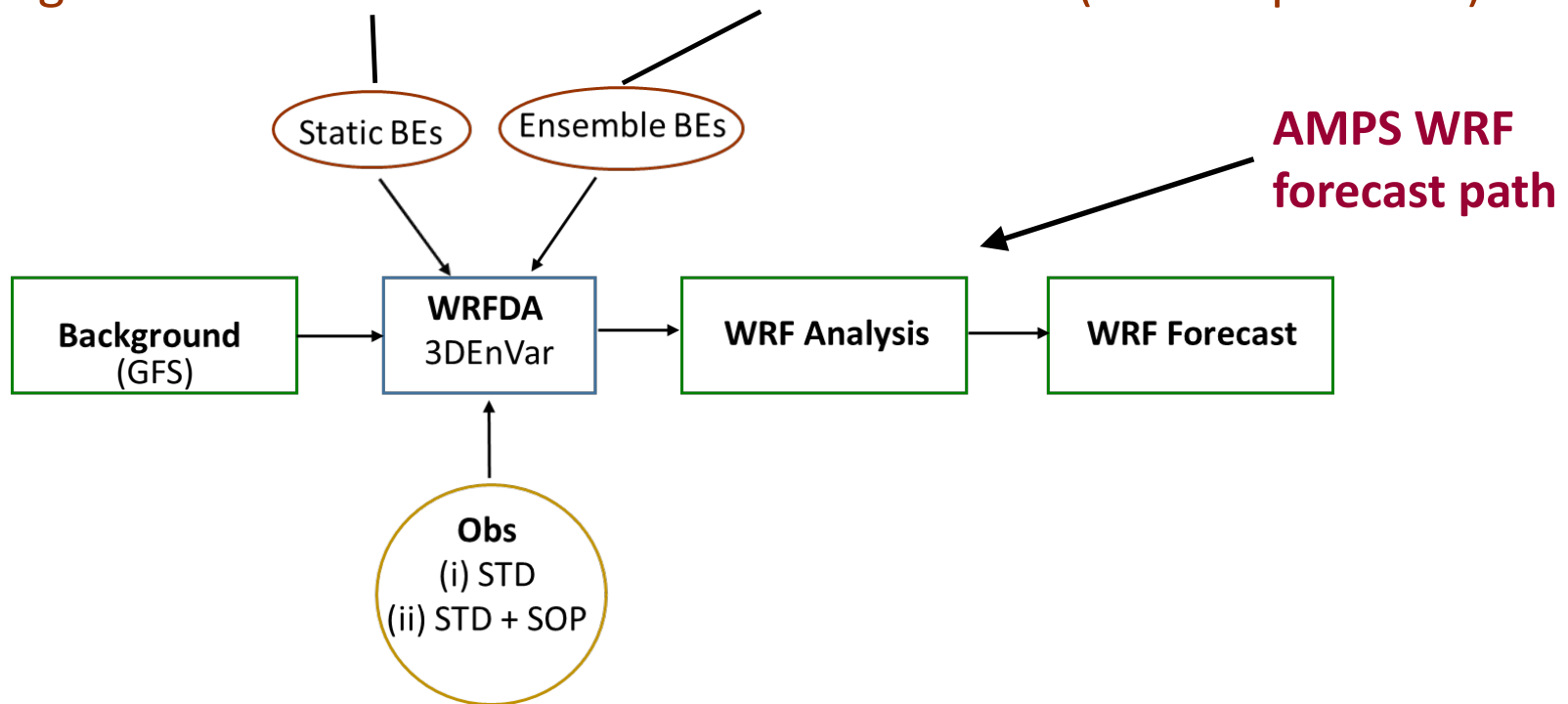
- **Current DA for WRF in AMPS:**

 - Hybrid Ensemble/3-Dimensional Variational DA (3DEnVar)**

 - 3DVAR w/ **background error covariances (BEs)** from two methods

(i) BEs from AMPS main fcsts using NMC method: **Static BEs**

(ii) BEs from AMPS ensemble fcsts: **Ensemble BEs (flow-dependent)**

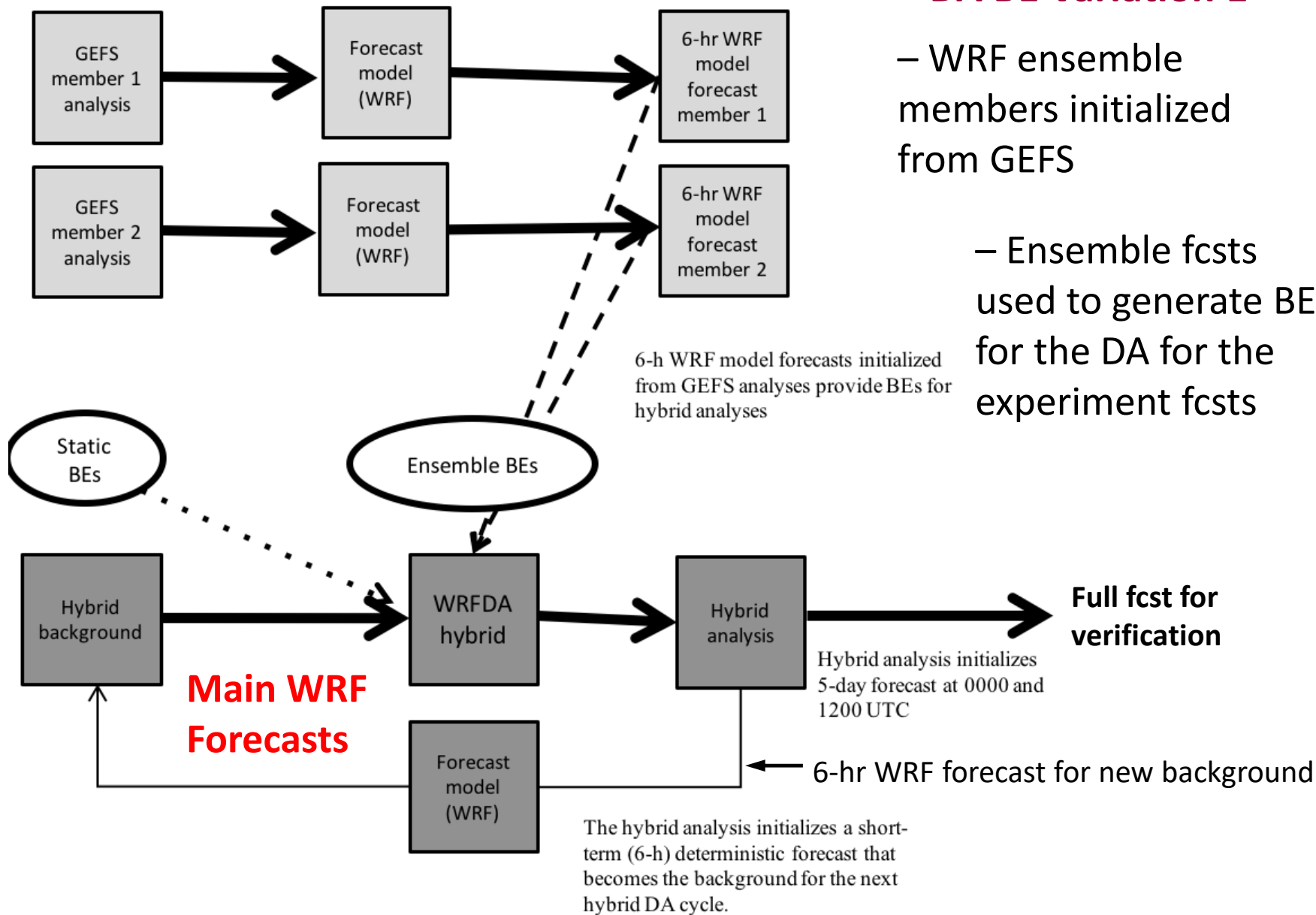


- **Experiments: WRF DA Variations Using New Ensembles**

- Purpose: Generate **two versions of flow-dependent BEs** for use in the DA
- Create 2 new, larger ensembles for expts: ~60 members each
 - ✓ BE covariances better estimated from larger ensembles
- Ensemble differences: Member (a) backgrounds and (b) initializations
 - **Ensemble 1: GEFS backgrounds + no DA**
 - **Ensemble 2: Cycled WRF backgrounds + DA**

DA method used: EnKF (Ensemble Kalman Filter) DA for initialization of members using **DART— Data Assimilation Research Testbed**

WRF Ensemble for BE Generation

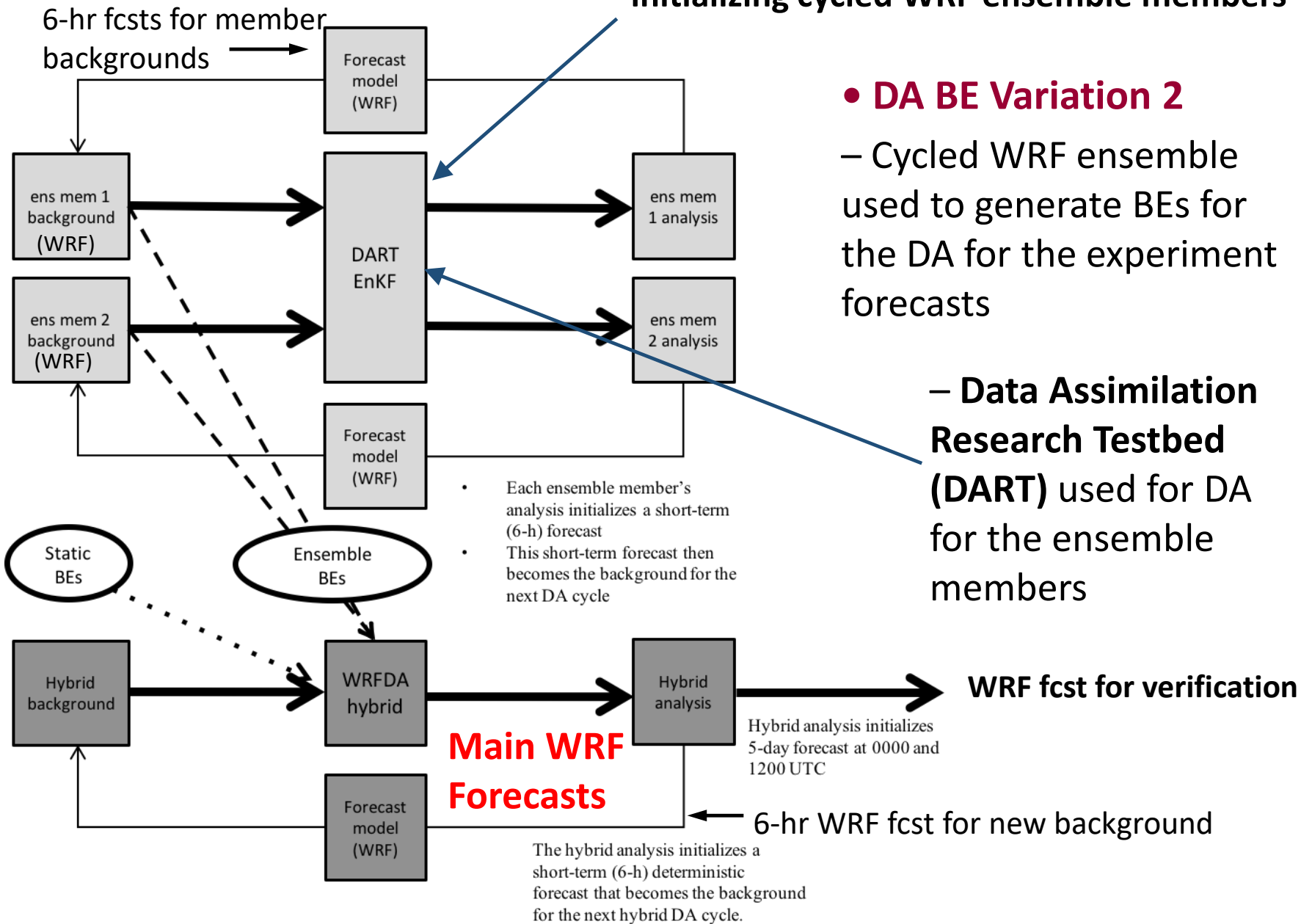


• DA BE Variation 1

- WRF ensemble members initialized from GEFS
- Ensemble fcsts used to generate BEs for the DA for the experiment fcsts

WRF Ensemble for BE Generation

DART uses an EnKF approach for DA in initializing cycled WRF ensemble members



SOP DATA WRF FORECAST EXPERIMENTS: 2 TYPES

- **Period Forecasts**

- 2-week periods

- November 2018* (spring)

- Early January 2019* (mid-summer)

- February 2019* (late summer)

- 24-km/8-km forecast grid used

- 2 forecasts/day: ≥ 72 hrs

- **Event Forecasts**

- Selected cases of significant weather affecting Palmer and
McMurdo

- Higher-resolution grids used: ≤ 2.67 -km

SUMMARY

- **Study: Examine Impact of YOPP-SH SOP Data on Antarctic Weather Forecasts**
- **Forecast Experiments**
 - Ingest of standard obs vs. extra YOPP-SH SOP data
 - Variation of DA approaches
 - Forecasts/evaluations
 - (i) Subseasonal period forecasts
 - (ii) Case studies
- **Goals**
 - **Determine forecast value of extra Southern Hemisphere obs**
 - **Identify improvements for DA in AMPS**