



CSSI Element: Cloud WRF for the Atmospheric Research and Education Communities

PI: Jordan G. Powers, National Center Atmospheric Research, Boulder, CO



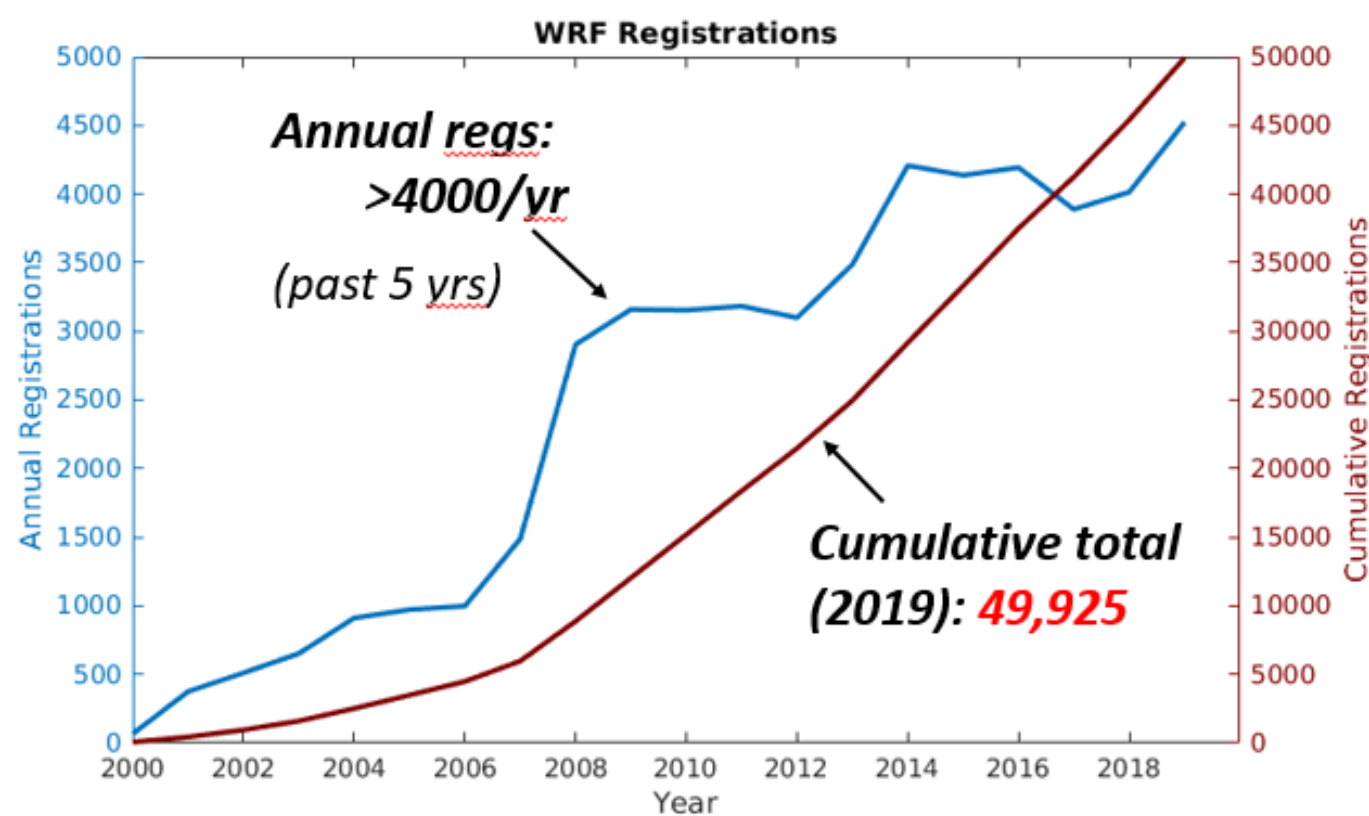
Award #: 1835511

Co-Pis: Yuh-Lang Lin, North Carolina A&T State University & Russ S. Schumacher, Colorado State University

Background

Weather Research and Forecasting (WRF) Model

- Numerical weather prediction model for *meteorological research* & *weather forecasting*
- Most popular atmospheric model in the world: ~50,000 registered users/175 countries
- Recent annual registrations: >4000/yr • Recent annual publications: 813/yr
- Operates in parallel compute and HPC environments
- Large university community and real-time forecasting presence

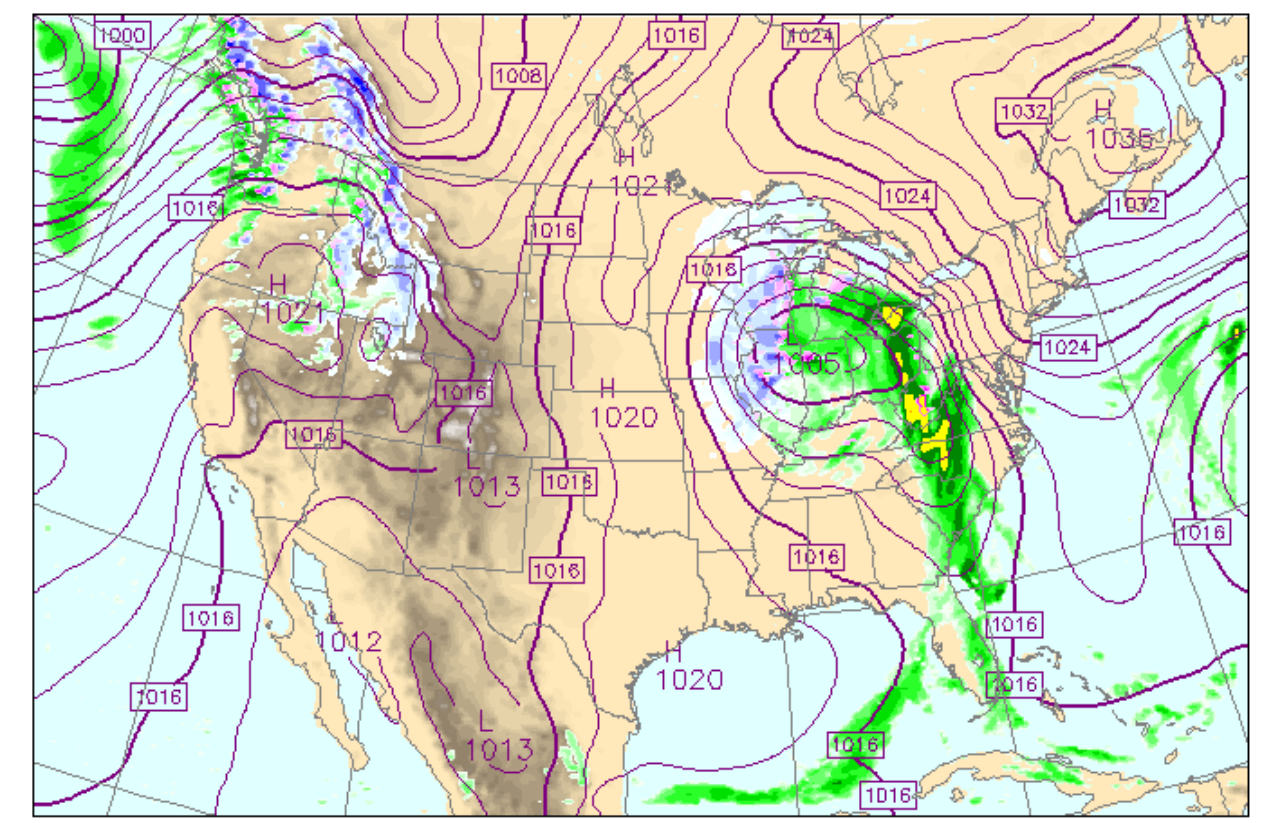


WRF Cumulative & Annual Registrations

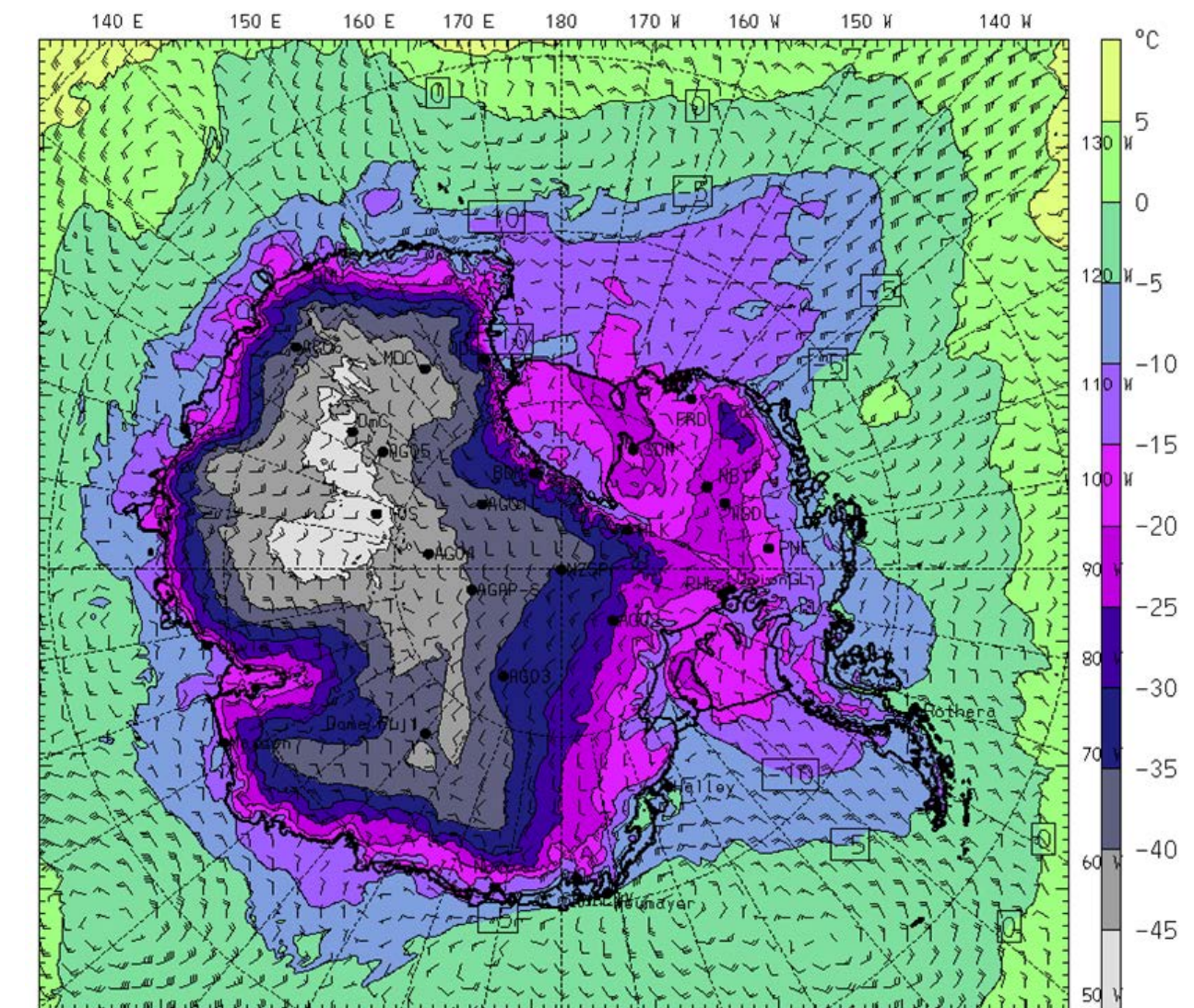
WRF Global User Registrations



Red: Registered user countries (175)
Yellow: Real-time/operational WRF



WRF Sea Level Pressure (mb) & 3-hr Precipitation
48-h Fcst Valid: 0000 UTC 25 Jan 2020



WRF Antarctic Surface Temperature (°C)
90-h Fcst Valid: 1800 UTC 8 Nov 2019

Motivation

Exploit cloud computing for critical WRF needs

- User support and training
- System development
- HPC operating environments

Methodology

- Work with CSPs to test and establish (i) an officially-supported version of WRF in the cloud and (ii) a cloud code testing capability
- Partner with universities to train students and researchers in cloud WRF

Project Goals

- Extend WRF system accessibility to the meteorological community
- Improve WRF support and training worldwide
- Facilitate model development

Project Products

- Cloud-porting WRF system code and configurations
- Cloud WRF tutorials delivered
- Cloud WRF code testing capability
- Online cloud WRF training

Cloud Service Provider (CSP) Support



Cloud-Based WRF Tutorial

- Students use configured WRF environments
- Student access personal instances (virtual servers)
- Instance elements: OS, compilers, libraries, WRF binaries, input data



Cloud WRF Website: Use of AWS Environment to Run WRF

https://www2.mmm.ucar.edu/wrf/OnLineTutorial/wrf_cloud_public/wrf_in_cloud_aws_tutorial.php



Amazon Web Services (AWS) Cloud WRF Utilities

Amazon Machine Images (AMIs)

- Operating spaces with compiled WRF/WPS code & libraries
- <https://www2.mmm.ucar.edu/wrf/users/supports/wrfcloud.html>

Amazon EBS (Elastic Block Store) Volumes

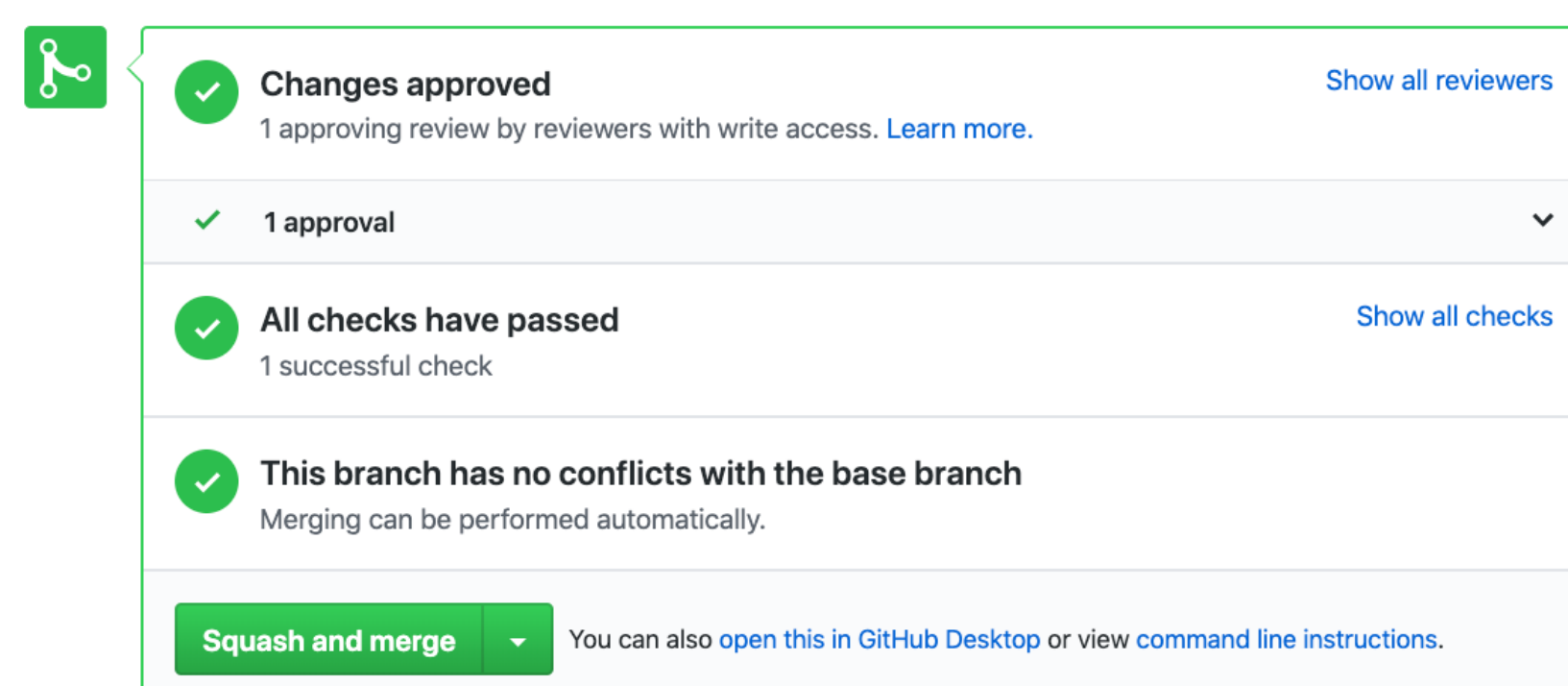
- Created with AWS ParallelCluster for multi-node operation

AWS S3 Bucket Storage

- Repository for voluminous WRF geographical datasets (e.g., global topography, land use)

Cloud-Based Testing for WRF Code Submissions

- Capability developed to automatically test submissions of new WRF code using cloud compute resources
- Series of regression tests launched on pull requests (PRs) to the WRF code Github repository
- Jenkins CI software applied
- Scala Computing resources accessed



University Partners & Student Training and Education

Project's broader impacts include training of students at universities, with an MSI focus.

- North Carolina Agricultural & Technical State University
- Colorado State University

