Dr. Petra Klein
Executive Associate Dean
Professor, School of Meteorology

Dean Dr. Berrien Moore
PI of the NASA GeoCarb Earth Venture Mission 2
A&GS Overview

• Two Academic Units
  • School of Meteorology
  • Department of Geography and Environmental Sustainability

• Associated Research Centers:
  • Cooperative Institute for Mesoscale Meteorological Studies (CIMMS)
  • Oklahoma Climatological Survey (OCS) and Oklahoma Mesonet
  • South Central Climate Adaptation Science Center (SC CASC)
  • Center of the Analysis and Prediction of Storms (CAPS)
  • Advanced Radar Research Center (ARRC)
  • Center for Spatial Analysis (CSA)
  • Oklahoma Alliance for Geographical Education (OKAGE)
  • Center for Autonomous Sensing and Sampling (CASS)
  • Hydrology and Water Security (HyDROS)
Weather and Climate Impacts on Military Operations
Relevant Research - School of Meteorology

1) Polar Meteorology – Arctic sea ice retreat
2) Weather & Climate Connections - Extremes in a Changing Climate
3) Multiscale Data Assimilation and Predictability
4) Observations of atmospheric aerosols (e.g., dust, smoke)
5) Weather Radar Applications
6) Flow and Dispersion in Complex Terrain
1) Polar Meteorology – Arctic sea ice retreat:
   - Polar regions atmospheric dynamics, and polar to lower latitude linkages:
     - Vortex dynamics
     - Global, nonhydrostatic, high-resolution, coupled modeling
     - Ensemble data assimilation
   - AAARG (Arctic And Antarctic Research Group)
     - Dr. Steven Cavallo (SoM), Dr. David Parsons (SoM)
   - Recipient of Office of Naval Research (ONR) Young Investigator Award
   - Leading 5-year ONR Departmental Research Initiative “Overcoming the Barrier to Extended Range Prediction over the Arctic” funding 13 research teams across the nation
2) Weather and Climate Connections

- Sub-seasonal to interannual to decadal variability and beyond
- Extremes
- Storms
- Polar Connections
- Water resources

Extreme precipitation events at sub-seasonal (14-90 day) timescales
Droughts, pluvials, and the annual cycle of precipitation in the future
Winter Weather: snow, ice, and coastal storms
Changes in the frequency of heat & cold across North America
Storm modes and severe weather in past and future climates
Tropical convection
Characteristics of pre-hurricane disturbances over Africa
Hurricane wind field size in future climates

Faculty & Staff Include:
Martin, Furtado, Basara, Homeyer, Sakaeda, Schenkel
3) Multiscale data Assimilation and Predictability, Prof. Xuguang Wang

- Multi-institution (NOAA, NASA, OU) collaboration on the development and testing of the Hybrid data assimilation system for US NWS’ operational Global Modeling System (GFS) under the support of THORPEX. The system became operational at NCEP beginning 2012.

- Co-lead the data assimilation team in US NWS NOAA Hurricane Forecast Improvement Program in developing and implementing the Hybrid data assimilation system in the US NWS convection allowing hurricane prediction system HWRF. The system is implemented operationally at NWS beginning 2017 hurricane season.

- Developed ensemble/hybrid data assimilation system for convective scale radar data assimilation for US NWS regional convection allowing prediction systems including NAM CONUS (North American Mesoscale Model Continental US), HRRR (High Resolution Rapid Refresh) and experimental WoF (Warn On Forecast) systems in collaboration with NOAA/NCEP, NOAA/ESRL and NOAA/NSSL colleagues. The system is planned to be implemented for NWS operational prediction of severe weather forecast over the Continental US in 2020.

- Co-developed the hybrid ETKF-variational data assimilation system for the community Weather Research and Forecasting (WRF) model in collaboration with NCAR and NOAA colleagues.
4) Observations of atmospheric aerosols (e.g., dust, smoke)

Atmospheric aerosols affect:
- Visibility
- Radiation balance
- Propagation of electromagnetic energy
- Cloud life-cycles

SoM uses multiple tools to study atmospheric aerosols:
- Satellite and airborne remote sensing
- Airborne in situ measurements
- Regional and global chemical transport models

Trends in burned area globally decreasing. In Africa, trend is increasing. → Potential increase in SE Atlantic aerosol

Andela et al., 2017
5) DoD Weather Radar Applications

Simulating the Battle Field
Assimilation of radar data to improve weather prediction over area of operations.

Protecting Coastal Bases and Assets
Mobile radar deployments in advance of landfalling hurricanes to derive wind attribute maps.

Non-GPS Geolocation
Mobile radar guided rocket-and-wire triggered lightning.

Robust, Light-Weight Bistatic Weather Radar: develop an innovative solution for a light-weight bistatic radar allowing ease in deployment, implementation, and operation.

Miniature, software-defined Man-Portable Doppler Radar (MPDR) for Atmospheric Measurement: develop a compact, rugged, modular, and polarimetric X-band radar for tactical weather sensing and detection of small UAS.
Weather and Climate Impacts on Military Operations
Relevant Research - School of Meteorology

6) Flow and Dispersion in Complex Terrain:
- In-Situ observations, wind-tunnel simulations, and numerical modeling
- Urban Meteorology:
  - Street canyon studies: traffic emissions, dispersion of air toxics
  - Urban heat island studies
  - Ozone pollution problems near metropolitan areas
- Mountain Meteorology
DGES Research expertise in DoD-relevant areas

- **Wildlife Conservation**
  - Species life history and conservation on base
    - Previous work at Tinker
  - Managing invasive species
  - Reducing habitat fragmentation
  - Animal movement and habitat use

- **Soil moisture and Water Availability**
  - Currently funding DoD young investigator project

- **Landscape Land Use Change**

- **Indigenous Geographies**
Managing invasive species

Landscape-scale conservation planning

Restoring native fish migrations

Reducing habitat fragmentation
Animal movement and habitat use

Optimize placement of Wildlife Crossings

Habitat fragmentation

Wildlife home range estimation
Water and Energy Budget Modeling Study and Military Operations Sites
INDIGENOUS GEOGRAPHIES

Work with Indigenous communities, organizations, and individuals to understand human-environment relationships historically, culturally and politically.

▪ Political Ecology
▪ Historical/Cultural Geography
▪ American-Indian Geography
▪ Gender and Environment
Center for Spatial Analysis

• A multidisciplinary research center at the OU-Norman Research Campus, specializing in applied research and development using Geospatial Technologies
  • Services to government agencies, private industry, and OU
  • Educational outreach programs
  • Traditional sponsored academic research
Center for Spatial Analysis

- Core capabilities
  - Web mapping application development, hosting, and maintenance
  - Spatial database creation, conversion, management, and processing (quantitative and qualitative)
  - Custom GIS, cartography, and geovisualization
  - Data warehousing and distribution
  - Training and Geospatial Educational Resources