WORKING GROUP ON NOWCASTING AND MESOSCALE RESEARCH

Co-Chairs: Rita Roberts and Pete Steinle

Members: Rachel Albrecht, Elisabeth Bauernschubert, Gyuwon Lee, Ping Wah Li, Valery Masson, Jason Milbrandt, Paola Salio, Dave Sills, David Turner, Yong Wang

MISSION OF NMR WG

- The WMO World Weather Research Programme has several Working Groups, to address the relevant topics for WWRP’s goals
- The Nowcasting and Mesoscale Research Working Group (NMR) aims to:
  - advance the knowledge of nowcasting and mesoscale processes and predictability;
  - promote and aid the implementation of nowcasting systems within National Meteorological Hydrological Services (NMHSs) and among their end-users, including the potential use of numerical modelling and assimilation of very high-resolution data.

DEVELOPING NOWCASTING SYSTEMS TO HELP SUPPORT WATCHES AND WARNINGS FOR NMHS

Field Campaigns – to improve nowcasts, watches and warning capabilities

- Argentina RELAMPAGO field campaign
- Brazilian SOS-CHUVA field project
- Lake Victoria HIGHWAY project
- SCMREX – China Monsoon Rainfall experiment

Aviation

- Aviation RDP (AvRDP) providing tools for detection, nowcasting and enroute forecasting of aviation weather hazards

Urban

- Beijing SURF program to monitor and prediction urban weather hazards

OBSERVATIONS

- LAFE is exploring state of the art observations for assimilation into NWP models
- ICE – POP winter observations for improved detection and prediction during Olympics
- Enhanced observations from field campaigns and SURF

REMOTE SENSING OF ELECTRIFICATION, LIGHTNING, AND MESOSCALE/MICRO-SCALE PROCESSES WITH ADAPTIVE GROUND OBSERVATIONS (RELAMPAGO) / CACTI

RELAMPAGO led by Paola Salio (WG-NMR member) and Steven Nesbitt; CACTI led by Adam Varble and Steve Nesbitt

Goals:

-to study intense continental convective systems in S. America and understand their interactions with local and region meteorology, aerosols, topography, and land-atmosphere interactions

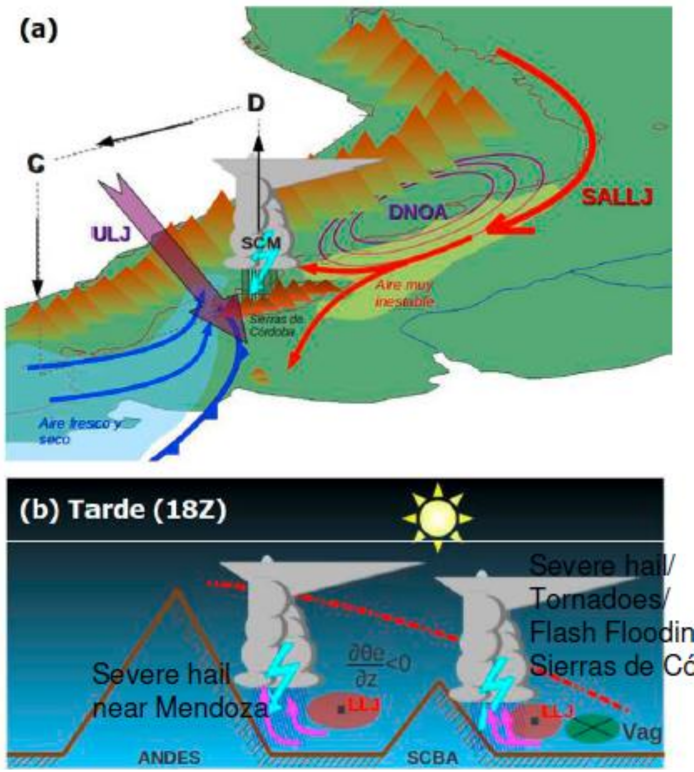
-to improve severe storm hazard prediction

-to place extreme continental convection in context with regional and global climate.

Field campaign will run from 1 Nov – 15 December 2018 with a large array of instrumentation.

Key Partners:

Key partners are scientists from the organization shown in the table to the right, along with additional university participants who will be running a variety of high resolution NWP models and ensembles.



RELAMPAGO + CACTI Contributions

NSF (US)	NASA (US) / NOAA (US)	DOE (US) CACTI	SMN (Argentina)	INPE/FAPESP (Brazil)
• S-PolKa • 3 DOWs • 1200 Soundings + Expendables, 5 sounding vehicles • 3 Mesonet vehicles • Pods • WV-DIAL LIDAR • 15 ISFS/ meteorological stations/disdrometers	**NASA (US)** Disdrometers Rain gauges **NOAA (US)** Lightning mapping array Field mills S-Band/449 Profilers (Proposed)	AMF-1 (cloud/profiling suite, aerosol measurements) C-SAPR2 G-I (microphysical and aerosol aircraft) TBD	C-Band DP op network Mobile soundings Enhancement of operational radiosondes Distrometers + rainfall	Mobile X-Band DP radar Precip/profiling supersite Lightning mapping array Sticknet S-Band DP radars downstream

RELAMPAGO/CACTI

Precipitation and Cloud Measurements:

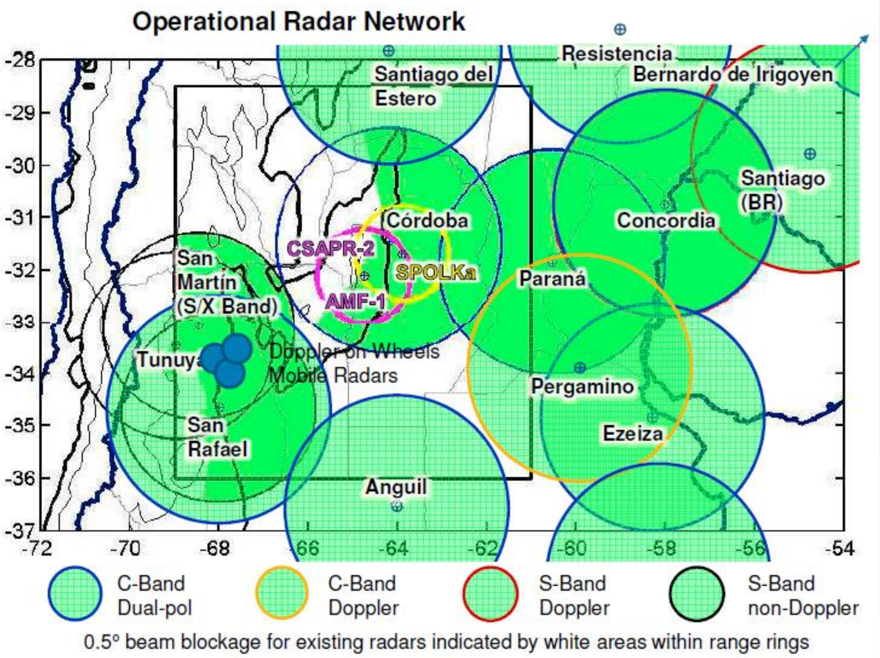
Multiple radar observations will be collected using Argentina radars, NCAR S-Pol radar, Doppler on Wheels, ARM X- and C-band radars and profiling systems.

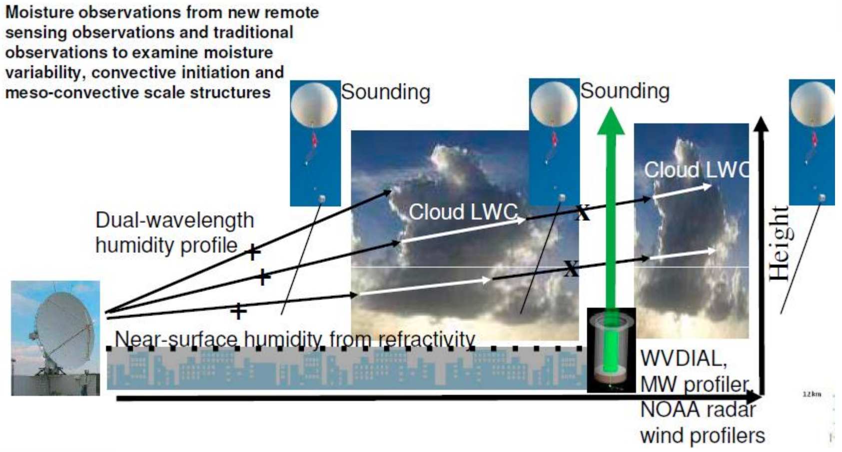
Water Vapor Measurements:

Radar-based moisture retrieval techniques will be collected (refractivity and S-band and Ka-band retrievals). NCAR water vapor DIAL lidar will also collect measurements

Key Partners:

Univ. of Buenos Aires, SMN, DOE, NCAR, CSWR, U. of Washington





ICE-POP
(SOUTH KOREAN OLYMPICS FDP & RDP)

High density radar coverage

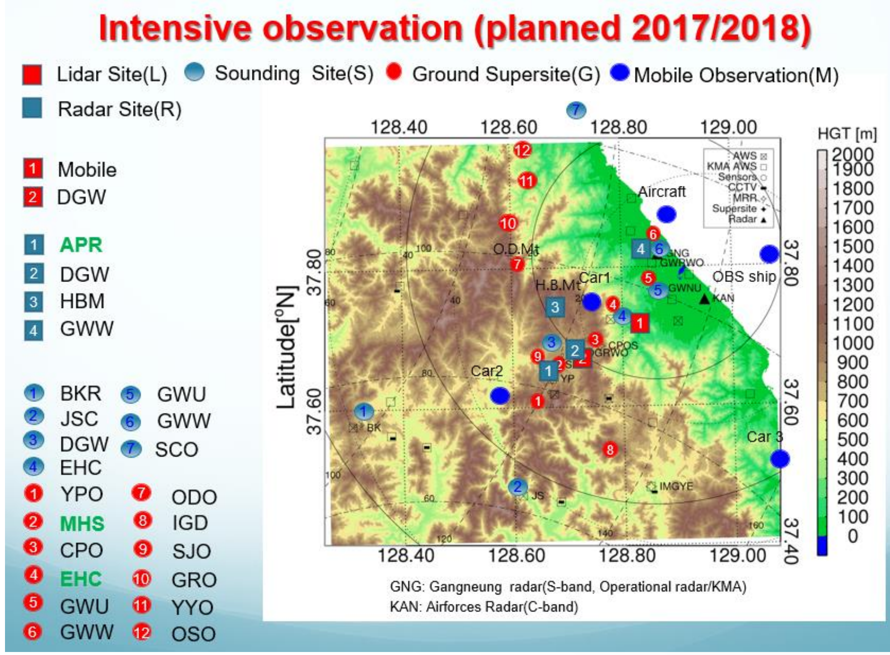
- Coordinated scanning strategy (cross-coast/along coast)
- Aligned with aircraft flights, scanning lidar, and other
- Calibrated with high density measurements of microphysical properties

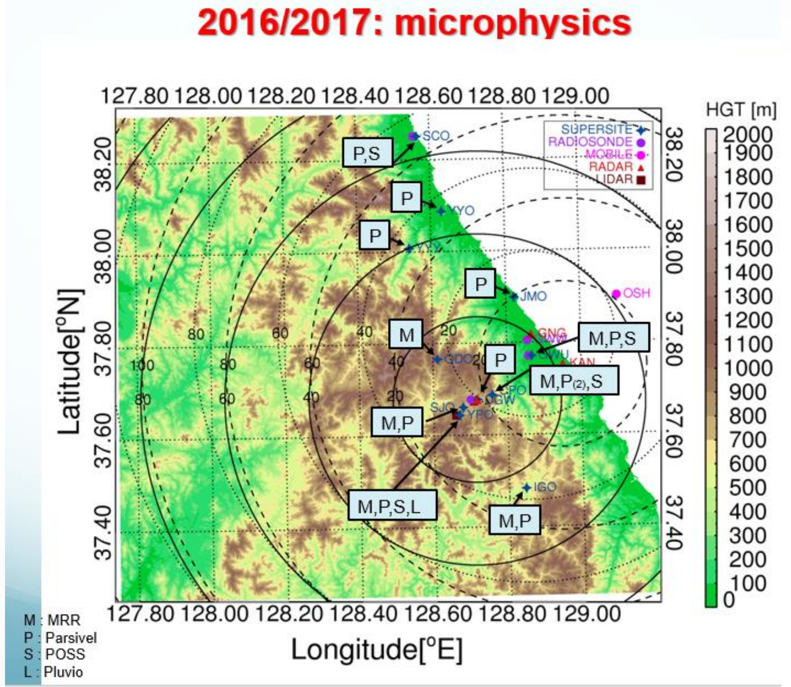
Additional in-situ observations

Network to calibrate satellite data

Ship, buoys and aircraft to provide air-sea flux

High density observation to understand process, augmented by multiple NWP models

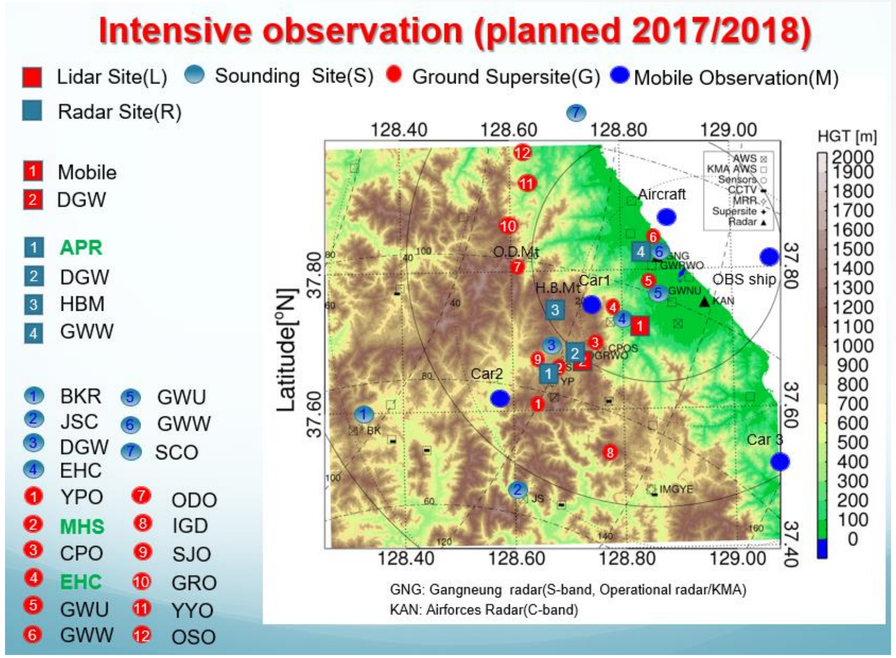




ICE-POP
(SOUTH KOREAN OLYMPICS FDP & RDP)

Multiple NWP systems available

- Models down to ~300m as well as km-scale
- 6 models available in delayed (RDP) mode
- UM, GRAPES, WRF, COSMO/ICON, MPAS, GEM
- Same domain, topography and obs



Test:

- Multiple microphysics schemes
- Limits of what can be captured at km-scale
- Versus features/processes that require ~200-300m grid

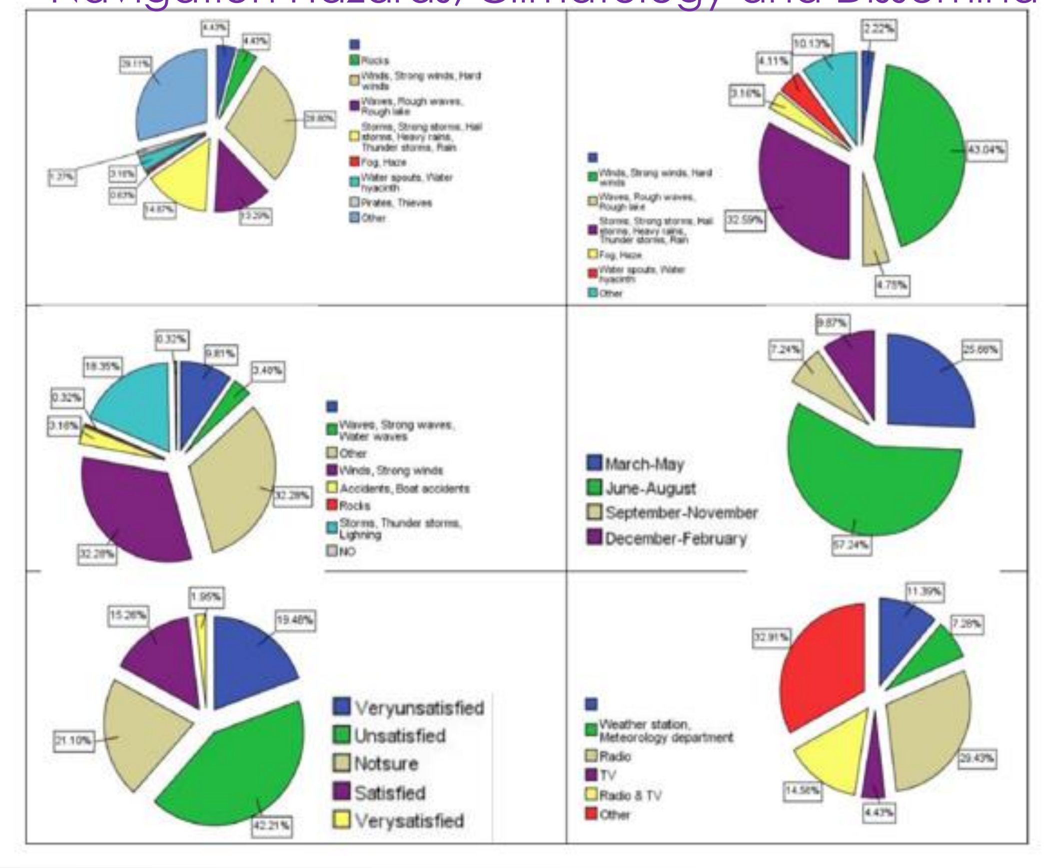
WMO LAKE VICTORIA HIGHWAY PROJECT

The World Meteorological Organization leads the implementation of the project which brings together international and regional partners including the National Meteorological and Hydrological Services (NMHSs) of Kenya, Rwanda, Tanzania, and Uganda, the Met Office, the UK’s national meteorological service, the East African Community (EAC), the Lake Victoria Basin Commission (LVBC), and the US National Center for Atmospheric Research(NCAR). (UKMO) and to NCAR.

Goals:

- Improve the understanding and application of high impact weather observations and prediction services in the Lake Victoria region.
- To strengthen the regional Meteorological Early Warning System (EWS) in the Lake Victoria Basin

Navigation Hazards, Climatology and Dissemination



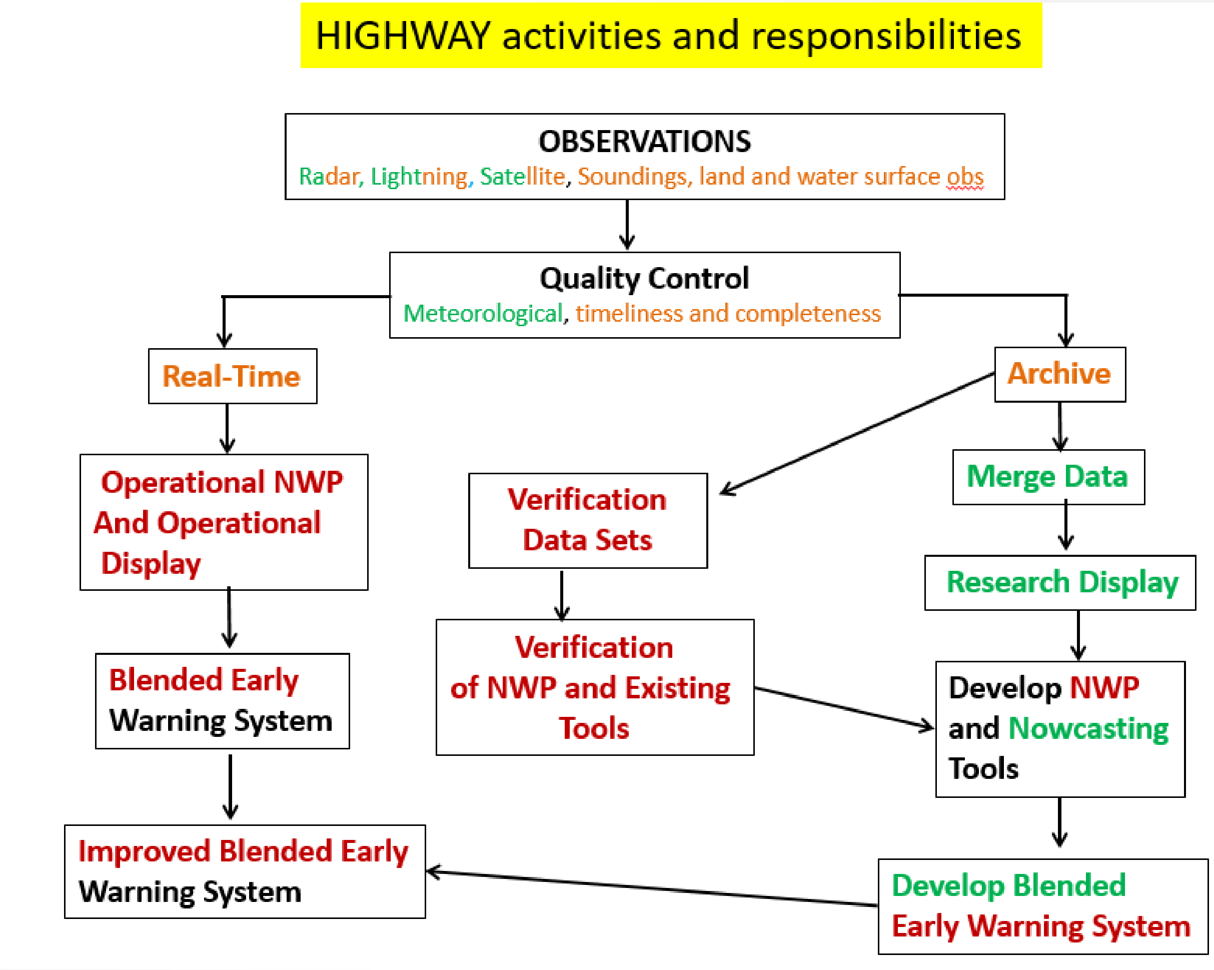
WMO LAKE VICTORIA HIGHWAY PROJECT

NWP model

- The UKMET Office 4 km model will run in the East Africa region initialized with observations from the GTS.
- The UK HyCristal experiment will run during a sub-set period of HIGHWAY, collecting observations for climate studies and eventual NWP studies.

Verification

Verification of the model will be done using the available radar, satellite, lightning, surface stations and soundings. JWGFVR will be involved.

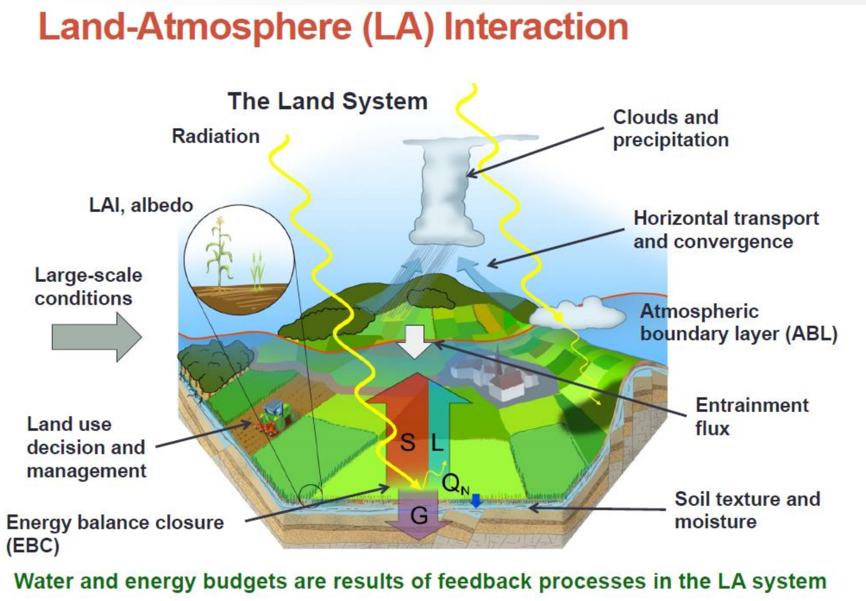


THE LAND-ATMOSPHERE FEEDBACK EXPERIMENT (LAFE)

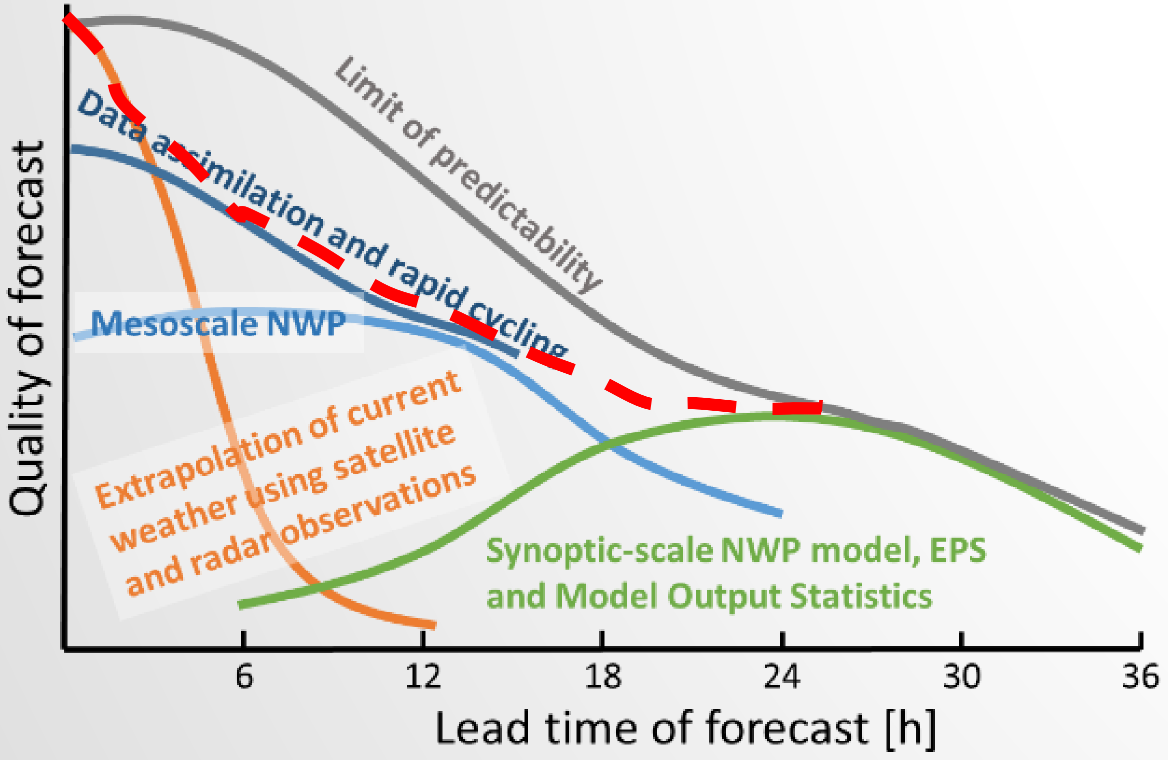
- Led by Dave Turner (WG-NMR member) and Volker Wulfmeyer
- Ran during August 2017 at the U.S. ARM Southern Great Plains field site
- **Goal**: to improve understanding of land-atmosphere interactions near the surface and how it impacts the entrainment zone.
- **Goal**: To use improved understanding to improve the representation of these processes in NWP models.
- The field campaign used state-of-the-art observations including:
    - Scanning (temperature, water vapor, Doppler) lidars, profiling systems, flux towers, aircraft in-situ measurement, and UAVs.

Key Partners:

DOE, NOAA/ESRL, U. of Hohenheim, U. of Wisconsin, NOAA/ARL, NCAR, NASA, Cleveland State Univ., and U. of Tennessee



The seamless vision for forecasting

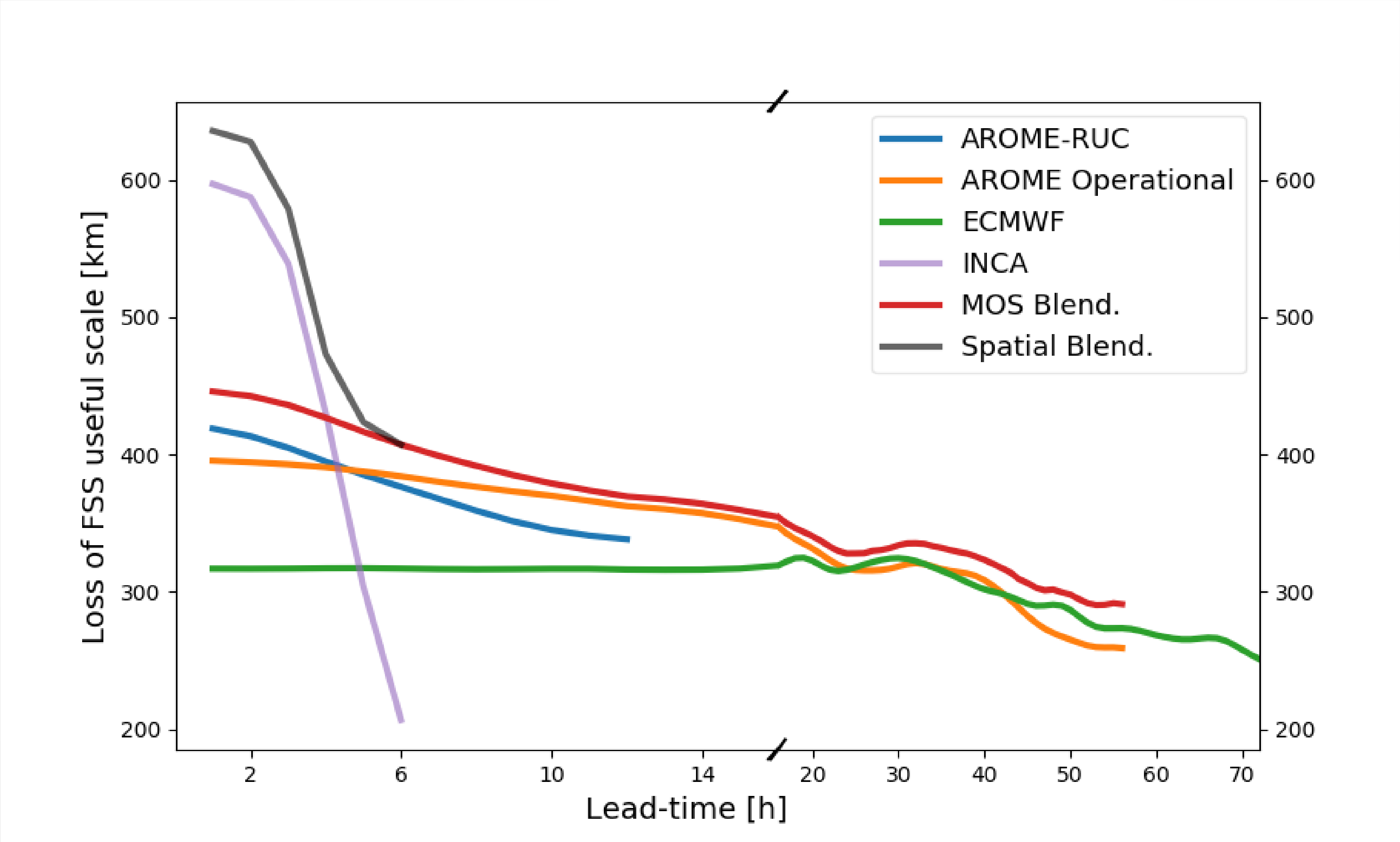


The quality of weather forecasts defined as a function of lead time for different forecasting methods. The figure is highly schematic and the quality of forecast is a qualitative accuracy of the different performance. This figure is based on a previous one originally created by Browning (1980).

"We are entering a new era in technological innovation and in use and ***integration*** *of different sources of information for the wellbeing of society"*

SAPHIR at ZAMG

SEAMLESS PROBABILISTIC ANALYSIS AND PREDICTION IN VERY HIGH RESOLUTION



SINFONY at DWD

A NEW SEAMLESS INTEGRATED FORECASTING SYSTEM FOR VERY SHORT RANGE CONVECTIVE-SCALE FORECASTING AT DWD

Seamless INtegrated FOrecastiNg sYstem

Some Broader Thoughts

Research to Operations and Seamless Prediction are two of the most challenging activities facing the weather community over the next several years.

Seamless prediction will not be achievable unless you have partners who are knowledgeable about every step in the chain and who can work as a team to produce the end-to-end system

Products for the operational weather services will only be successful if they are developed and provided in close collaboration with end user (forecasters or others) and with partners who have expertise in translating weather information into information useful and relevant to the end user needs.

Damage Models that "learn" the correlation between weather features/phenomena and damage processes that happen, is an excellent conceptual model and framework for translating weather information into products for end users.