



# The Role of Research Aircraft in YOPP

Chawn Harlow, YOPP Summit, WMO, Geneva

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# Contents

This presentation covers the following areas

- General value of research aircraft to YOPP
- Past Met Office Arctic Campaigns
- FAAM
- NERC and Met Office proposal for three YOPP campaigns using FAAM

# General value of research aircraft to YOPP

- Aircraft provide dropsondes, and in situ and remote sensing measurements of sub-grid scale processes and ancillary data used in validation of DA schemes. Provide better spatial coverage than fixed/slow platforms.
- “Enhance the observational system”
  - Gather additional observations aimed at improving understanding key processes.
- “Progress in understanding processes and dynamics”
  - Validation of improved parameterizations of model processes
- “Advance the operational forecasting system”
  - Gathering data to underpin development and validation of improved satellite data assimilation over snow- and ice- covered regions

# Past Arctic Campaigns that the Met Office has contributed to

- Two studying surface microwave emissivities for use in satellite data assimilation
  - POLEX 2001
  - CLPX-II 2008
- GFDex 2007 – orographic flow dynamics and air-sea interaction around the coastal seas off Greenland
- MEVALI 2012 – cloud microphysics of cold-air outbreak systems over the Norwegian Sea
- ACCACIA in 2013 -- boundary layer cloud and aerosol interactions
- MAMM in 2013-14 -- arctic chemistry, CH<sub>4</sub> and other greenhouse gases



# The Facility for Airborne Atmospheric Measurements



Ceiling: 35,000 ft  
Duration: 5 hours

Dropsondes  
MW and IR radiometers  
Surface energy balance  
Cloud microphysics  
Aerosol sampling  
Lidar



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# NERC and Met Office plan for YOPP campaigns using FAAM

## Campaign and overall project objectives (tentative):

- Obtain novel observations from the Arctic of surface emissivity over snow, surface and boundary-layer processes over sea ice, cloud microphysics & aerosols over sea ice, and orographic flows and leeside impacts.
- Use these observations to improve our understanding of key processes and develop new or improved parameterizations of these suitable for numerical weather and climate prediction models.
- Test these parameterizations for a range of predictive timescales from hours to seasons.
- Implement new parameterizations and new configurations into operational weather forecasting systems (hours to seasons); and earth system modelling systems.
- Contribute to and exploit the Year of Polar Prediction, coordinating with the MOSAiC drifting observatory and making use of additional model output and diagnostics

# Investigators



- Ian Renfrew (NERC lead; UEA)
- Ian Brooks (Leeds)
- Richard Essery (Edinburgh)
- Thomas Choularton (Manchester)
- Others...
- Met Office: Chawn Harlow and numerous others



# Three Campaigns to get a variety of Arctic processes

- Feb 2018: St. John's, NL. One week targeting
  1. cold-air outbreaks in the Labrador Sea
  2. heat and momentum fluxes over sea and sea-ice.
- March 2018: Fairbanks, AK. Three weeks targeting
  1. Snow emissivity studies to promote satellite data assimilation of atmospheric and snow properties.
  2. Orographic flows and gravity waves in the lee of the Brooks Range.
  3. Surface energy balance and surface exchange over sea-ice.



# Three Campaign to get a variety of Arctic processes

- March or April 2020(?): One week adhoc campaign based out of Svalbard or Kiruna when MOSAIC passes through Fram Strait.
  - Goal: map out meso-scale variability of surface fluxes and albedos, cloud and aerosol properties and surface emissivities around MOSAIC and relate these to longer term measurements made there.
  - As timing is indeterminate for MOSAIC to pass through Fram Strait so flexibility is needed on campaign timings. Alternative science needed in case MOSAIC is delayed or diverted.
  - Fall-back might include flights over Oden in summer 2019.
- All three campaigns might also address:
  - Aerosol sources and sinks; deposition and effects on albedo; and impacts on radiative balance in the Arctic.

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# Questions or comments?

