



Office of Naval Research Arctic Efforts

2015 Review and Plans for 2016-2018

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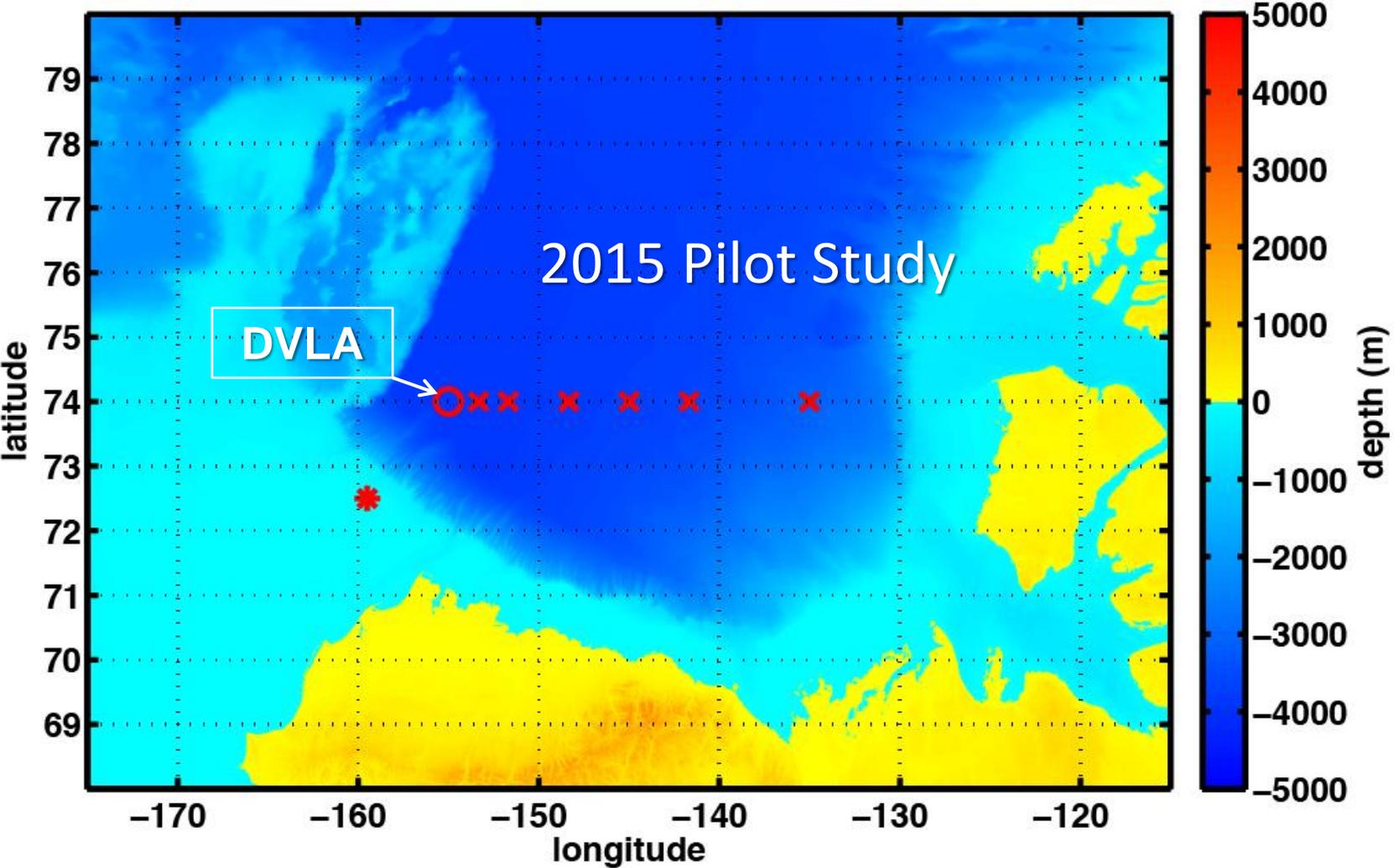


Overview of this Brief

- **2015 Cruise Activities**
 - CANAPE Pilot (July 23 – Aug 21)
 - Sea State DRI (Sept 30 – Nov 9)
 - Environmental Compliance Issues
 - Shore-Support
 - Arctic Weather Forecast Assessment
 - Remote Sensing
- **2016 Plans**
- **2017-2018 Plans**

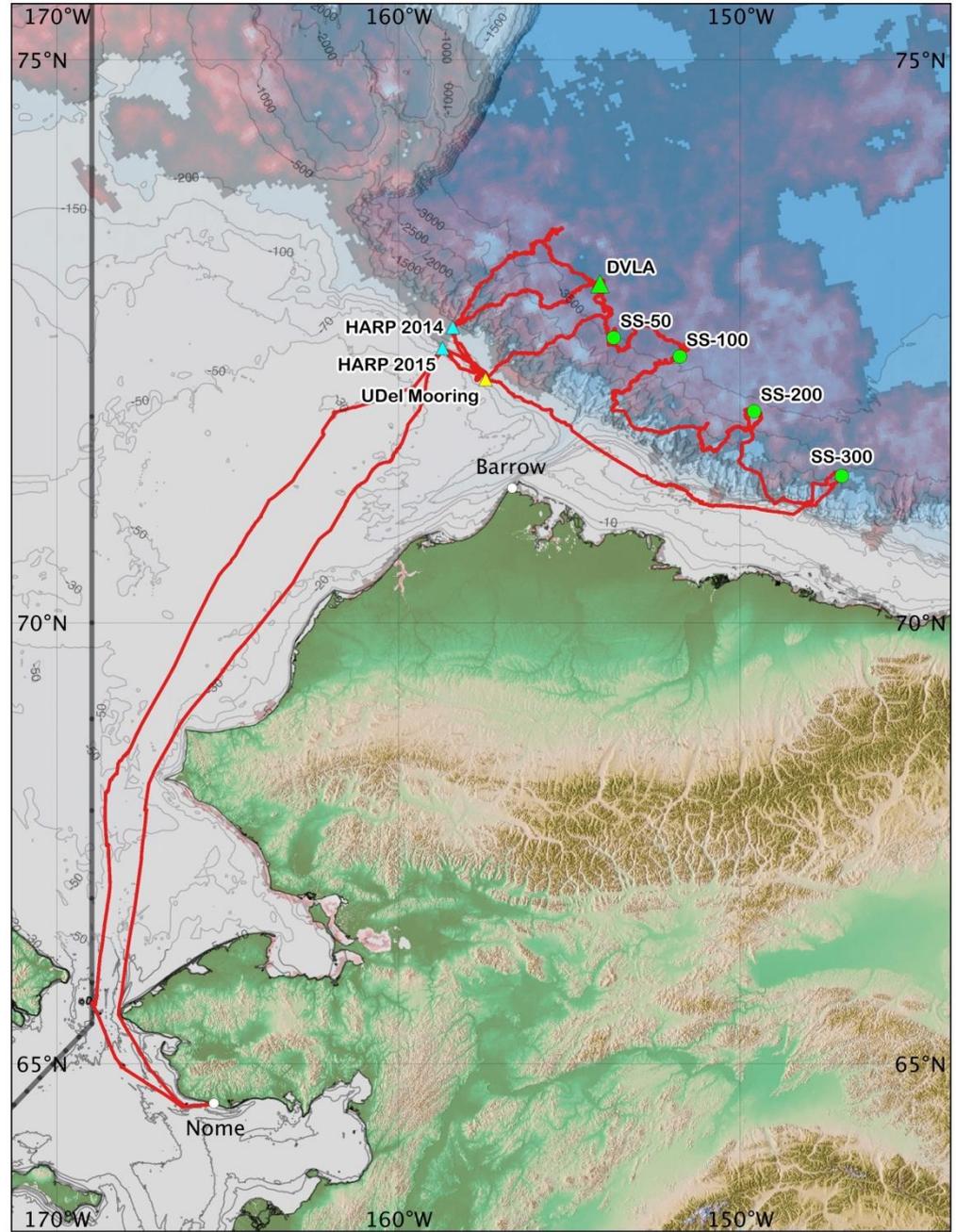


CANAPE: Original Cruise Plan



CANAPE 2015: The reality

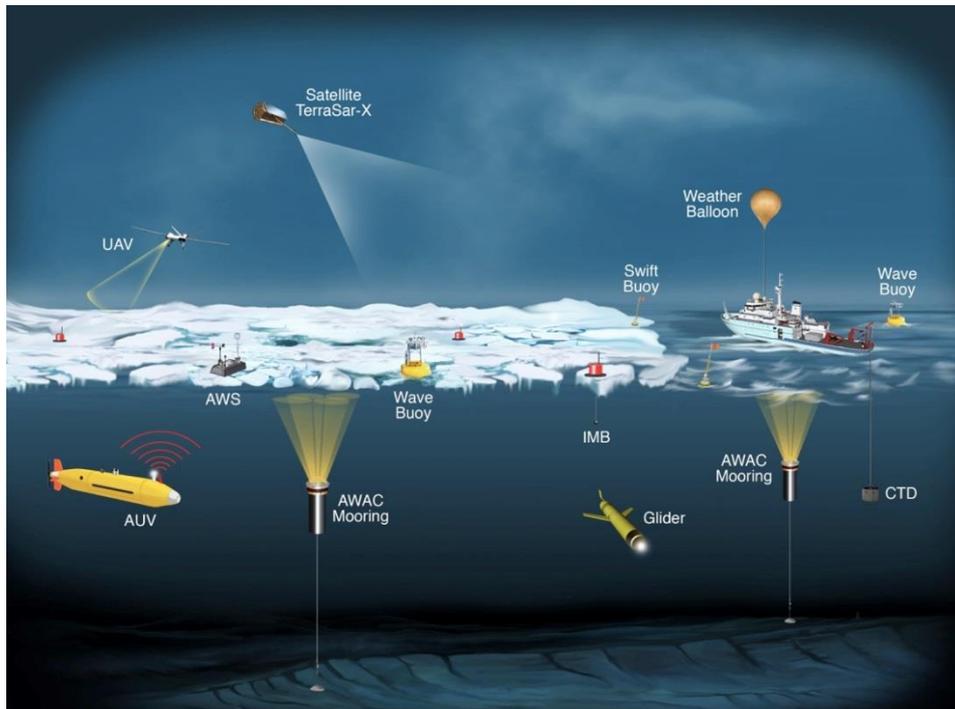
July 18: Depart Dutch Harbor
July 21: Arrive Nome
July 23: Depart Nome
August 21: Arrive Nome



Sea State DRI Science Goals

“Sea State and Boundary Layer Physics of the Emerging Arctic Ocean” DRI will use a combination of modeling, in situ observations, and remote sensing to:

- Develop a sea state climatology for the “new” Arctic Ocean
- Improve wave forecasting in the presence of sea ice
- Improve theory of wave attenuation/scattering in the sea ice cover
- Apply wave–ice interactions directly in integrated arctic system models
- Understand heat and mass fluxes in the air–sea–ice system



Towed CTD



Mast fluxes



**Balloon
radiosondes**



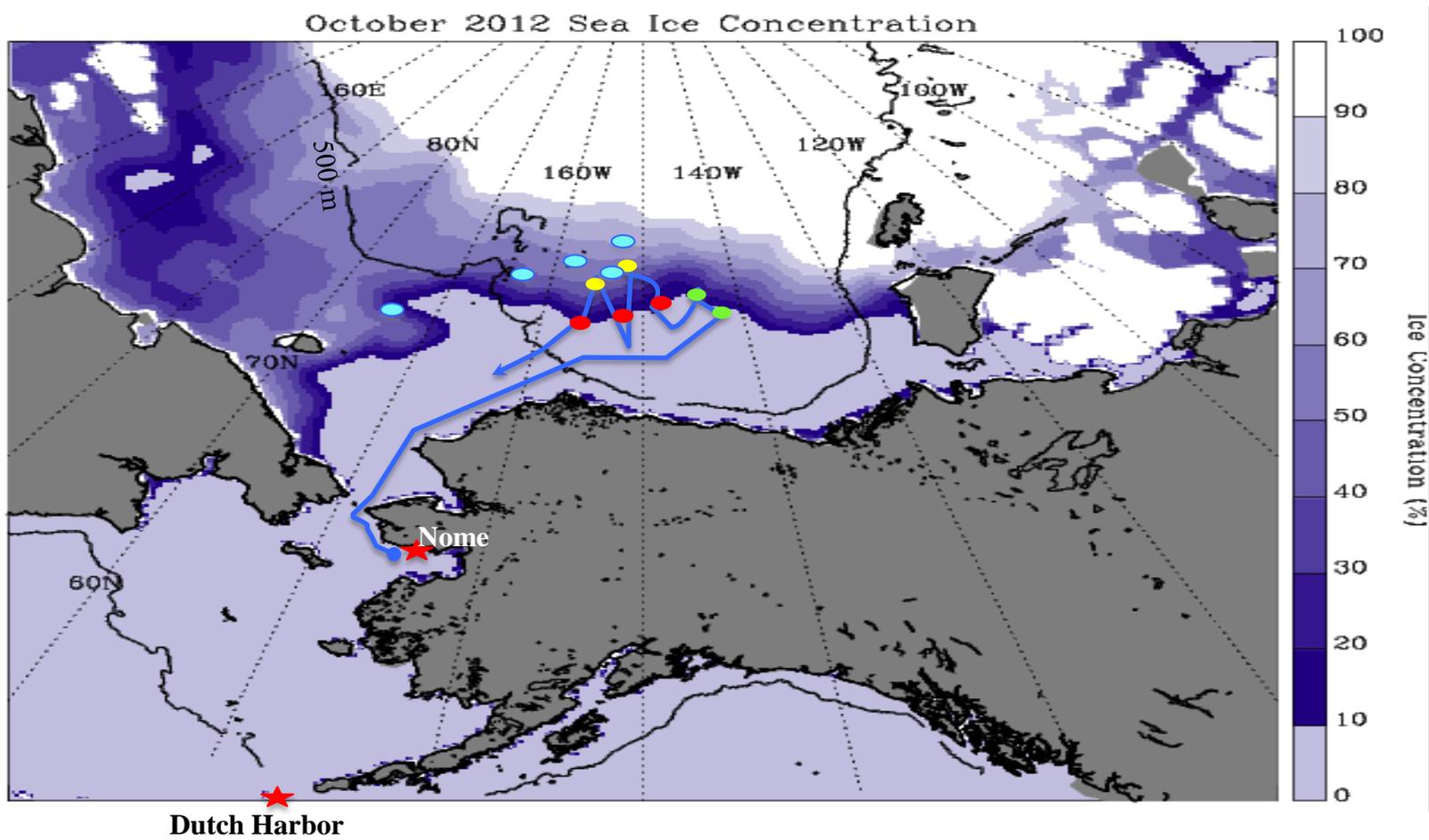
**SIMS: Sea Ice
Measurement System**



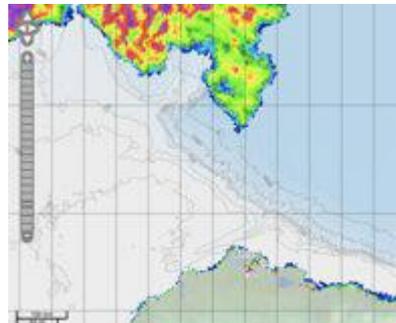
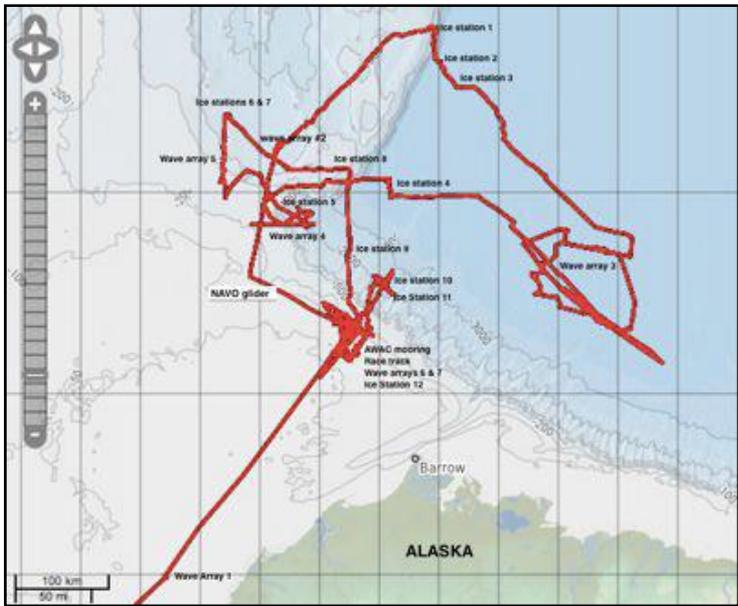
Rutter Radar

Sea State DRI: Original Cruise Plan

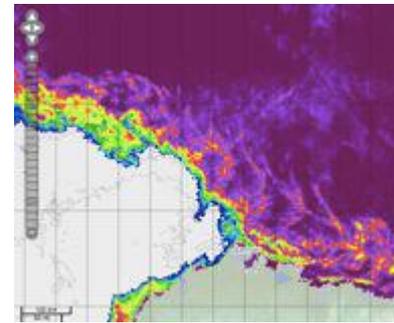
- Boundary layer fluxes (underway meteorology, wave radar, temperature, salinity)
- Open water, sea state / flux study (SWIFTs, wave buoys, CTDs, glider)
- Solid ice edge, wave reflection study (wave buoys, CTDs, SWIFTs)
- Advancing ice study (AUV under-ice transects, LiDAR, EMI, CTDs, UpTempOs)
- Ice pack/transect study (IMBs, AUV, LiDAR, EMI, CTDs)



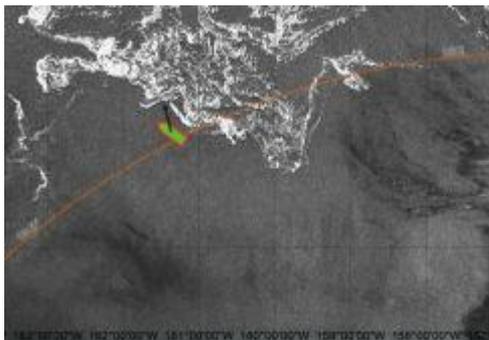
Sea State DRI: Actual Cruise Track



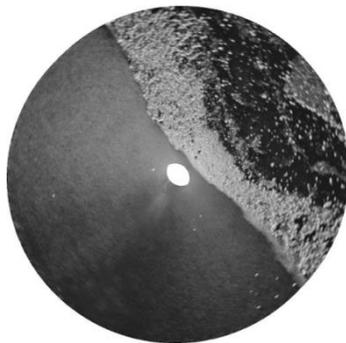
AMSR2: Oct 1, 2015



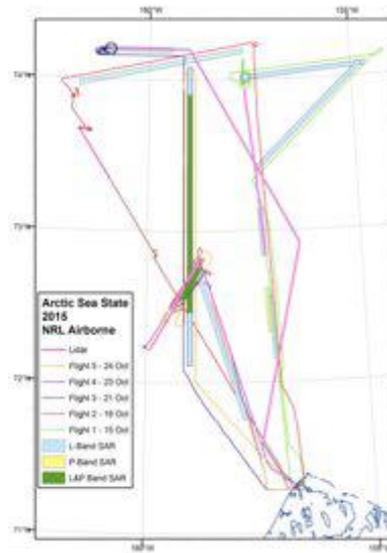
AMSR2: Nov 1, 2015



SAR image of ship and ice



Rutter radar image of ice edge



NRL P-3 Surveys

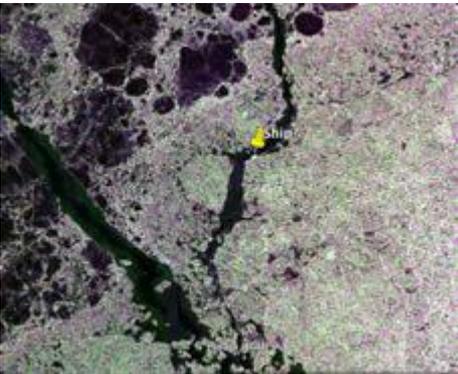


NASA UAVSAR Surveys

Sea State DRI: More Observations



NASA UAVSAR



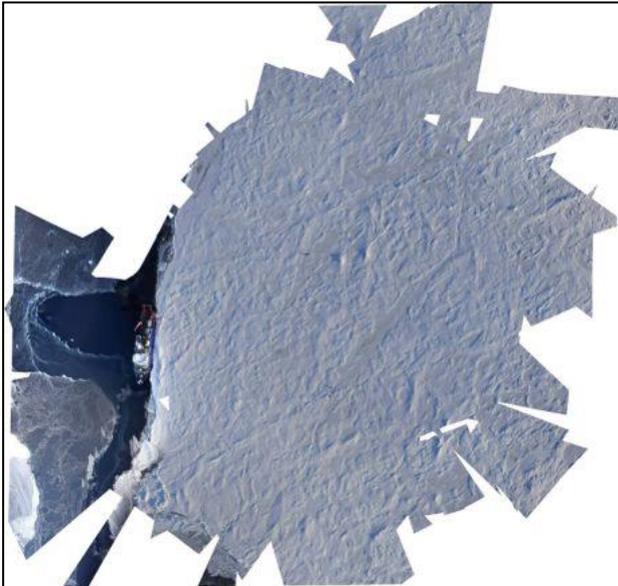
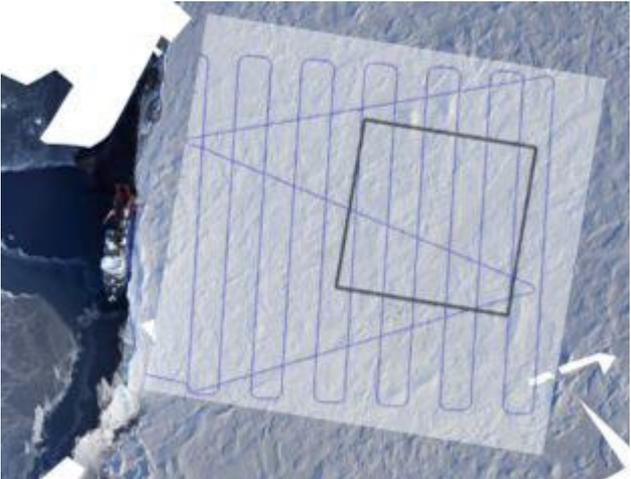
UAVSAR Flyover



UAS mosaics



Jaguar AUV with planned mission path under ice

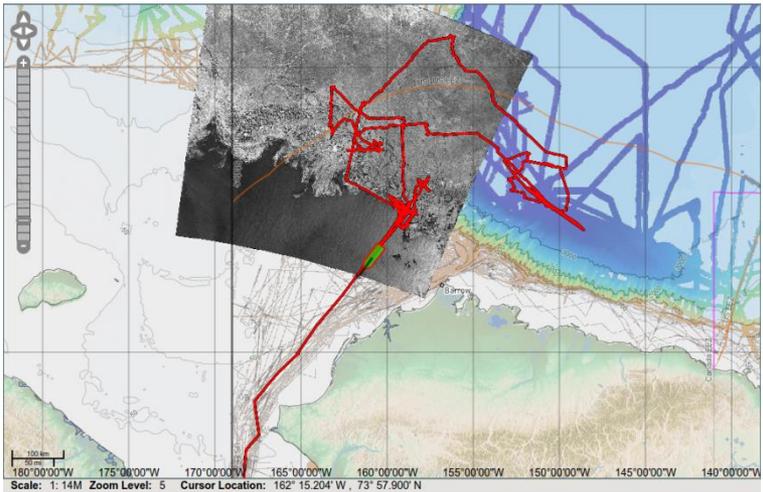




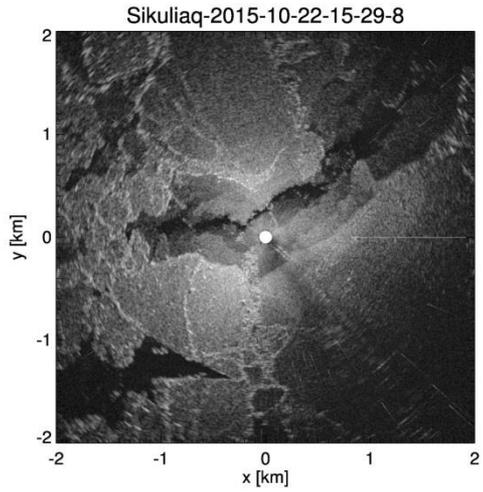
Environmental Compliance Issues

- Informal consultation with U.S. Fish and Wildlife Service
- Informal consultation with National Marine Fisheries Service
- Acoustic modeling done by NUWC
- No OEA or OEIS
- ONR made a finding that each experiment “environmentally benign” with “no foreseeable takes”
- Care taken to avoid 50nm limit for native whaling issues; coordination with Alaska Eskimo Whaling Commission
- NMFS *very* interested in acoustics; lots of questions about potential noise impacts of icebreaking !!!

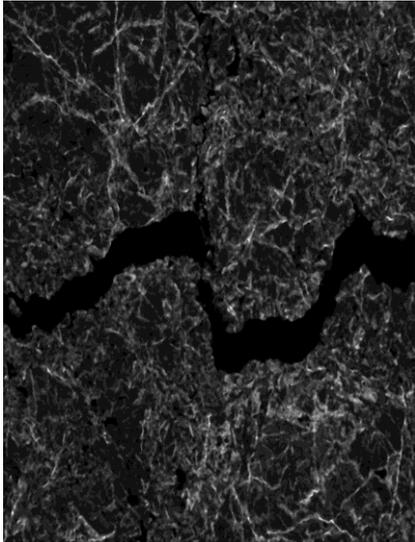
Remote Sensing Support



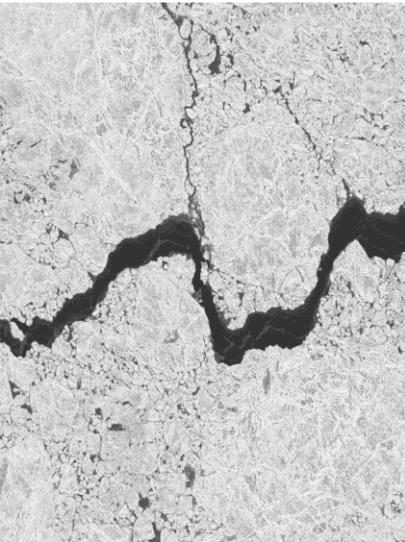
Sea State DRI cruise track with SAR overlay



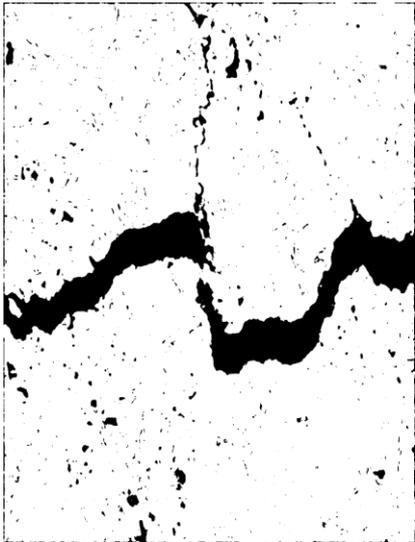
Science Radar Image



Raw SAR image



visible image (MEDEA)



Analyzed SAR data

Science parties on all Sikuliaq cruises this summer found the provision of dedicated remote sensing to be critical for site selection and ad hoc cruise planning.

CANAPE 2016-2017

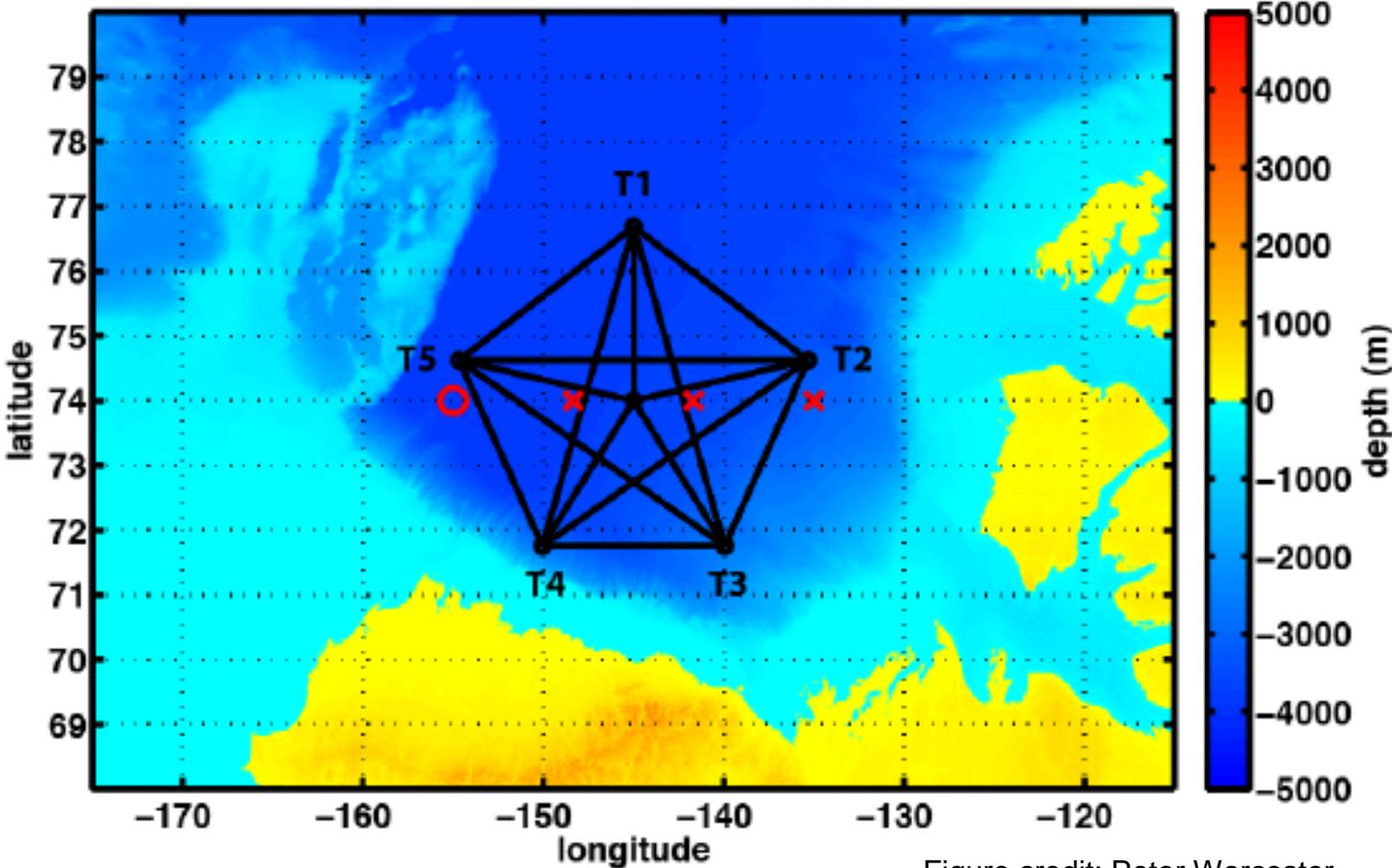
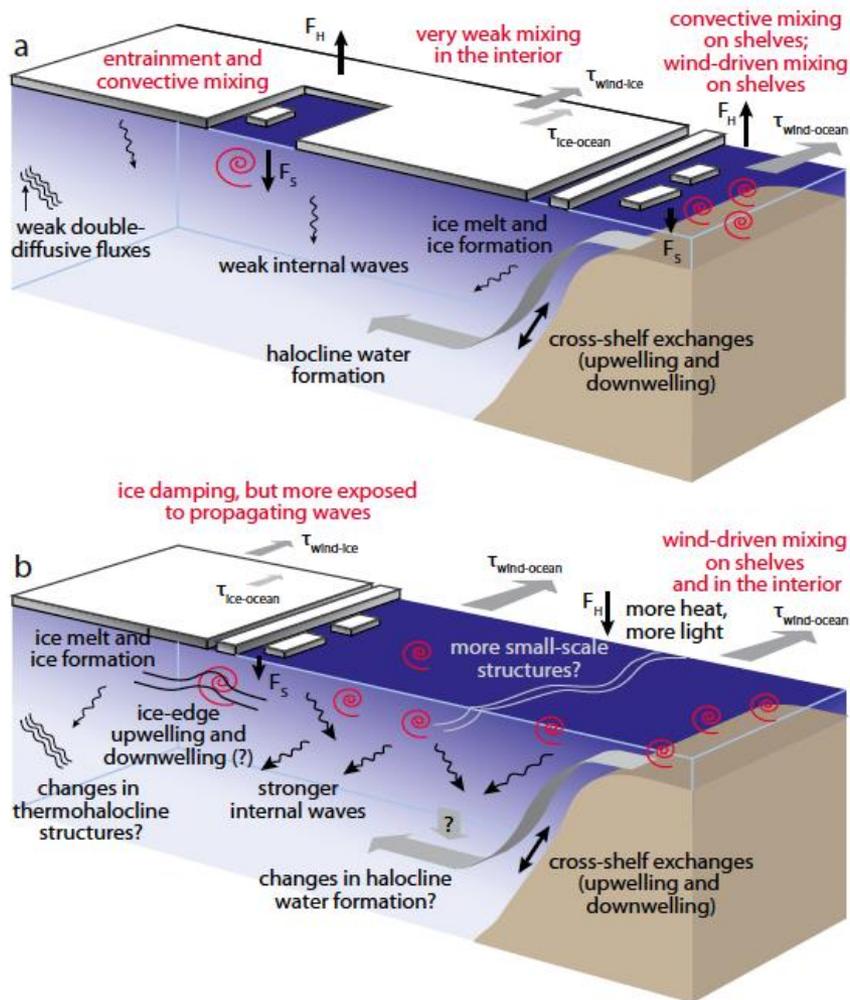


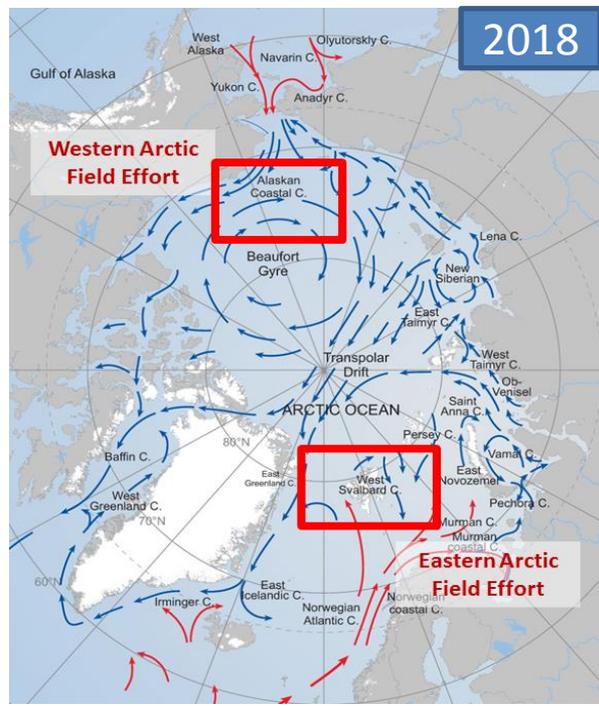
Figure credit: Peter Worcester

SODA DRI Field Effort: 2017-2019 (tbd)

Stratified Ocean Dynamics in the Arctic (SODA) FY16 – FY20



Reduced ice cover in summer may lead to changes in ocean mixing, stratification, and circulation.





Questions/Discussion?