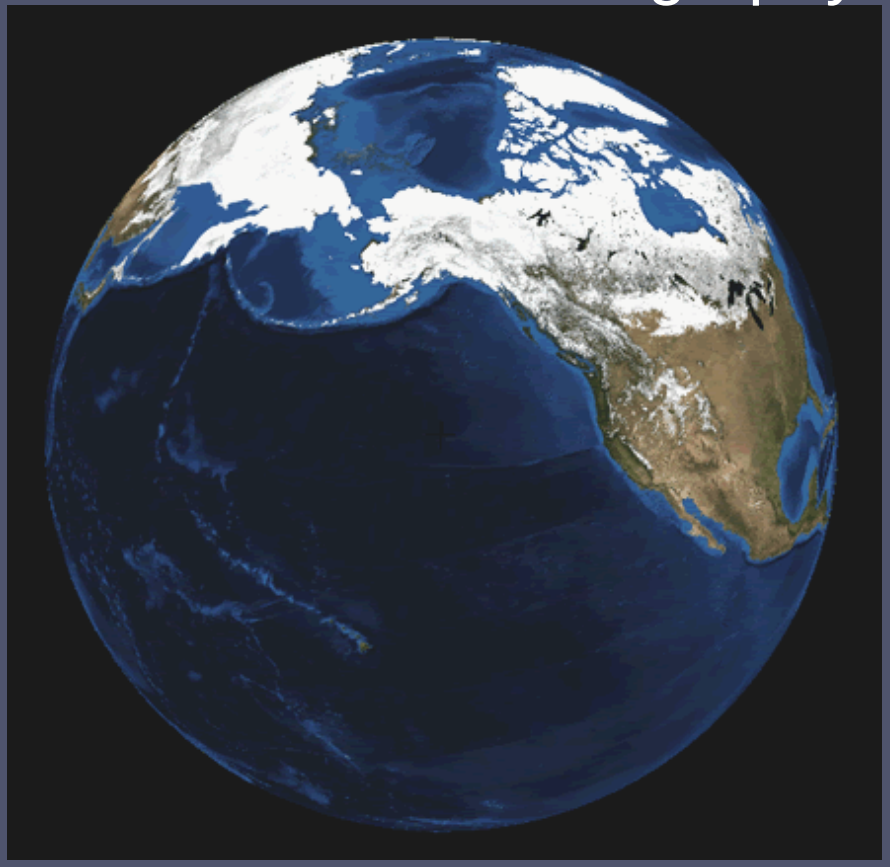
ECOSYSTEM CONSIDERATIONS

Climate and Oceanography



Stephani Zador
Elizabeth Siddon
Ellen Yasumiishi

NPFMC Groundfish Plan Team
September 12, 2017

Outline

- September:
  - North Pacific climate and physical oceanography update
- November:
  - EBS and GOA ecosystem synthesis to separate Plan Teams

North Pacific Climate Highlights

Bond

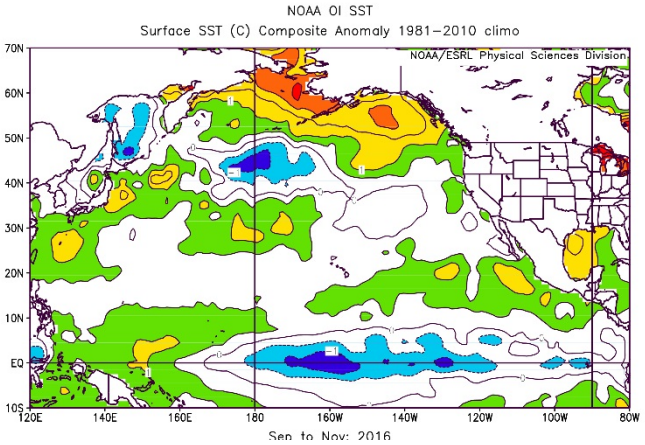
Moderation and Transition

- Moderation of temperatures after marine heat wave
- High sea level pressure in winter with weak Aleutian Low, a disproportionate response to weak La Nina
- Positive but declining PDO

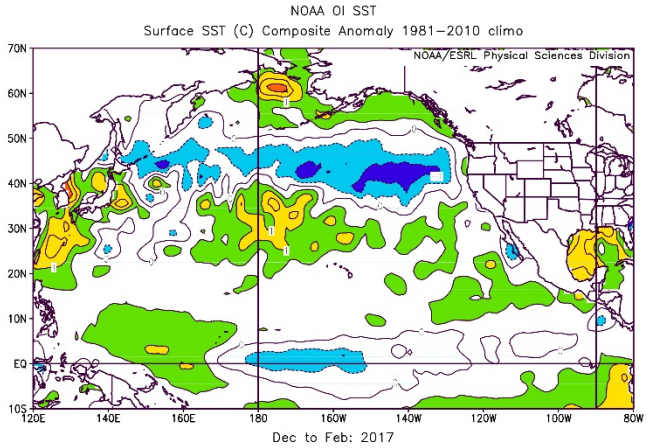
Sea Surface Temperature Anomalies

Bond

Beginning of transition from extreme heat wave to climatological normal



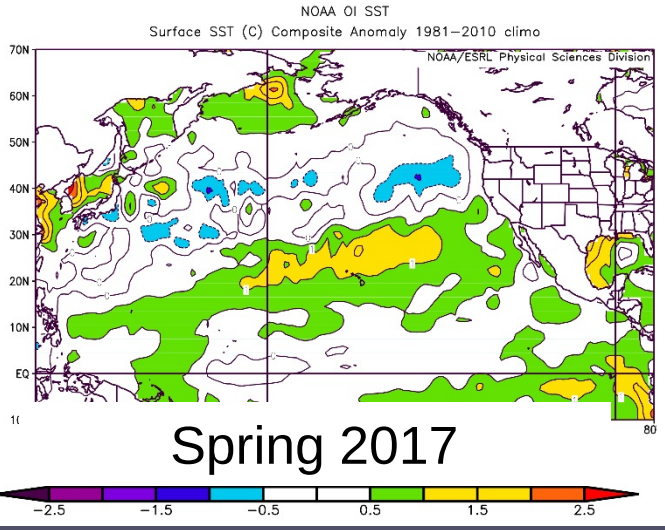
Autumn 2016



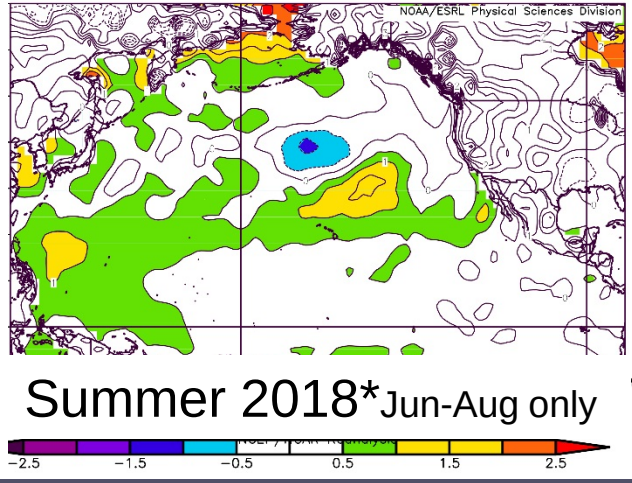
Winter 2016/7

Cooling from fall winds from the west and winter winds from W/NW

Weak positive PDO pattern



Spring 2017



Summer 2018*Jun-Aug only

+2^{o} anomaly in southern Chukchi

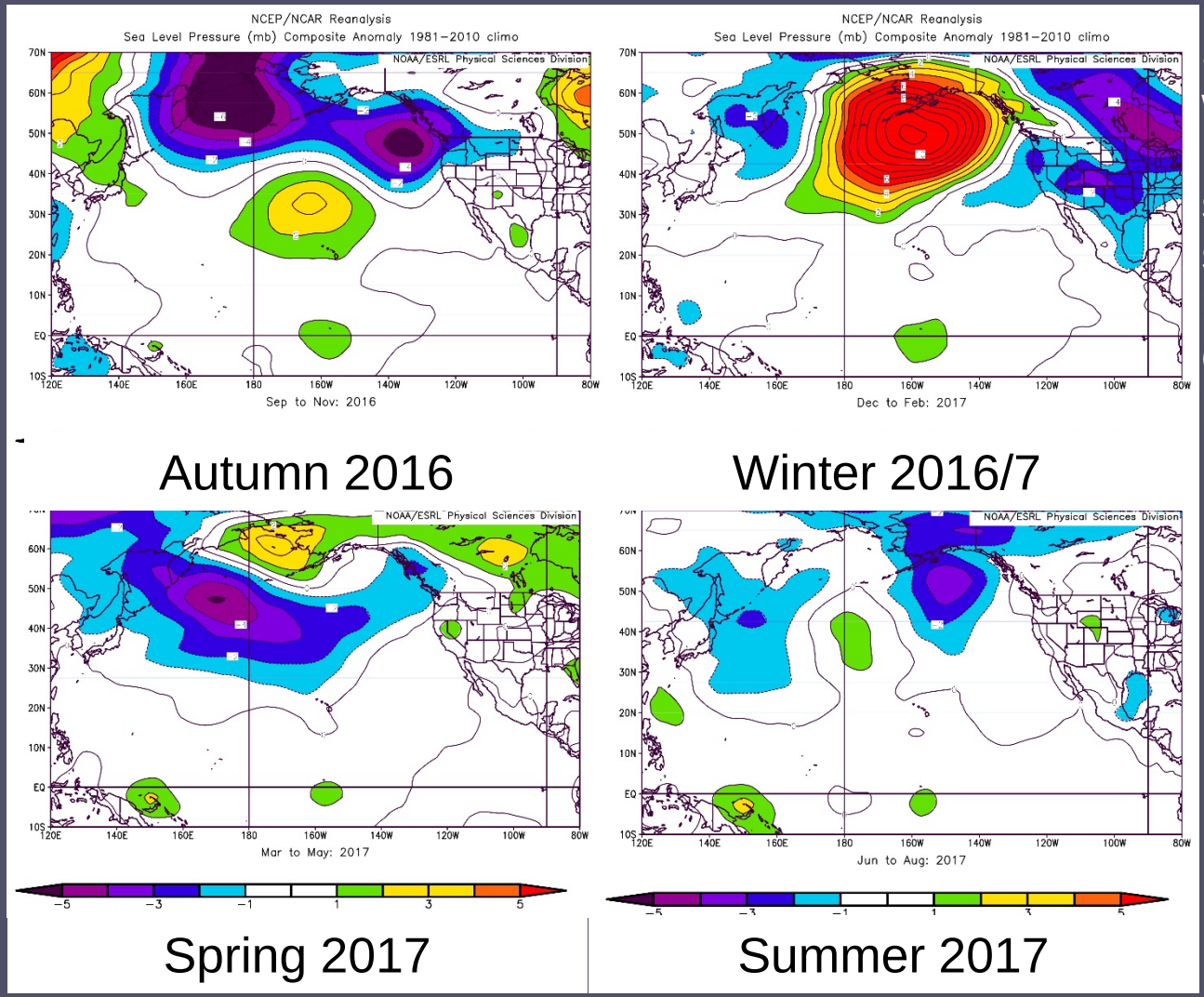
From NOAA's Optimum Interpolation SST analysis

Sea Level Pressure Anomalies

Bond

Wind anomalies from the west, enhancing cooling

Suppressed storminess in EBS, downwelling favorable winds in GOA



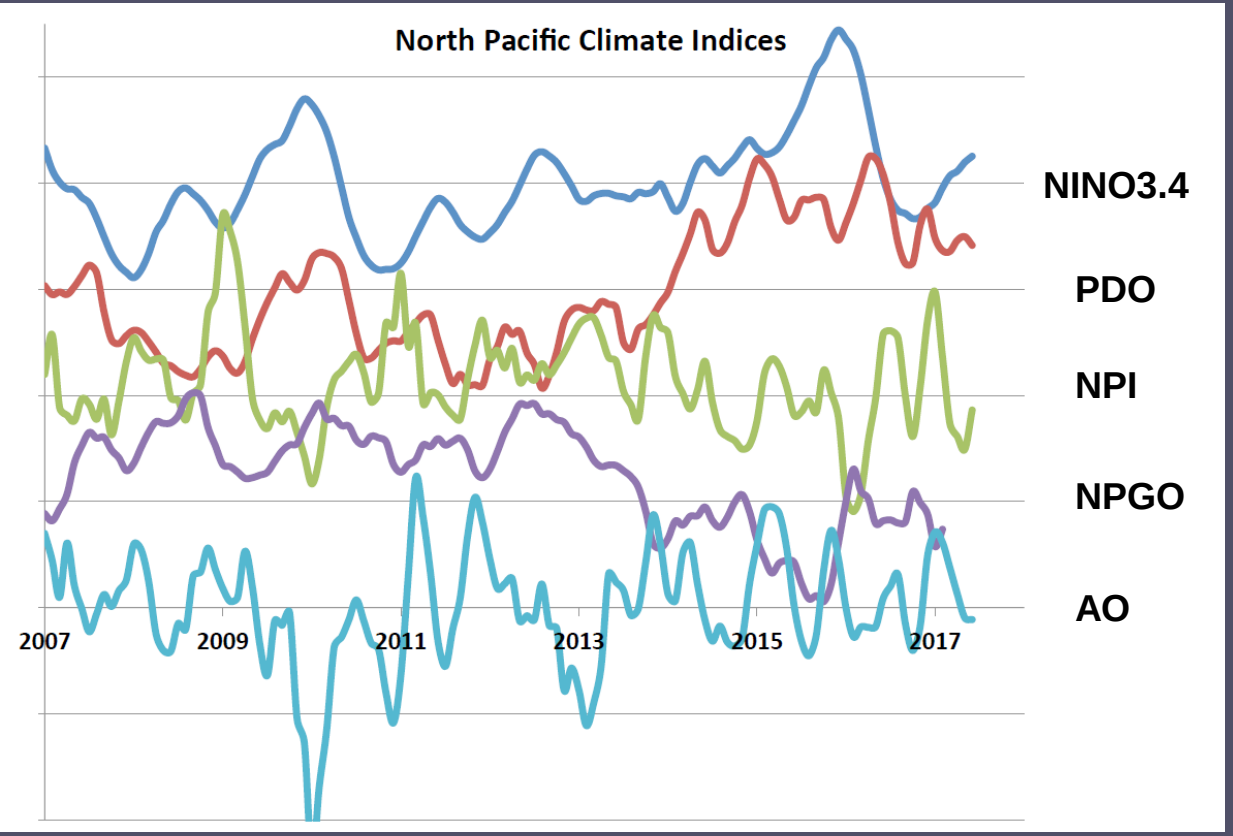
Signature of weak Aleutian Low, implies suppressed storminess, but N flow -> coldest winter in PNW

From the NCEP/NCAR Reanalysis project

Climate Indices

Bond

North Pacific atmosphere-ocean climate system moderated relative to past 2 yrs



ENSO “quiet state” compared to recent

PDO positive with lower magnitude (related to ENSO)

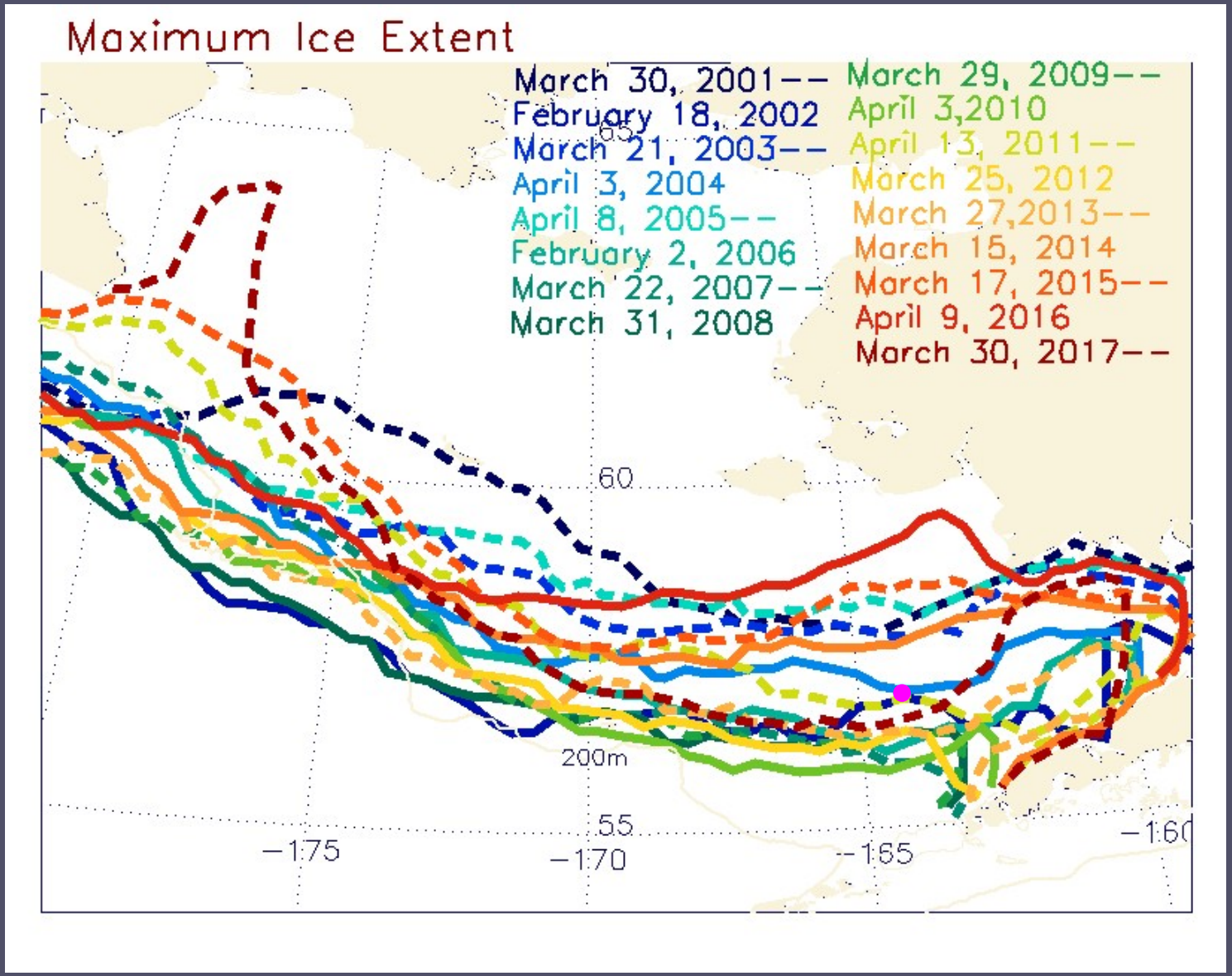
NPI implies deep Aleutian Low F/S, weak during W; surprisingly strong response to weak La Nina

NPGO relates to chemical and biological properties in GOA and CalCOFI area. Negative→ reduced flows in Alaska and CA currents

AO measures strength of polar vortex. Positive = low pressure over Arctic, high over Pacific (45^{o}). Mostly neutral recently

Maximum Extent of Ice Edge

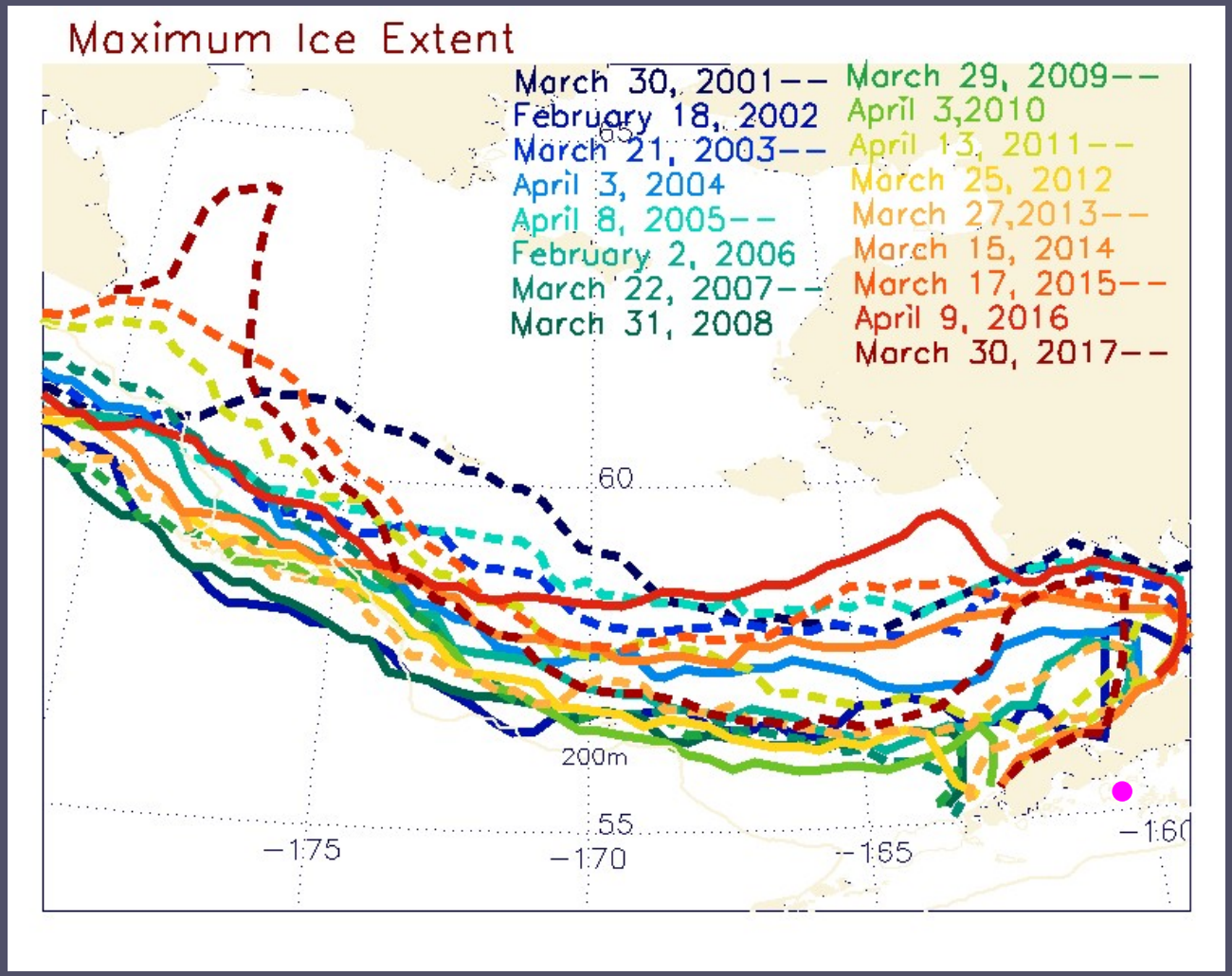
Overland



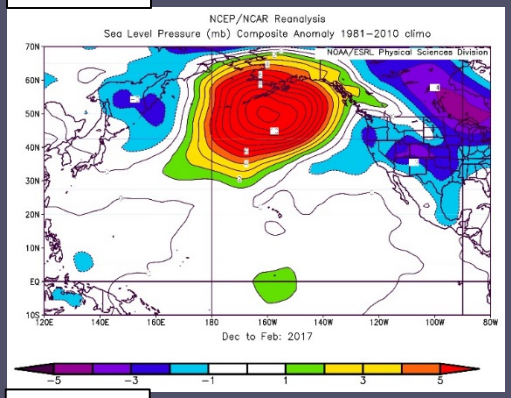
Ice reached the M2 mooring (~pink dot)

Maximum Extent of Ice Edge

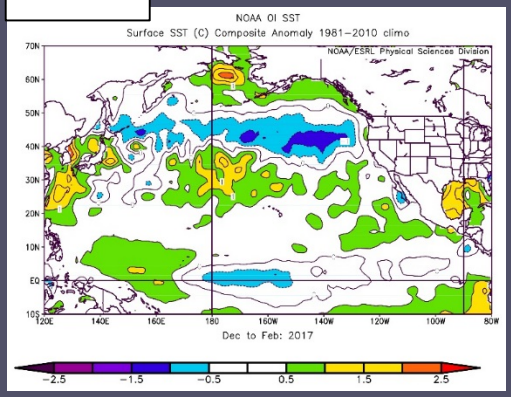
Overland



SLP



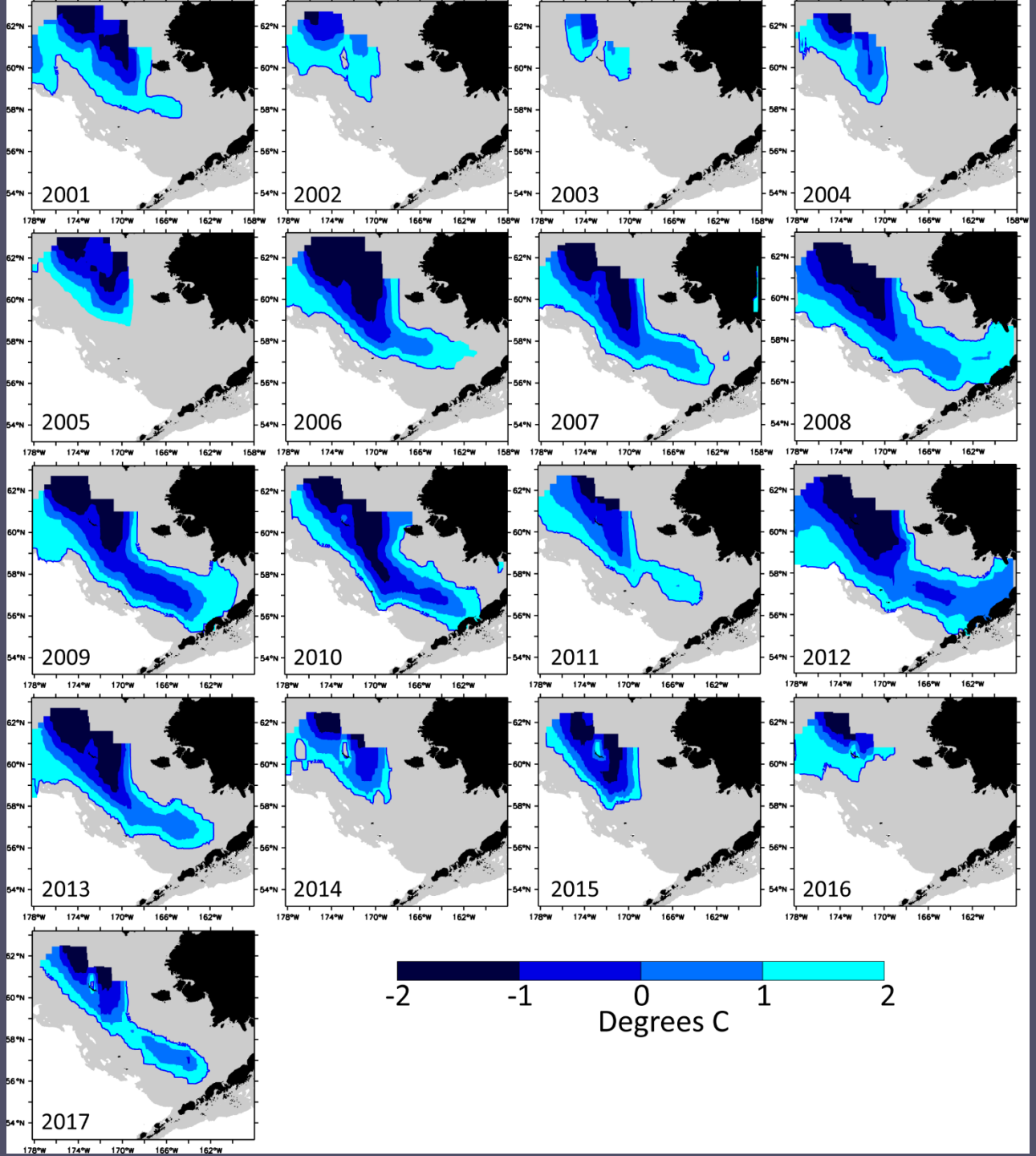
SST



Unusual lack of sea ice in NW: pre-existing warm water and winds from S

EBS Cold Pool

Overland



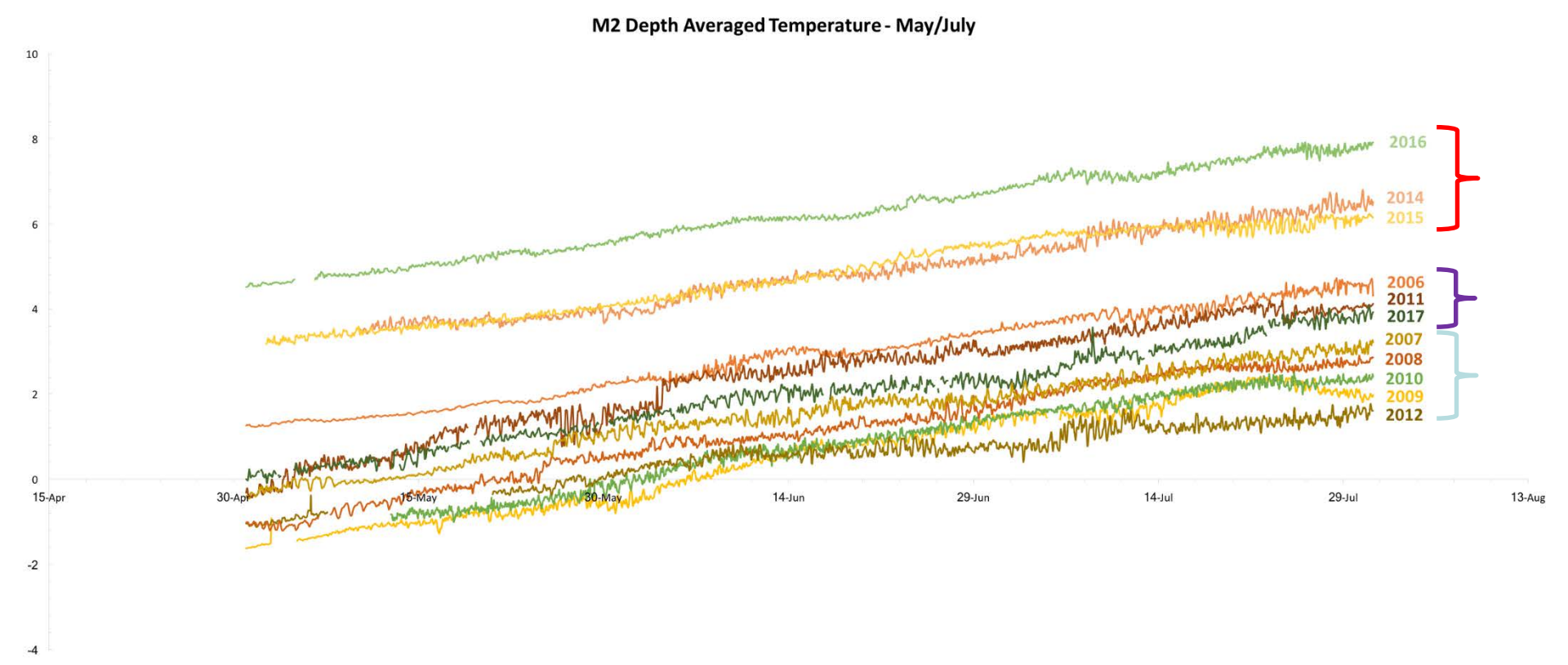
Measured during the bottom trawl survey

Larger extent than previous 3 years

Similar to 2013, with smaller overall extent

M2 Depth-averaged Temperature

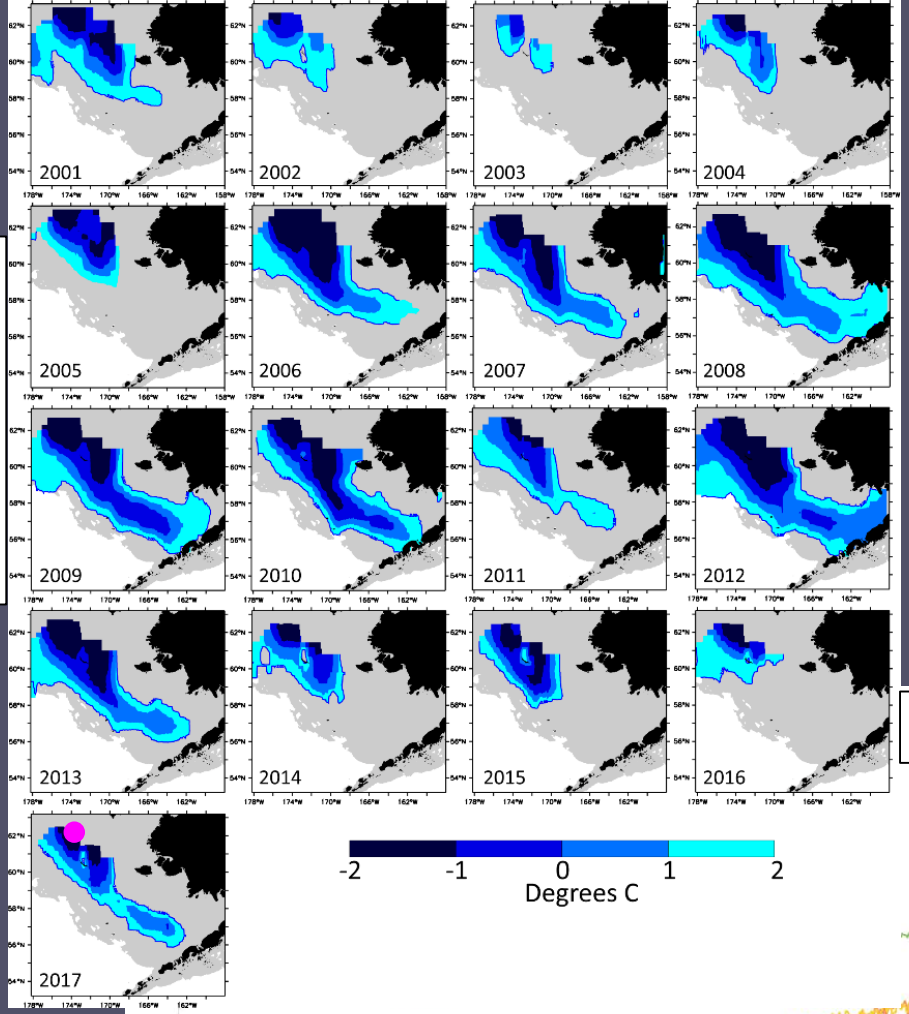
Stabeno



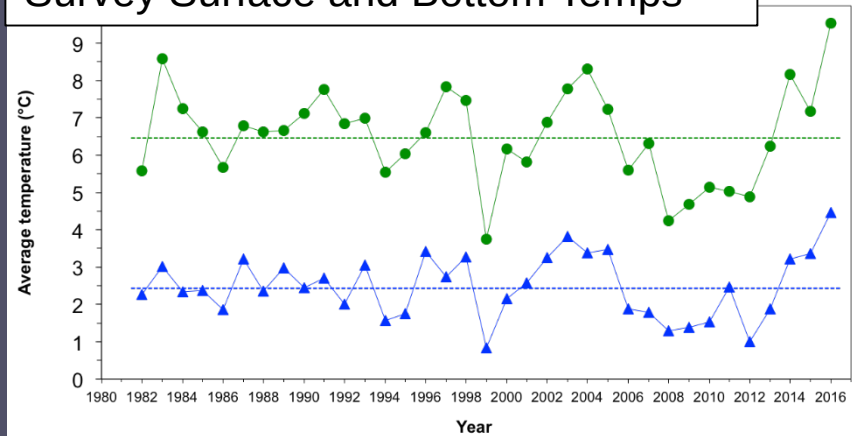
Temperature Comparisons

Stabeno, Overland, Lauth

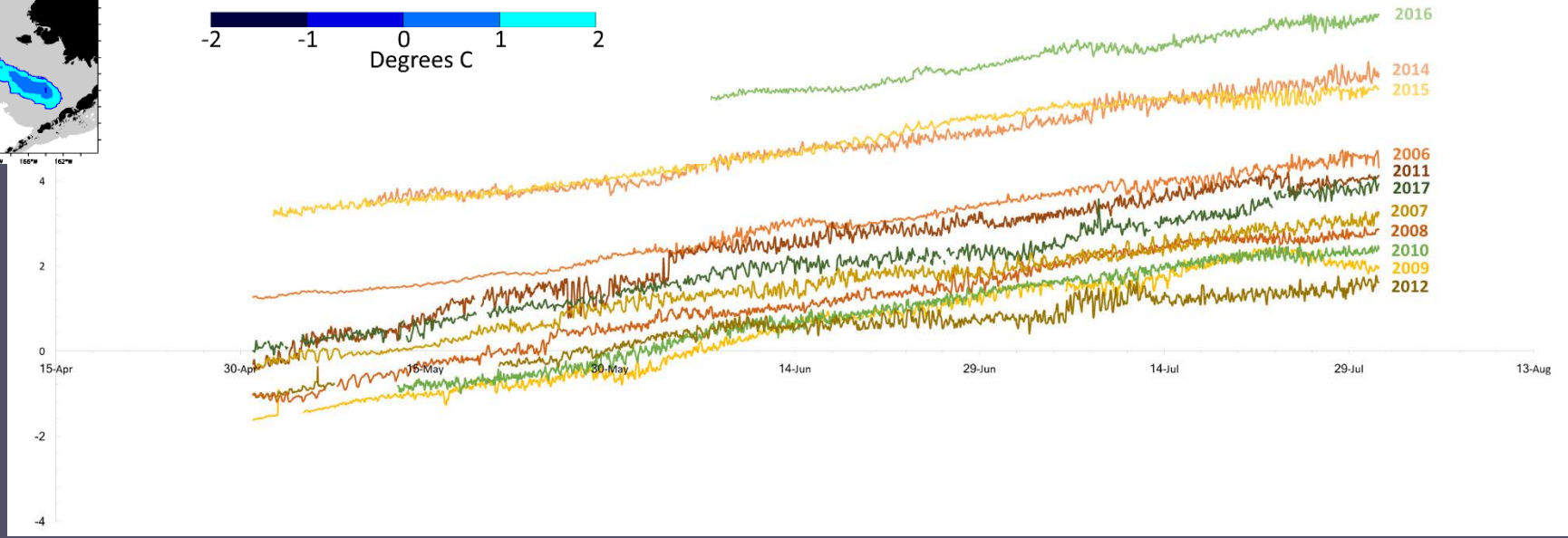
Survey Cold Pool

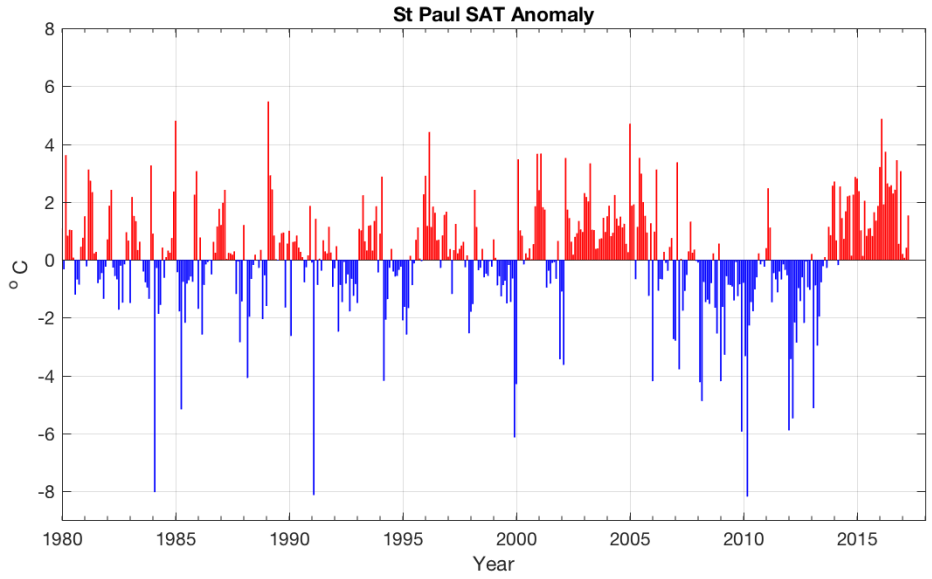


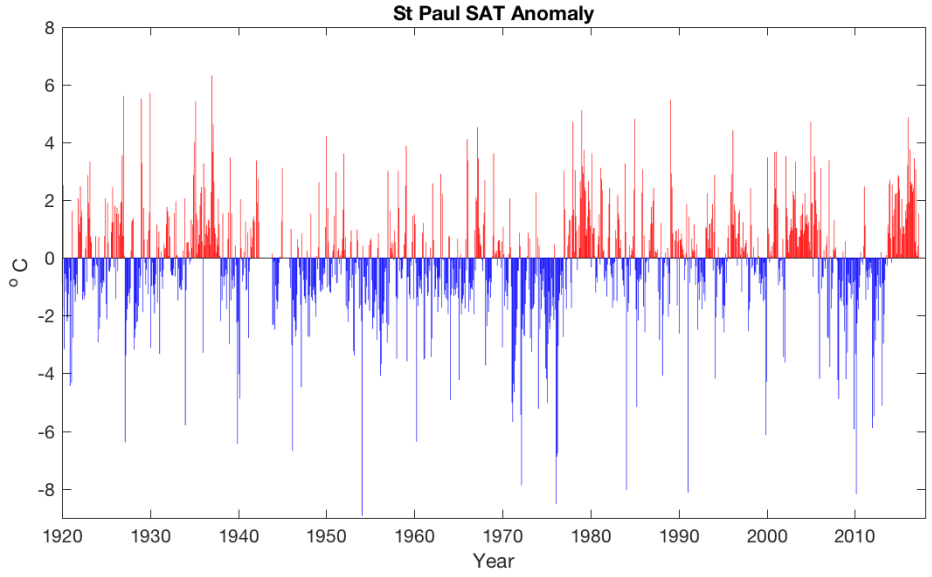
Survey Surface and Bottom Temps



Depth-averaged at M2, May-July







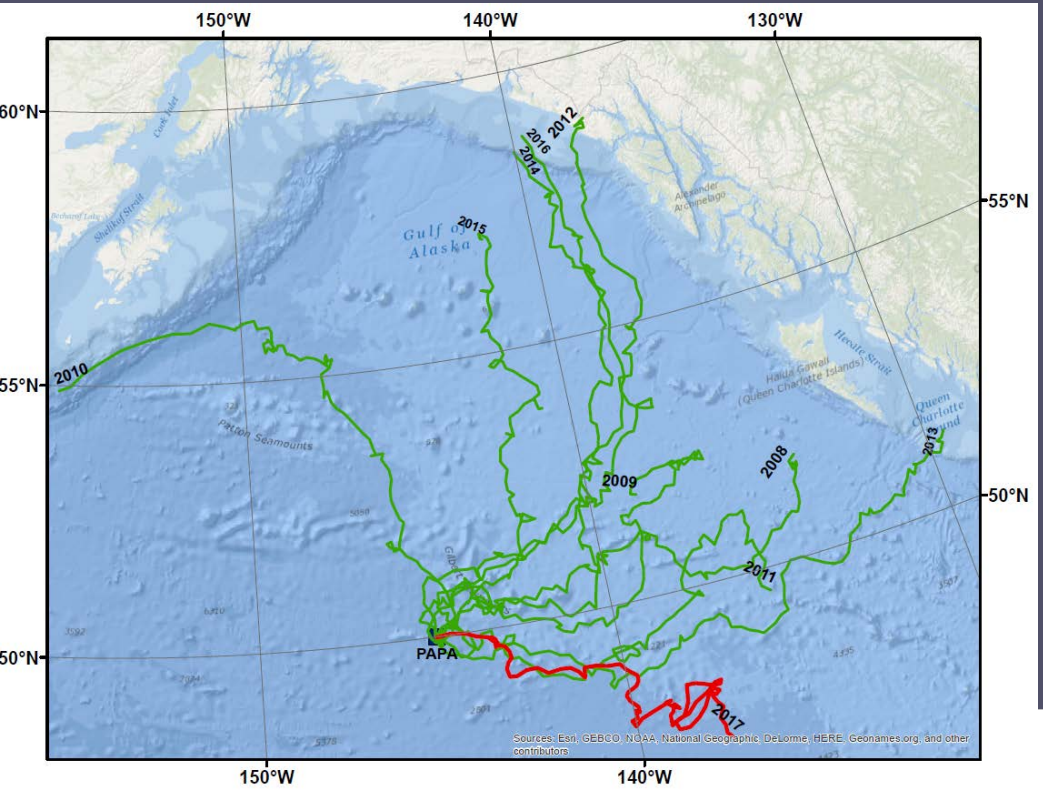
Surface Air Temperatures on St Paul

Overland

Persistent anomalously warm air temperatures since 2013

GOA Ocean Surface Currents – PAPA Trajectory Index

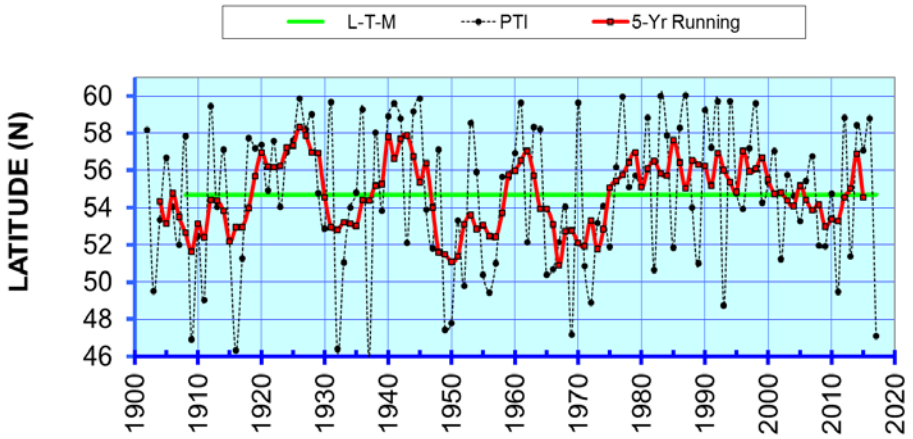
Stockhausen



- Simulated surface drifter released from Ocean Station PAPA Dec 1 for 90 days
- 2014-2016 trajectories similar (S wind anomalies -> “Blob”)
- Strong northerly winds pushed drifter farthest south since 1930s

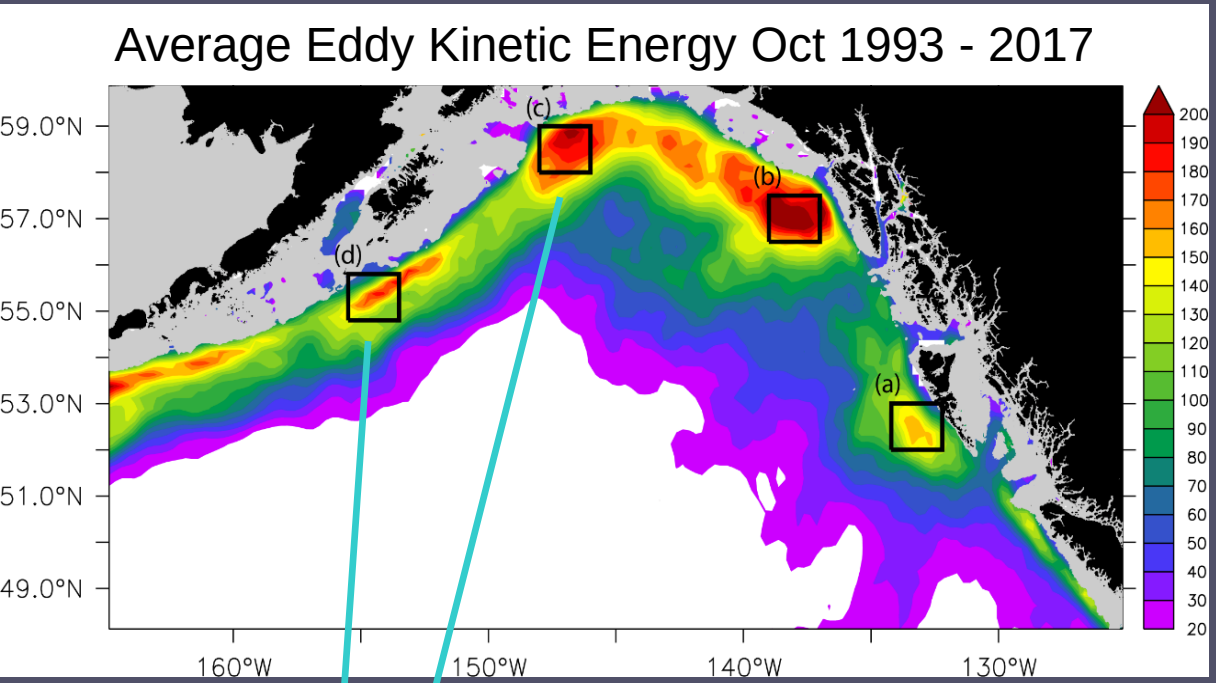
- Big change from past 3 years
- Recent period of mostly southerly flow is shortest in time-series
- PTI currently at mean

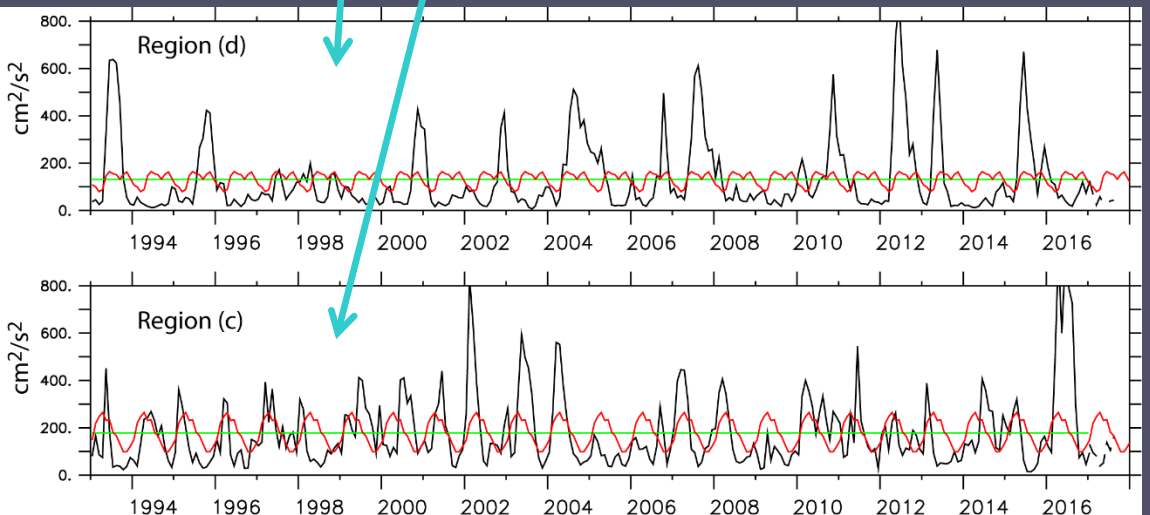
Papa Trajectory Index (PTI) End-point Latitudes (Winters 1902-2017)



Eddies in the Gulf of Alaska

Ladd





Seasonal cycles:

(c) High EKE in spring

(d) High EKE in fall

(c) → Strong persistent eddy in 2016, currently weak

(d)→ Also currently weak, after recent strong ones in 2012, 2013, 2015

E GOA: influenced by winds (climate and gap scale)

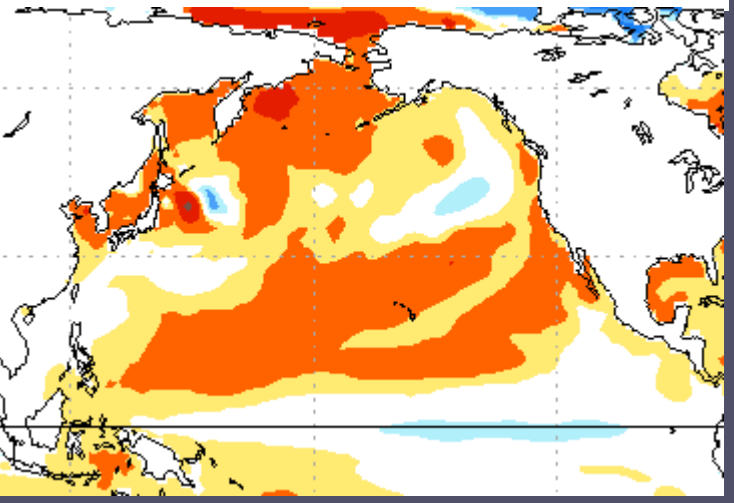
W GOA: influenced by propagation and intrinsic variability

2018 Sea Surface Temperature Forecasts

Seasonal Projections from the National Multi-Model Ensemble (NMME)

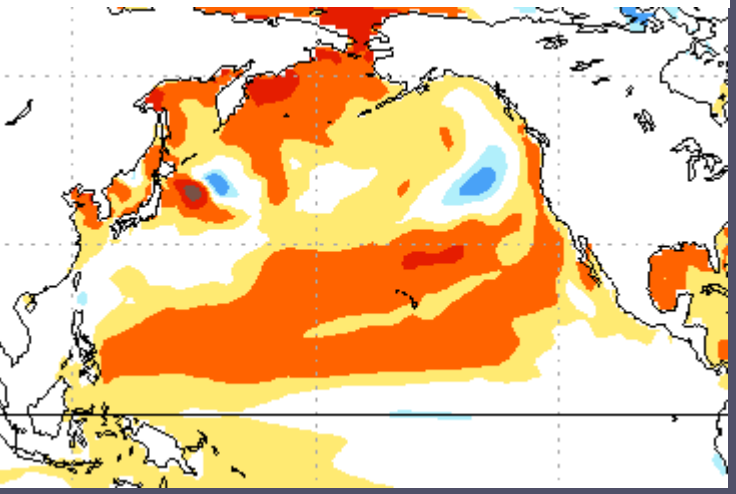
Bond

2017 Oct-Nov-Dec



- SST projections
- NMME is average of 8 models
- Continuation of warm, with slight cooling in EBS and GOA
- Strongest positive anomalies in WBS
- 55-60% chance of neutral ENSO, with weak PDO temp pattern

2018 Dec-Jan-Feb



2018 Jan-Feb-Mar