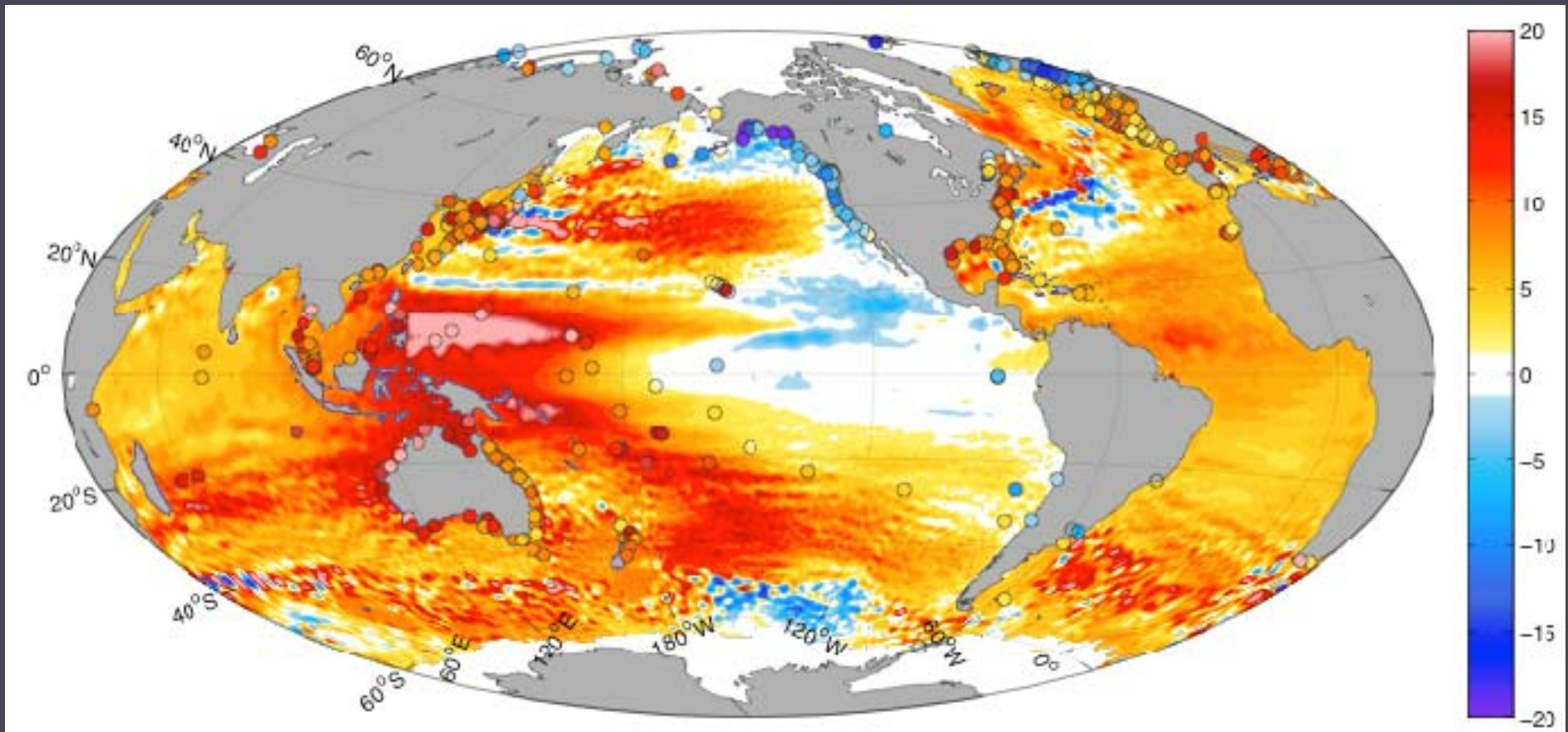


# Sea Surface Temperature impact on the Sea Level Changes Over North Pacific

Xichen Li; Jiang Zhu; Shang-Ping Xier; Shan Li  
Institute of Atmospheric Physics

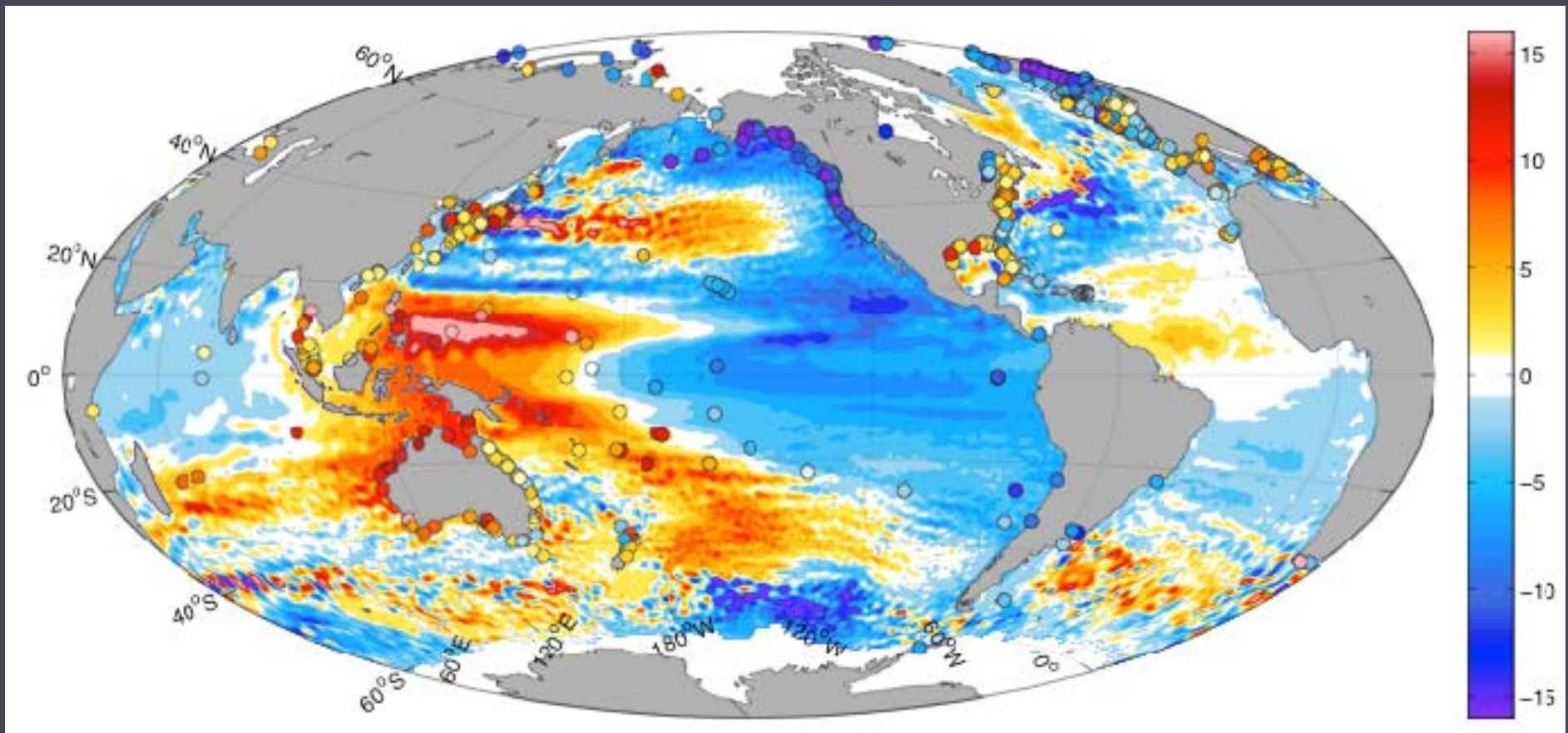
## Observed Changes in Sea Surface Height



- *Observed Changes in Satellites (TOPEX / Jason 1 / Jason2) and Coastal Stations*

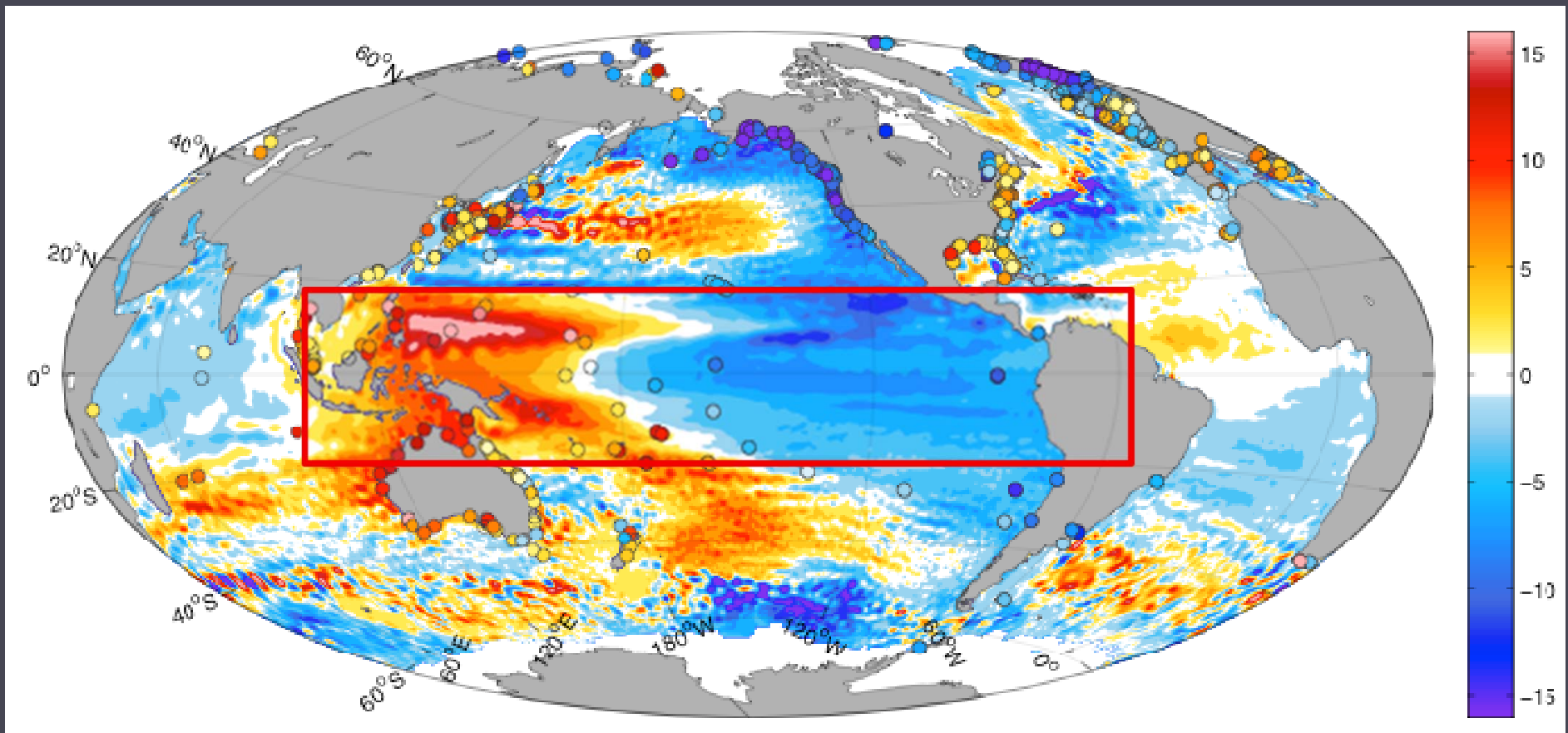
► SST drives SLA over North Pacific

## Regional Sea Level Changes after Removing the Global Mean



▶ SST drives SLA over North Pacific

## Regional Sea Level Changes after Removing the Global Mean



## Recent Climate Changes over Antarctica

Sea Surface Temperature



Surface Wind



Sea Surface Height

## Recent Climate Changes over Antarctica

Sea Surface Temperature

Surface Wind

Sea Surface Height

Sea Surface Temperature

## Recent Climate Changes over Antarctica

Sea Surface Temperature

Surface Wind

Sea Surface Height

Sea Surface Temperature

# Questions

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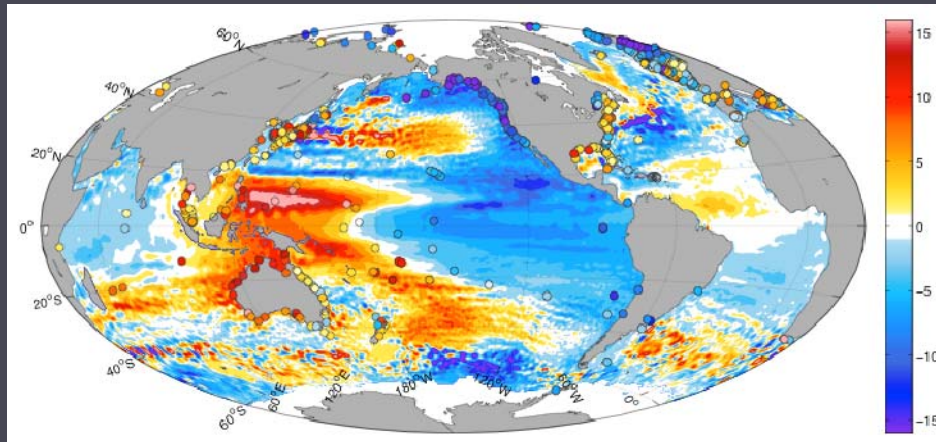
- ▶ Whether SST induced Surface Wind Changes can Drive the Observed Sea Level Changes?
- ▶ Whether Inter-basin Teleconnections can Trigger These Changes?



# Observed Changes in Sea Level, SST, and Atmospheric Circulations

## SLA SST and Surface Atmospheric Circulation Changes

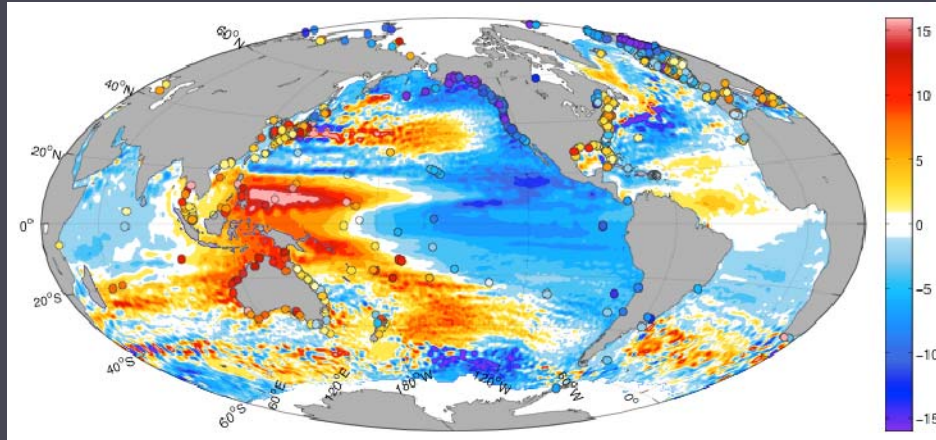
SLA



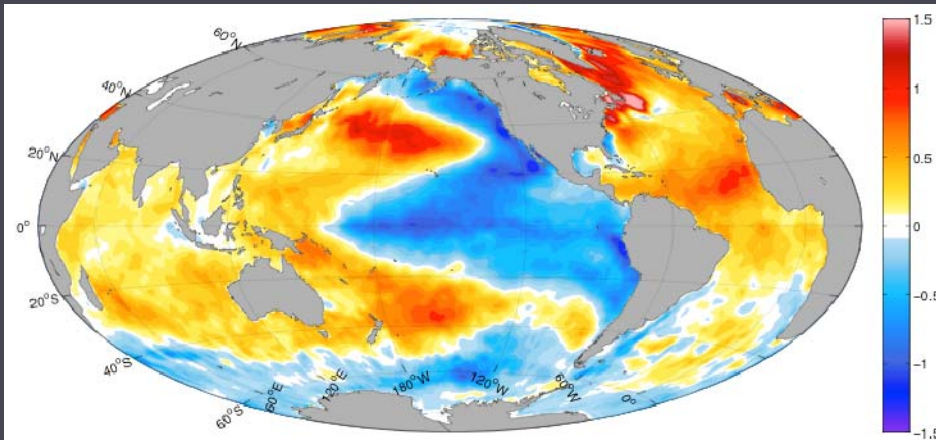
▶ SST drives SLA over North Pacific

# SLA SST and Surface Atmospheric Circulation Changes

SLA



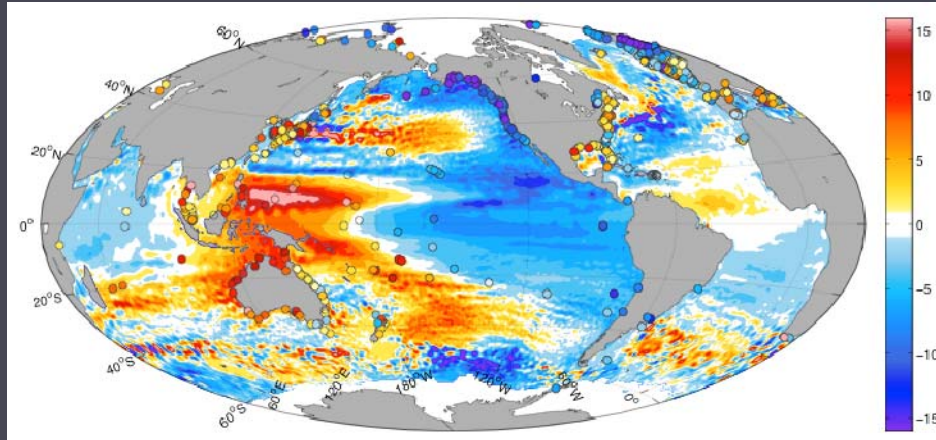
SST



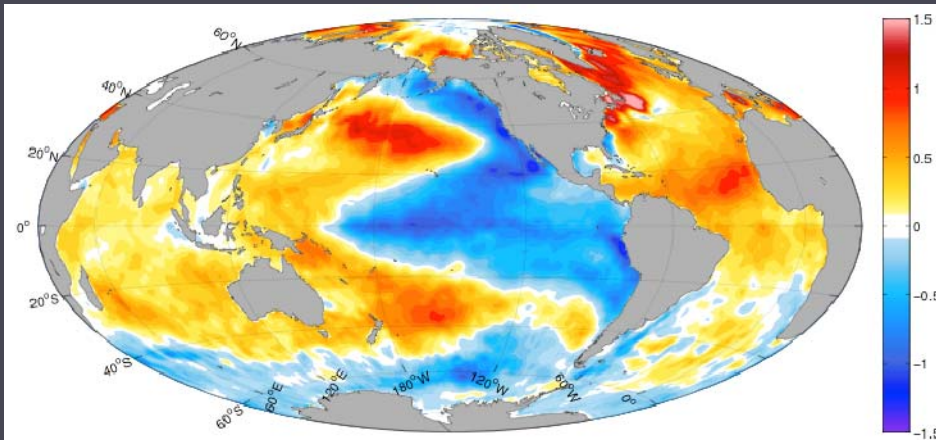
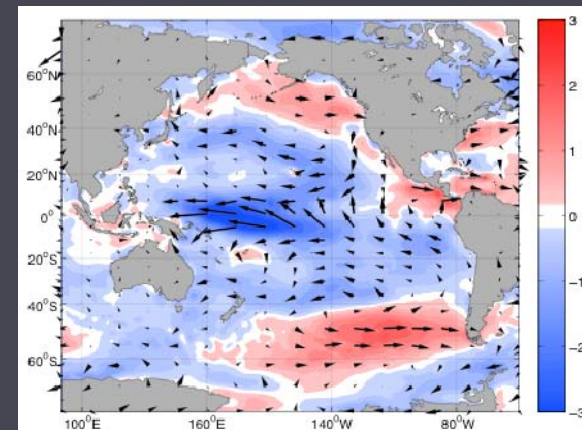
▶ SST drives SLA over North Pacific

# Observed SLA SST and Surface Atmospheric Circulation Changes

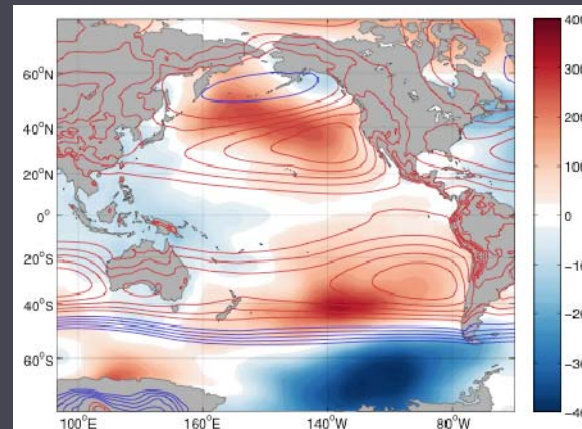
SLA



SST

Surface  
Wind

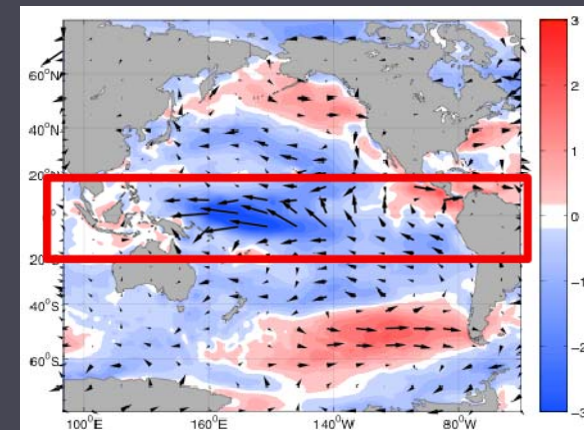
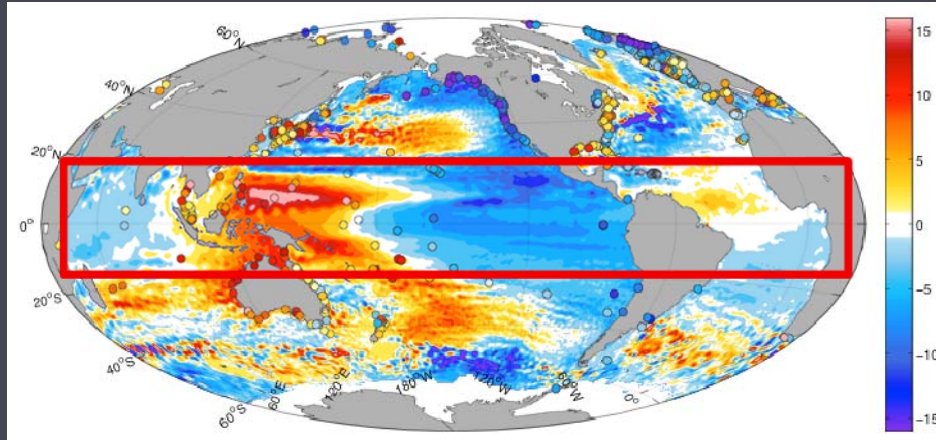
SLP



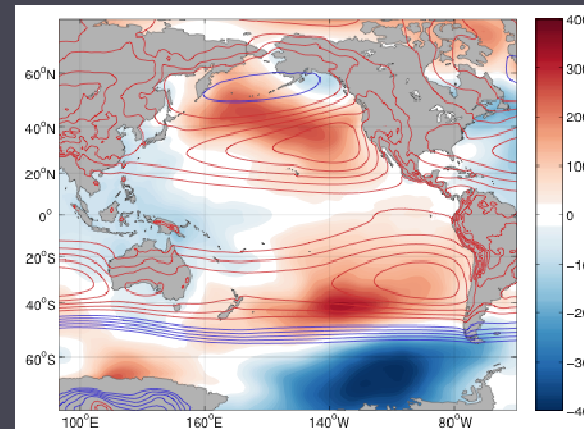
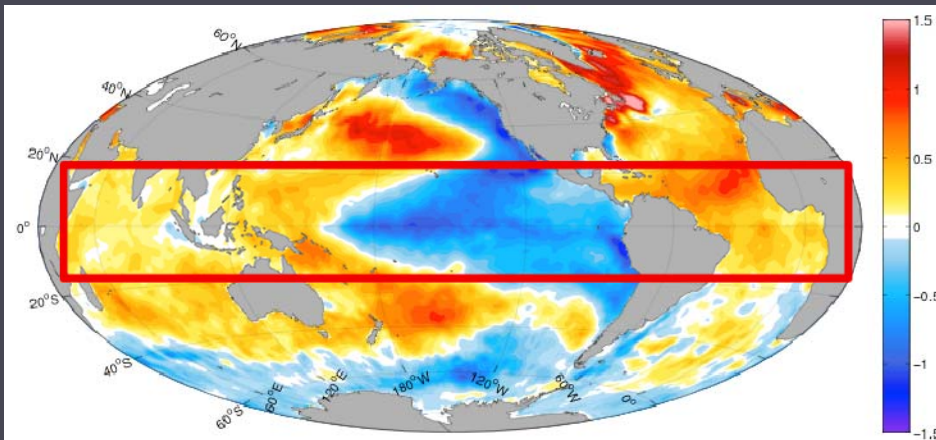
▶ SST drives SLA over North Pacific

## Observed SLA SST and Surface Atmospheric Circulation Changes

SLA

Surface  
Wind

SST



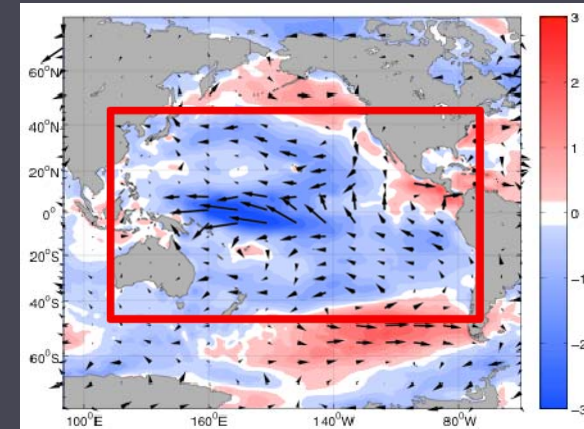
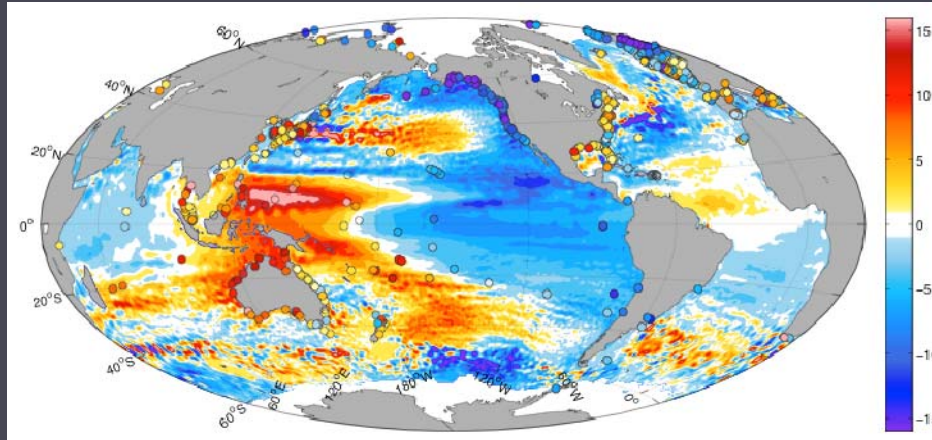
SLP

England et al, 2014; McGregor et al, 2014; Li et al, 2016;

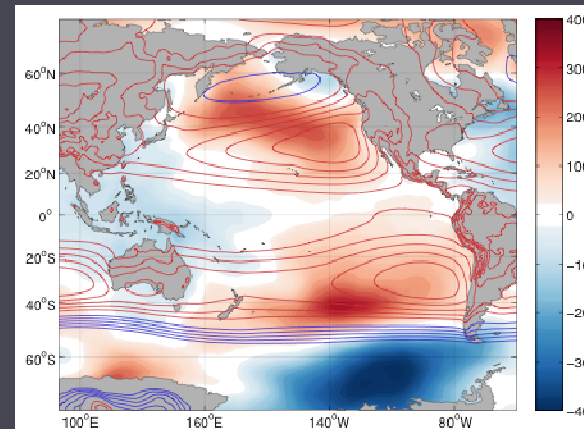
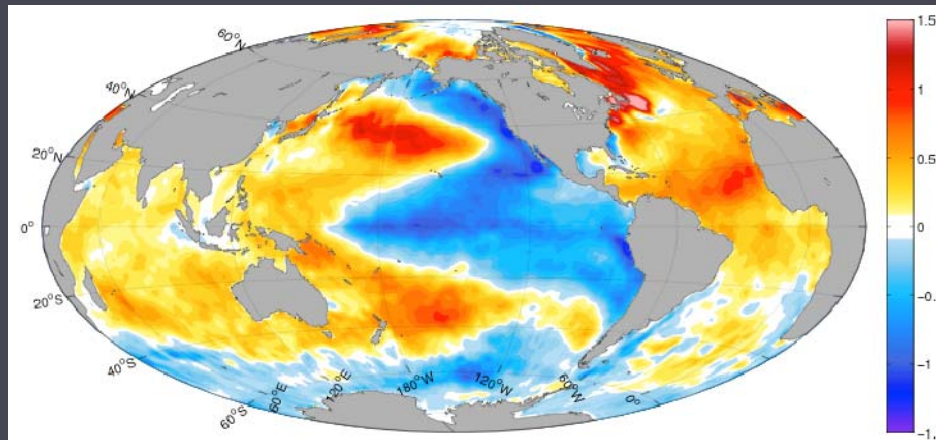
▶ SST drives SLA over North Pacific

# Observed SLA SST and Surface Atmospheric Circulation Changes

SLA

Surface  
Wind

SST

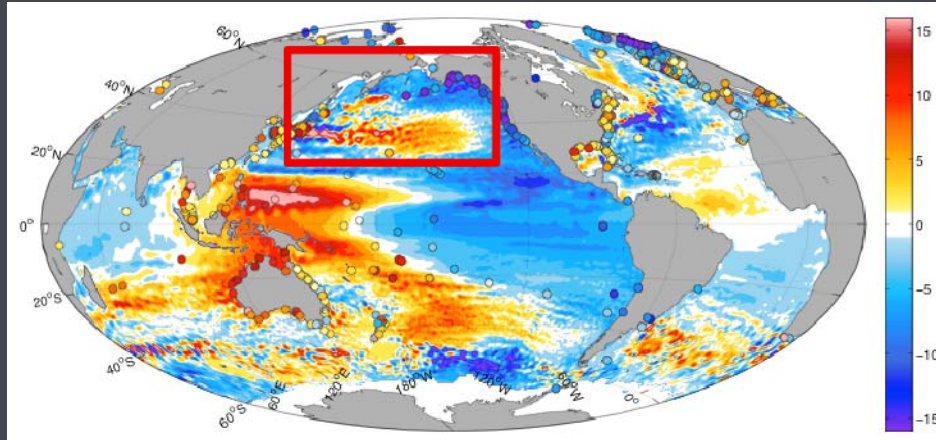


SLP

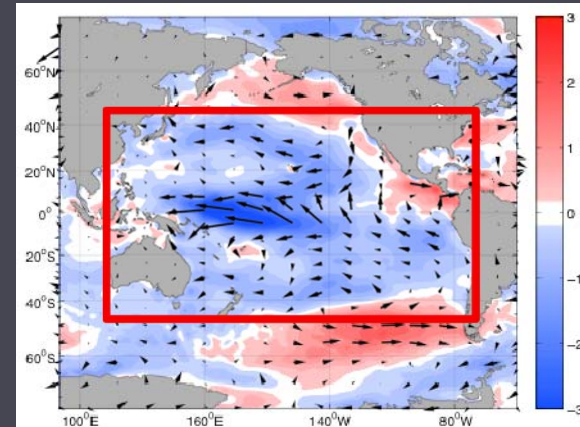
▶ SST drives SLA over North Pacific

## Observed SLA SST and Surface Atmospheric Circulation Changes

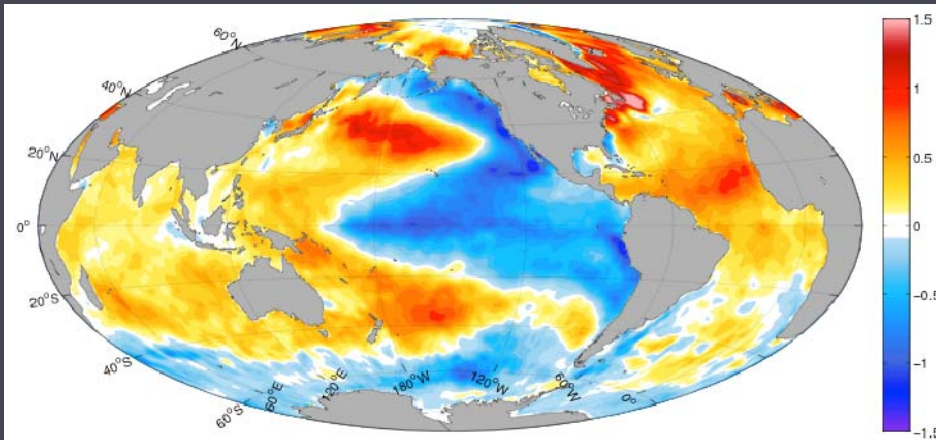
SLA



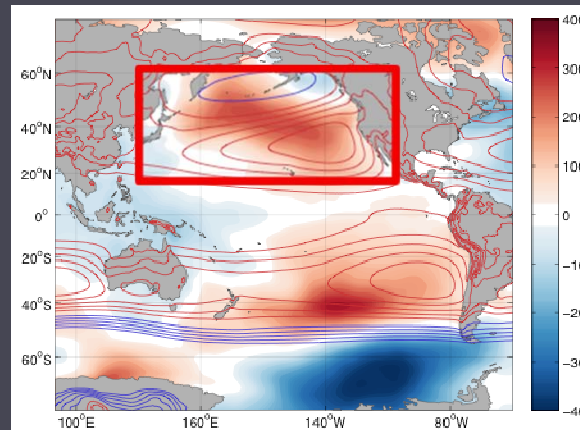
Surface Wind



SST



SLP



Zhang et al, 2006; Yu et al, 2016

▶ SST drives SLA over North Pacific

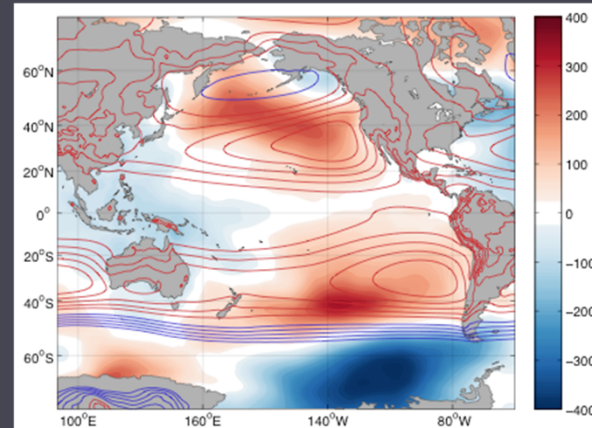
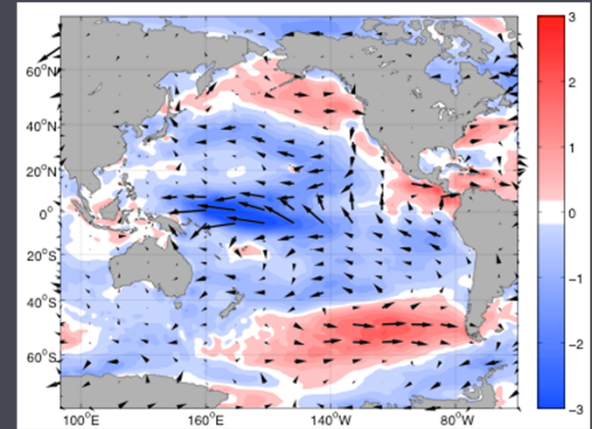


# Ocean Model Simulations Forced by Surface Wind Changes



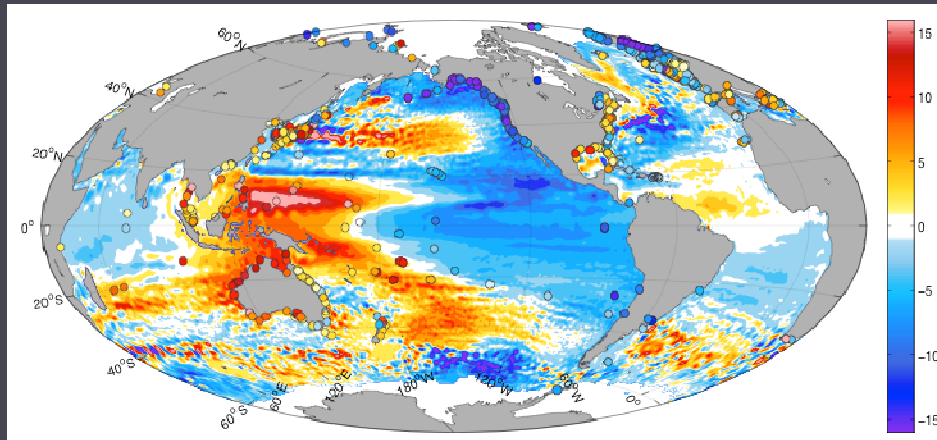
## Observed Changes .VS. Ocean Model Simulations

*Using Observed Atmospheric Forcing  
to Drive the Ocean Model (POP)*

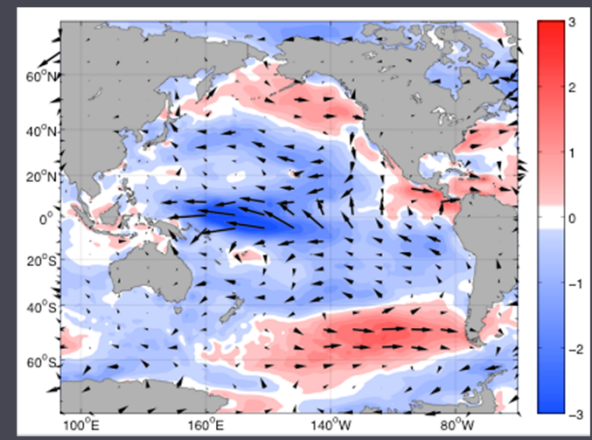
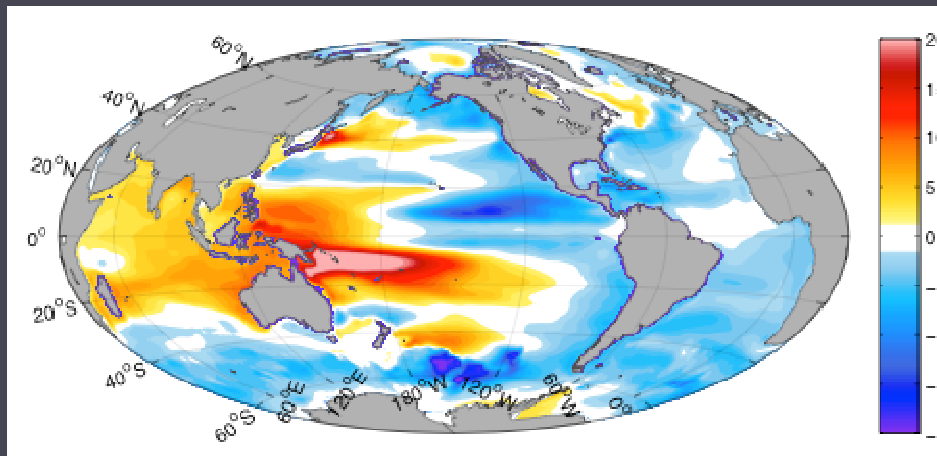


# Observed Changes .VS. Ocean Model Simulations

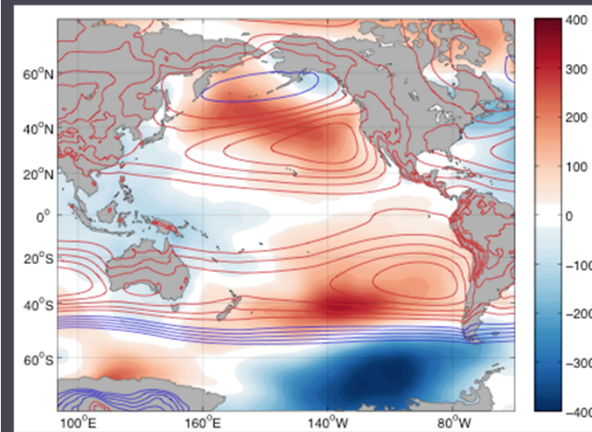
Observed  
Changes  
In SLA



Ocean  
Model  
Results  
In SLA



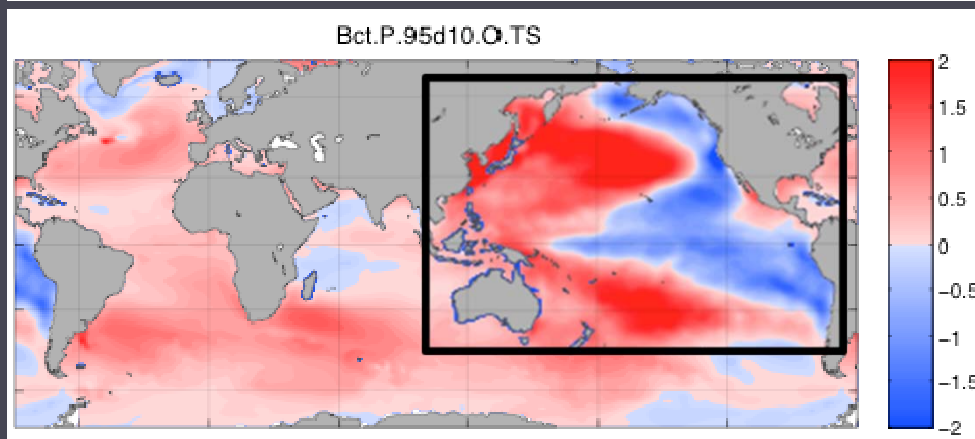
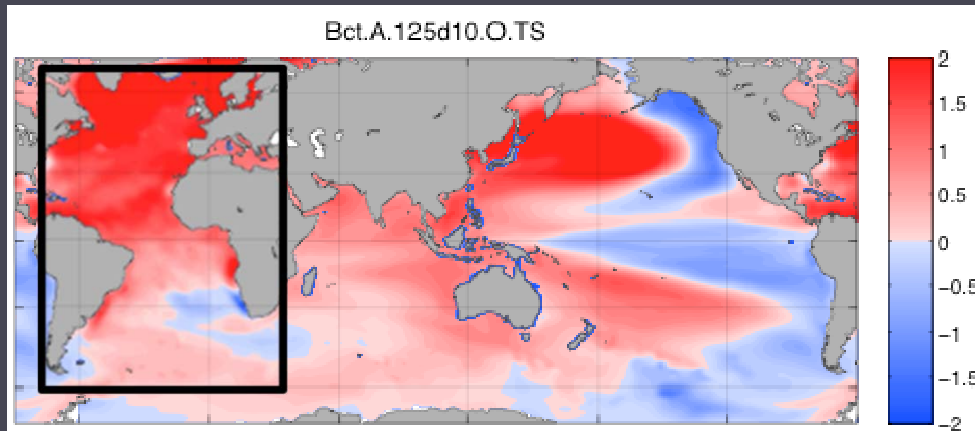
Atmos  
Forcing



▶ SST drives SLA over North Pacific

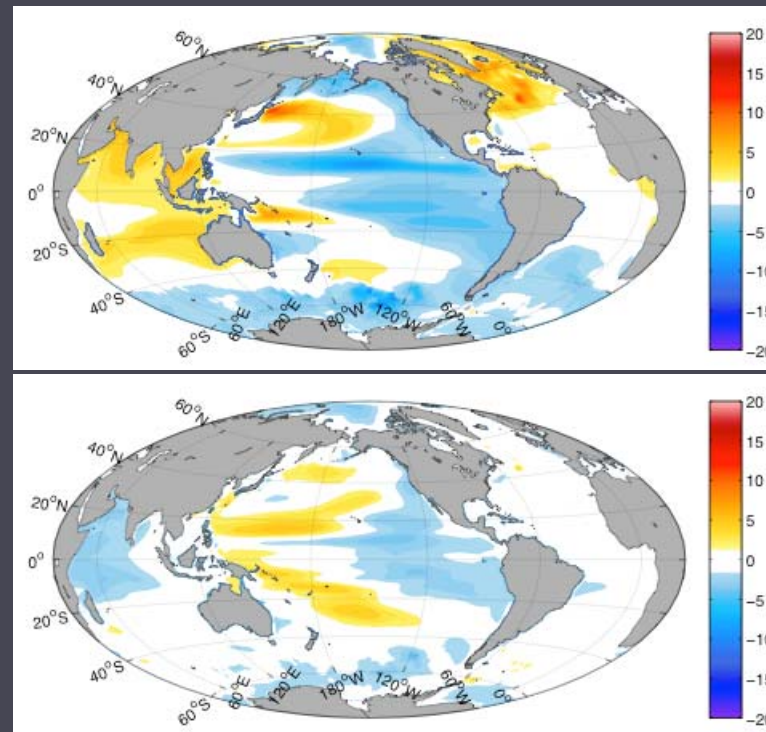
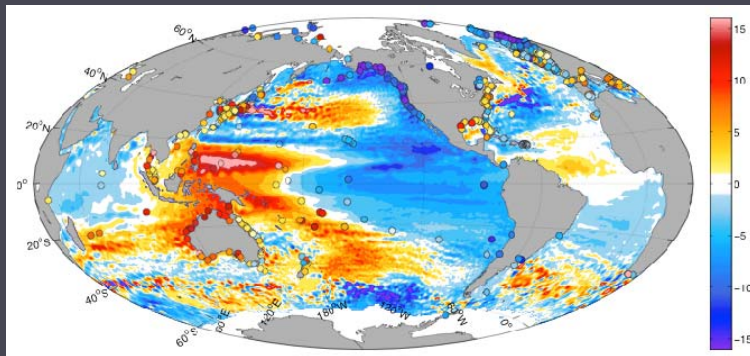
# Coupled Model SST Restoring Simulation and Atmospheric Simulation Results

## Restoring the SST over Atlantic and Pacific in CESM system



## Sea Level Response in Coupled Simulations

### Observed Changes



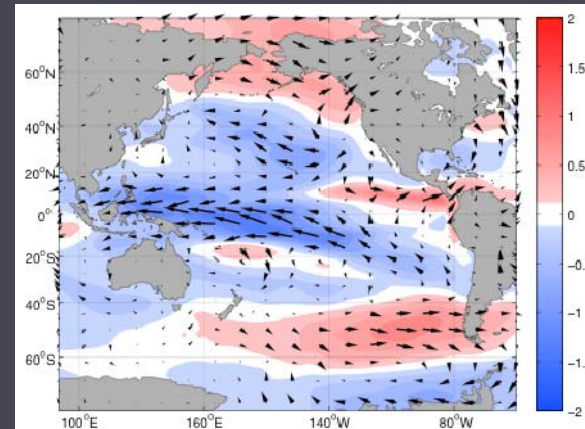
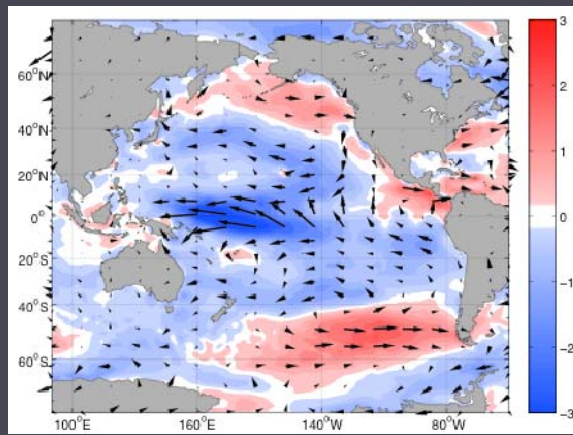
*Atlantic  
Forcing*

*Pacific  
Forcing*

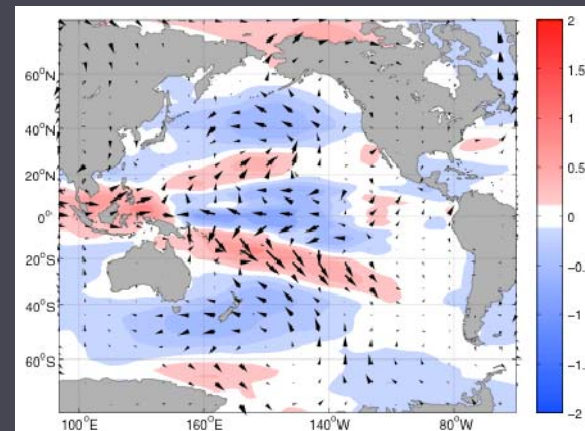
▶ SST drives SLA over North Pacific

# Surface Wind Responses in Coupled Simulations

*Observed  
Changes*



*Atlantic  
Forcing*



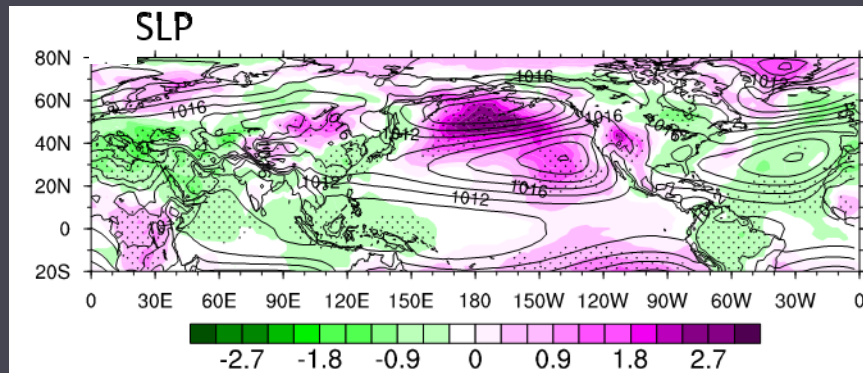
*Pacific  
Forcing*

- K

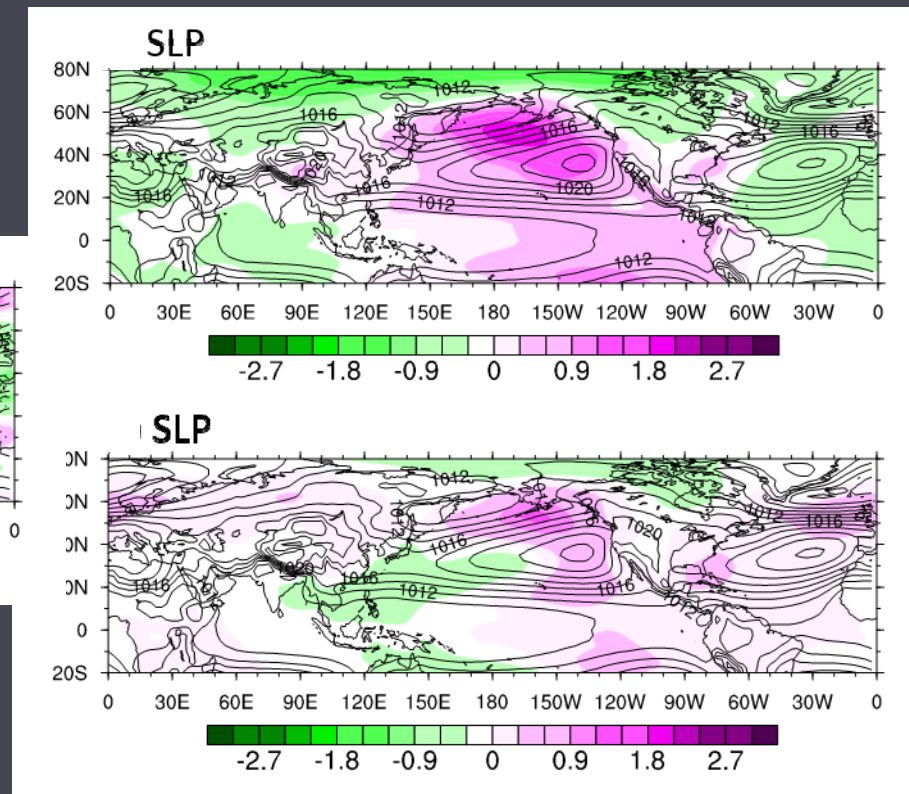
▶ SST drives SLA over North Pacific

# Surface Wind Responses in Coupled Simulations

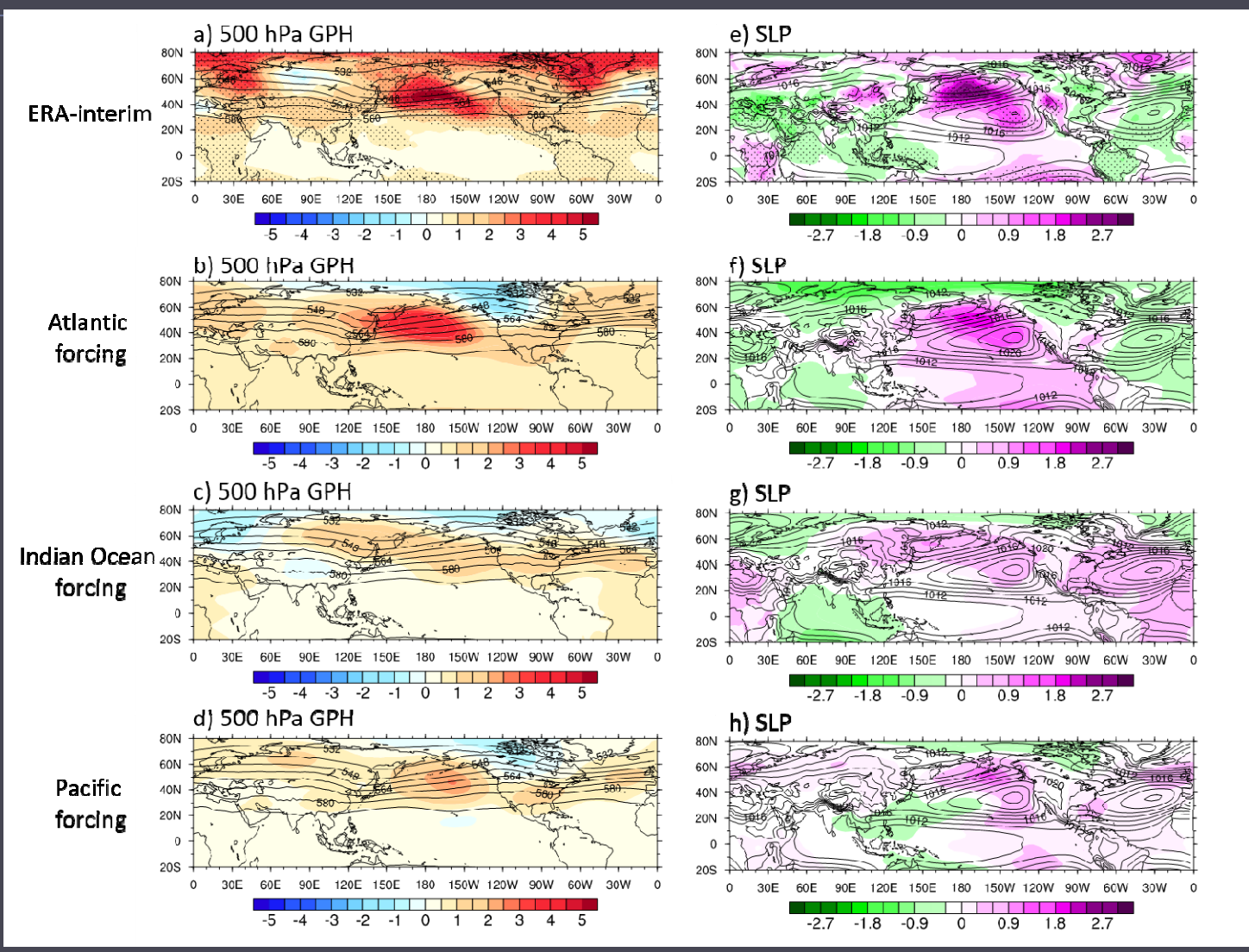
## Observed Changes



## Atlantic Forcing



## Pacific Forcing

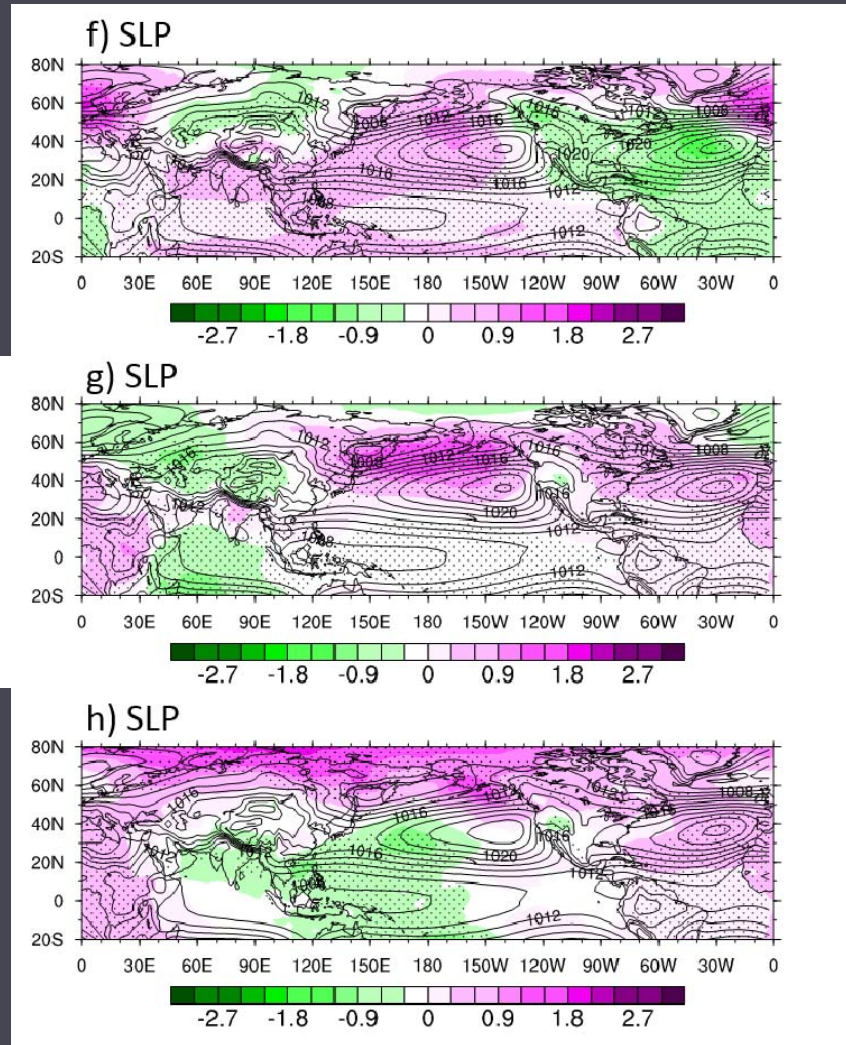
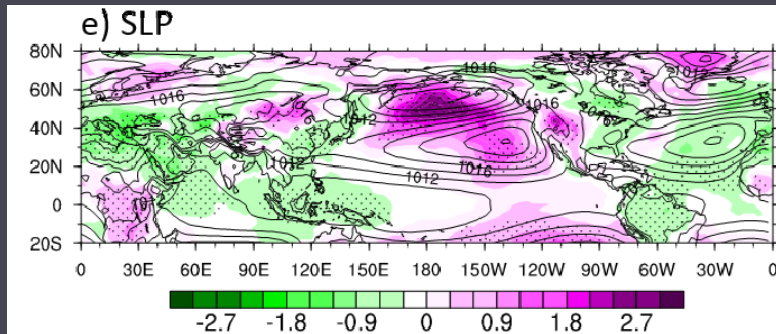


▶ SST drives SLA over North Pacific



# Surface Wind Responses in Atmospheric Simulations

*Observed Changes*



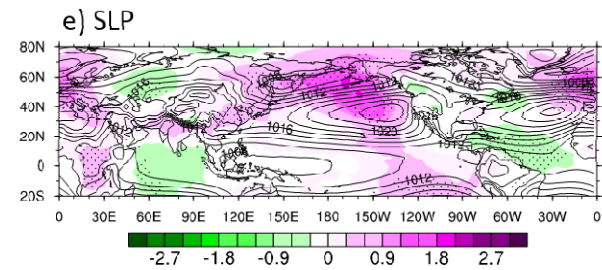
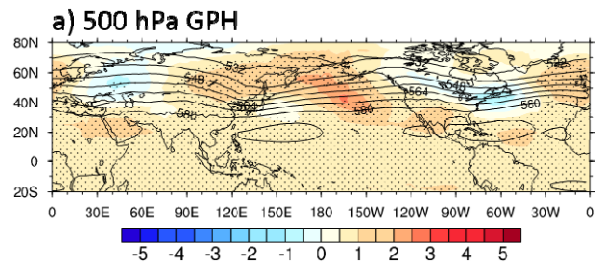
*Atlantic Forcing*

*Indian Ocean Forcing*

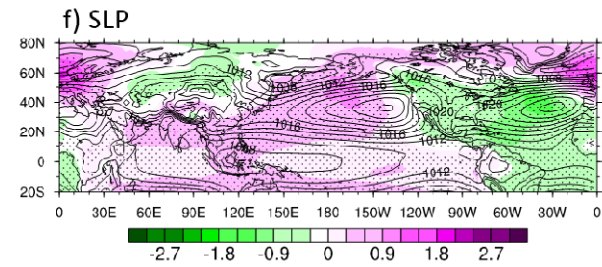
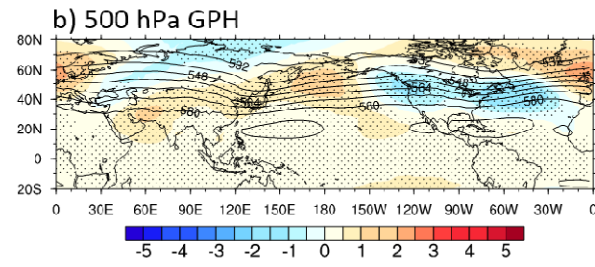
*Pacific Forcing*

▶ SST drives SLA over North Pacific

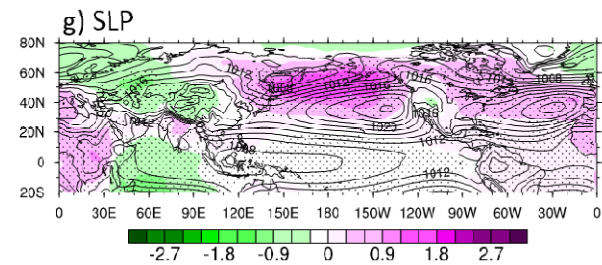
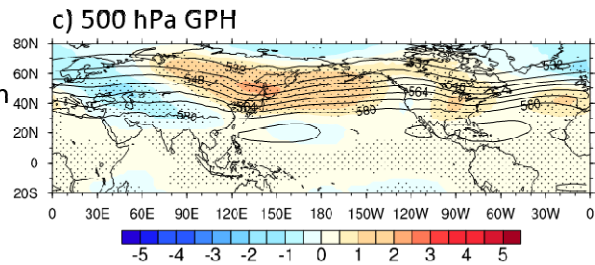
Tropical Ocean forcing



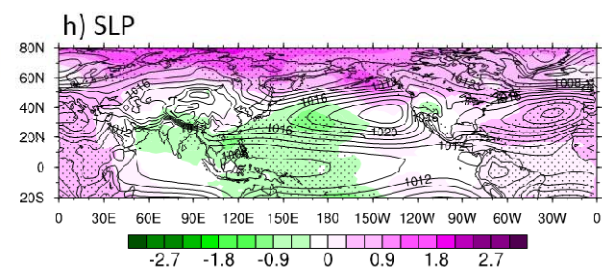
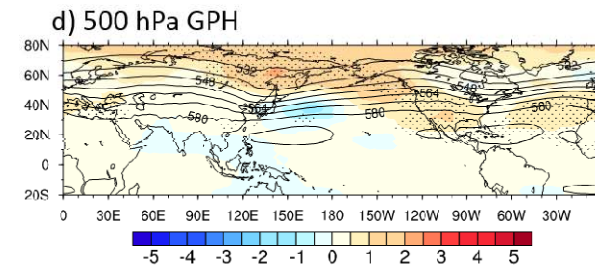
Atlantic forcing



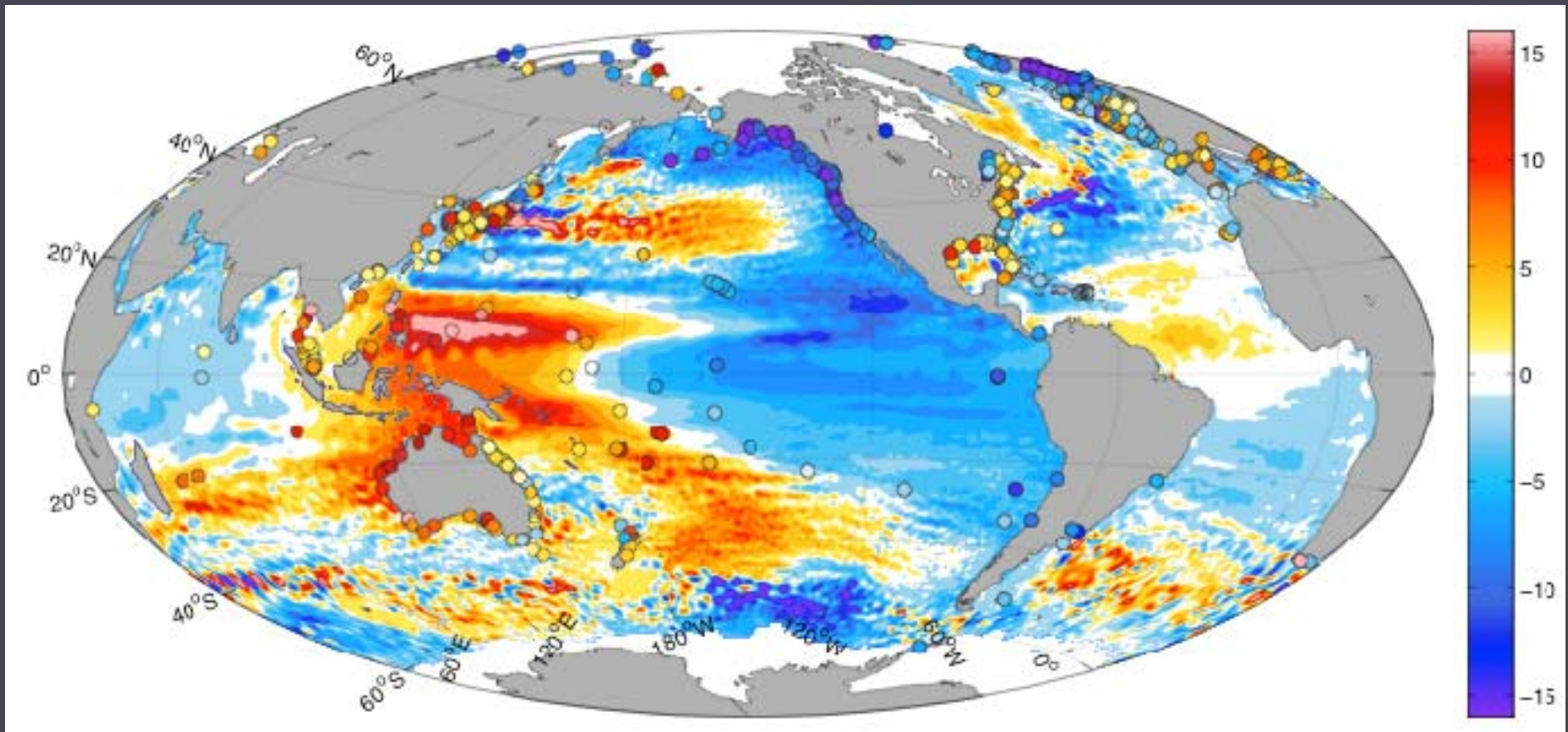
Indian Ocean forcing



Pacific forcing

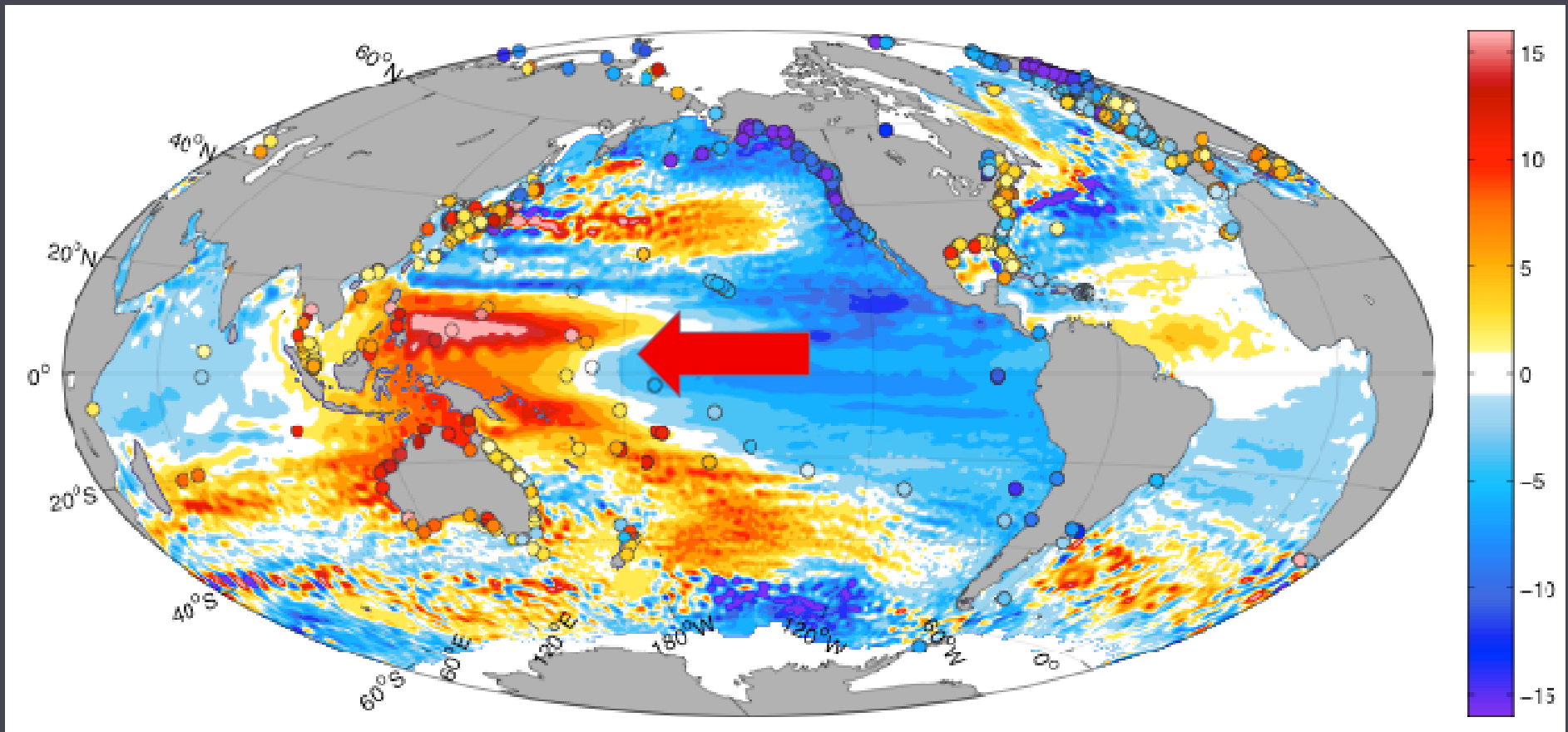


## Summary



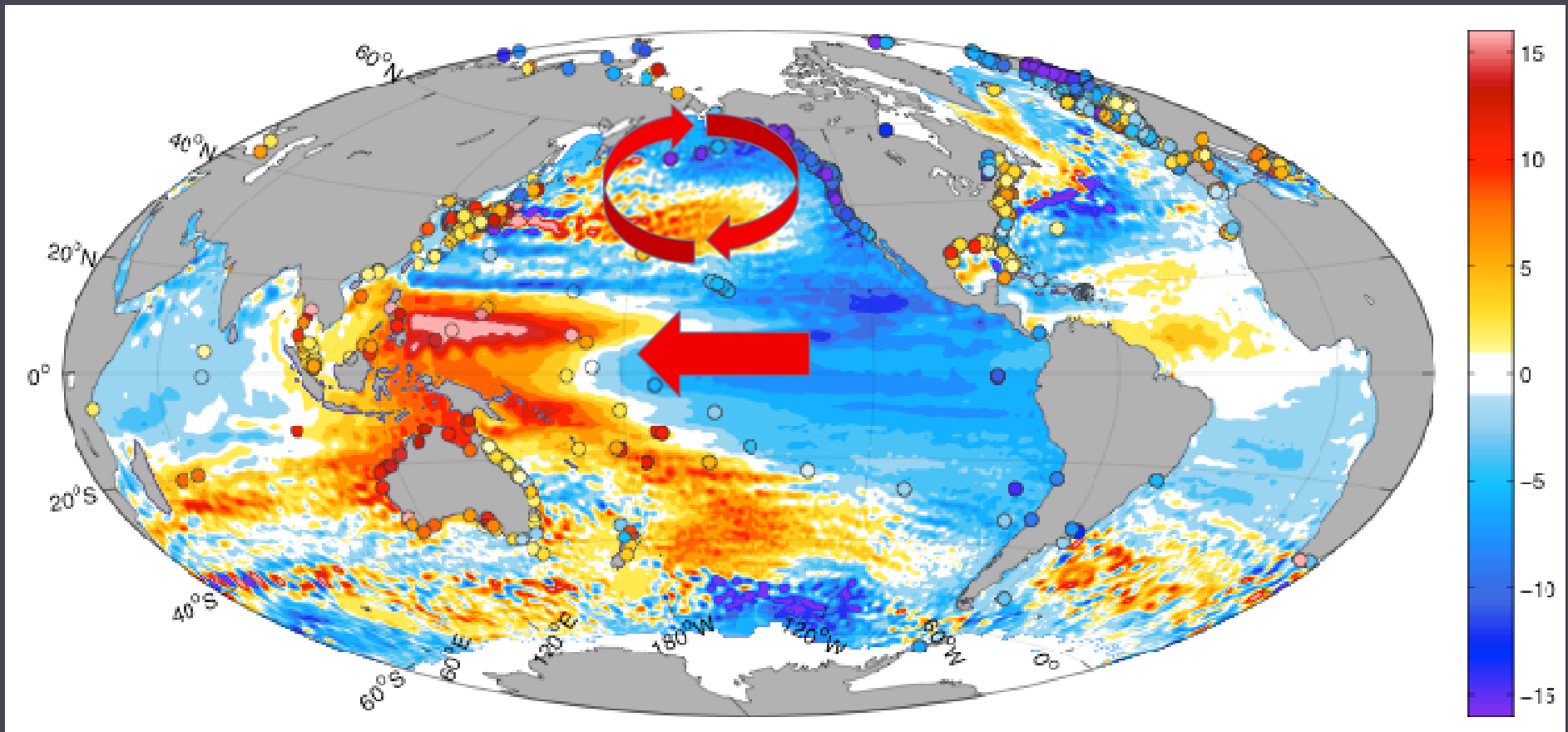
▶ SST drives SLA over North Pacific

## Summary



▶ SST drives SLA over North Pacific

## Summary



Thank you 😊

Xichen Li