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# Evaluation of the equatorial current system in the POP simulations based on different wind forcings


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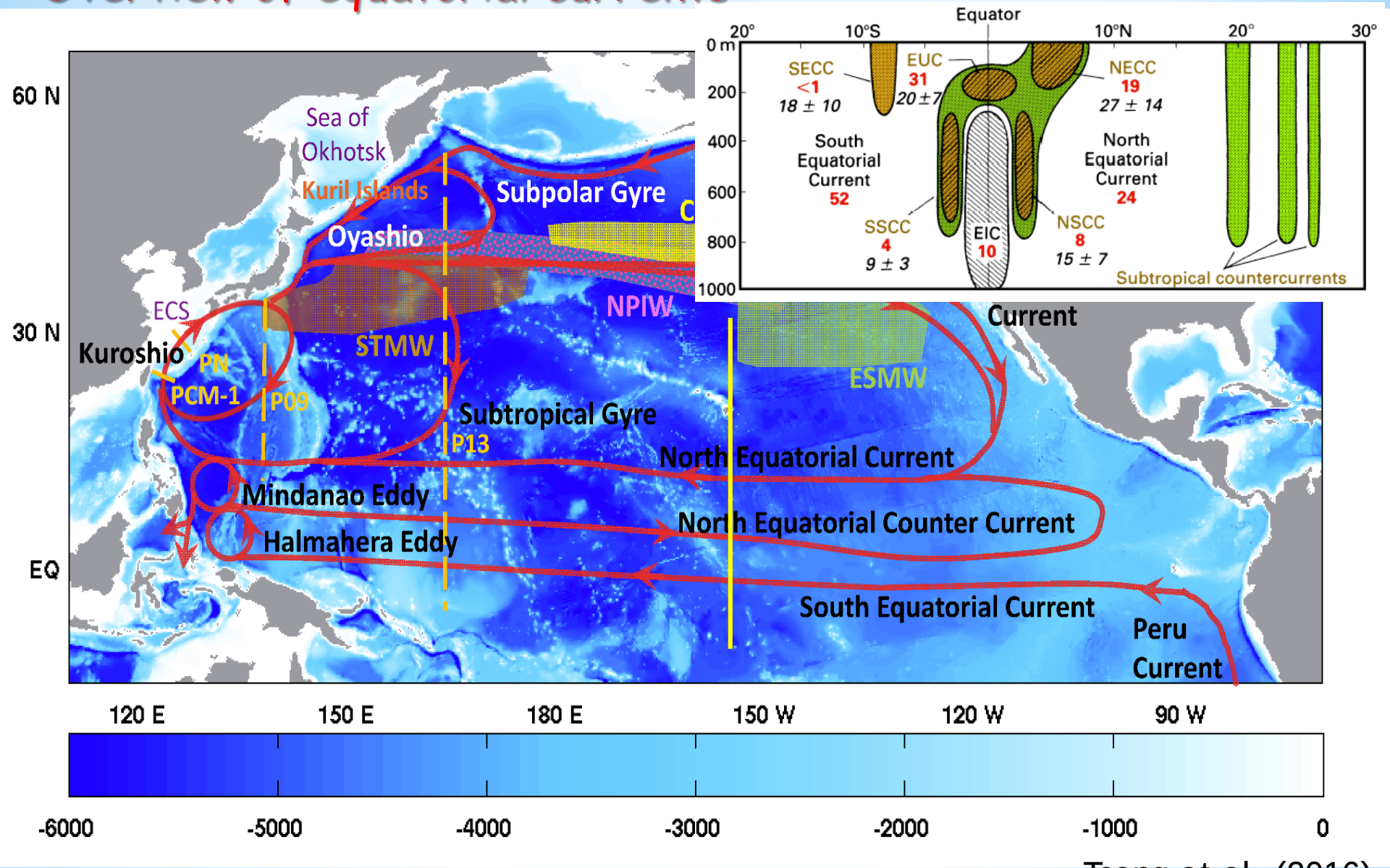
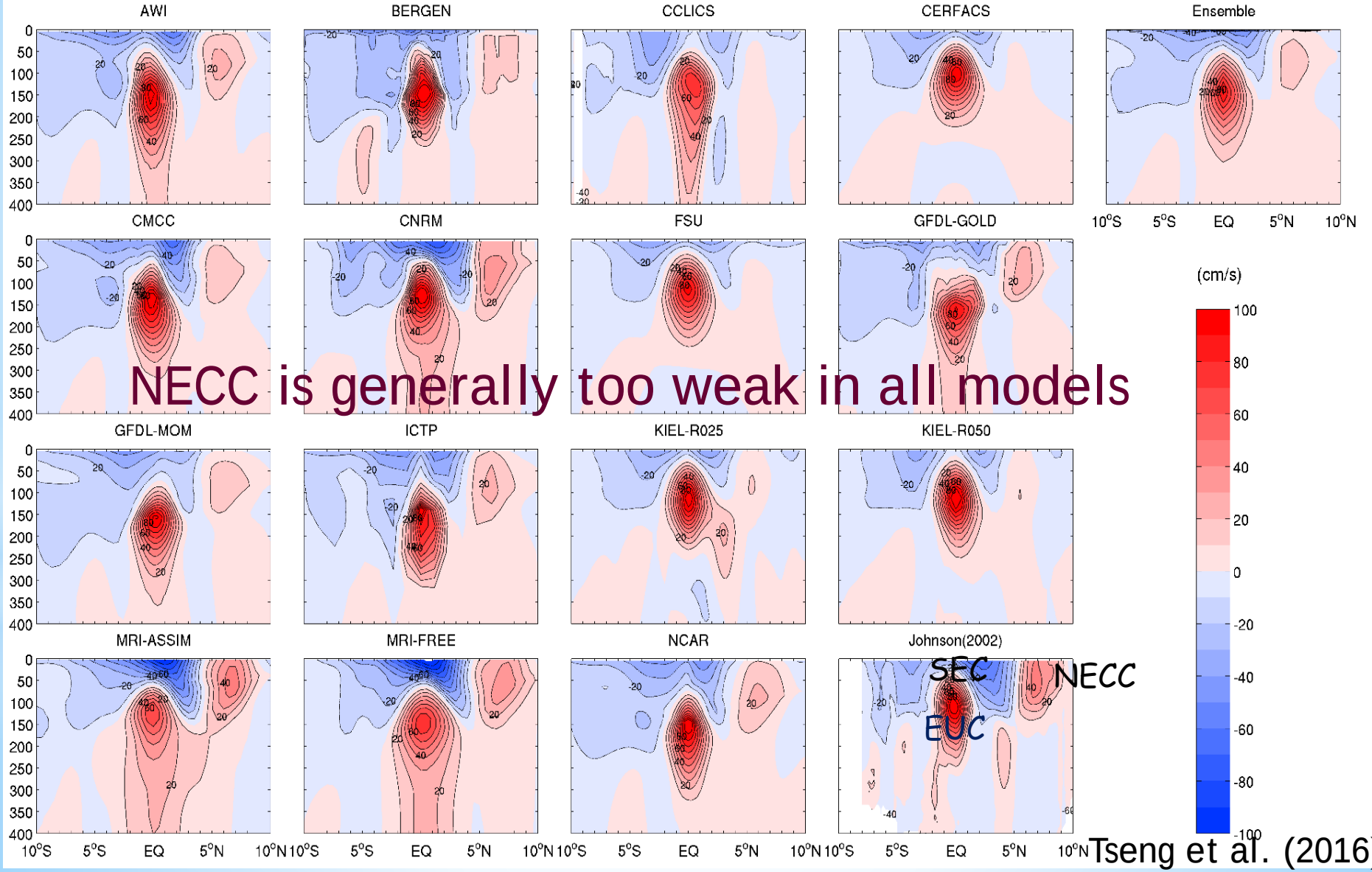
- Motivation
- Model experiments
- Results
  - Zonal transport and Sverdrup transport
  - Impacts of wind stress curl
  - Transport contributions
- Conclusion

# Overview of equatorial currents




Tseng et al. (2016)

# Mean zonal velocity along 140°W in the CORE-II experiments



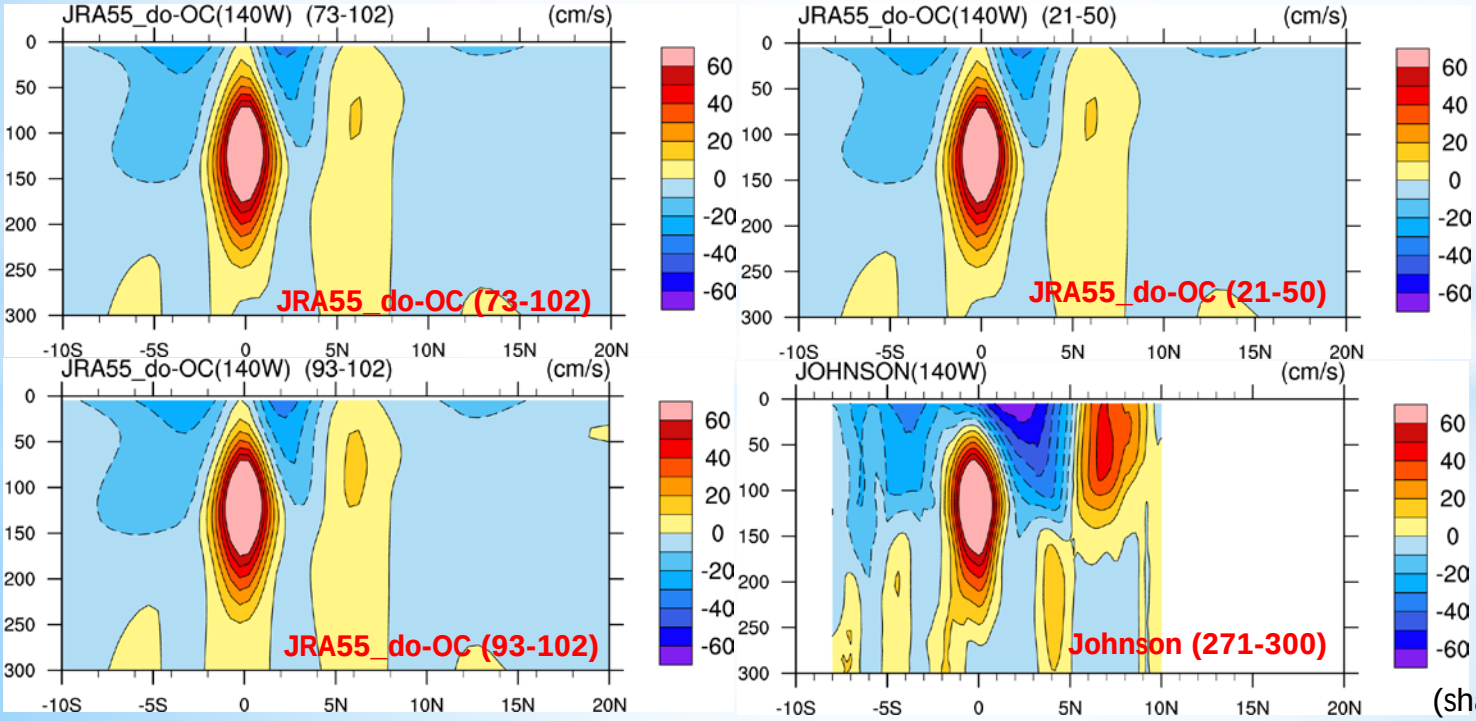

NECC is generally too weak in all models

Tseng et al. (2016)

# model and data

OBS: Johnson et al. (2002)

| Model | Test name | Forcing | Used time |
|---|---|---|---|
| POP | JRA55_raw-OC (S06) | JRA55 | 1978-2007(73-102) |
| POP | JRA55_raw-NC (S07) | JRA55 | 1978-2007(73-102) |
| POP | JRA55_do-OC (T03) | JRA55 | 1978-2007(73-102) |
| POP | JRA55_do-NC (T07) | JRA55 | 1978-2007(73-102) |
| POP | POP | COREII | 1978-2007(271-300) |




(shaded interval : 10 cm/s)

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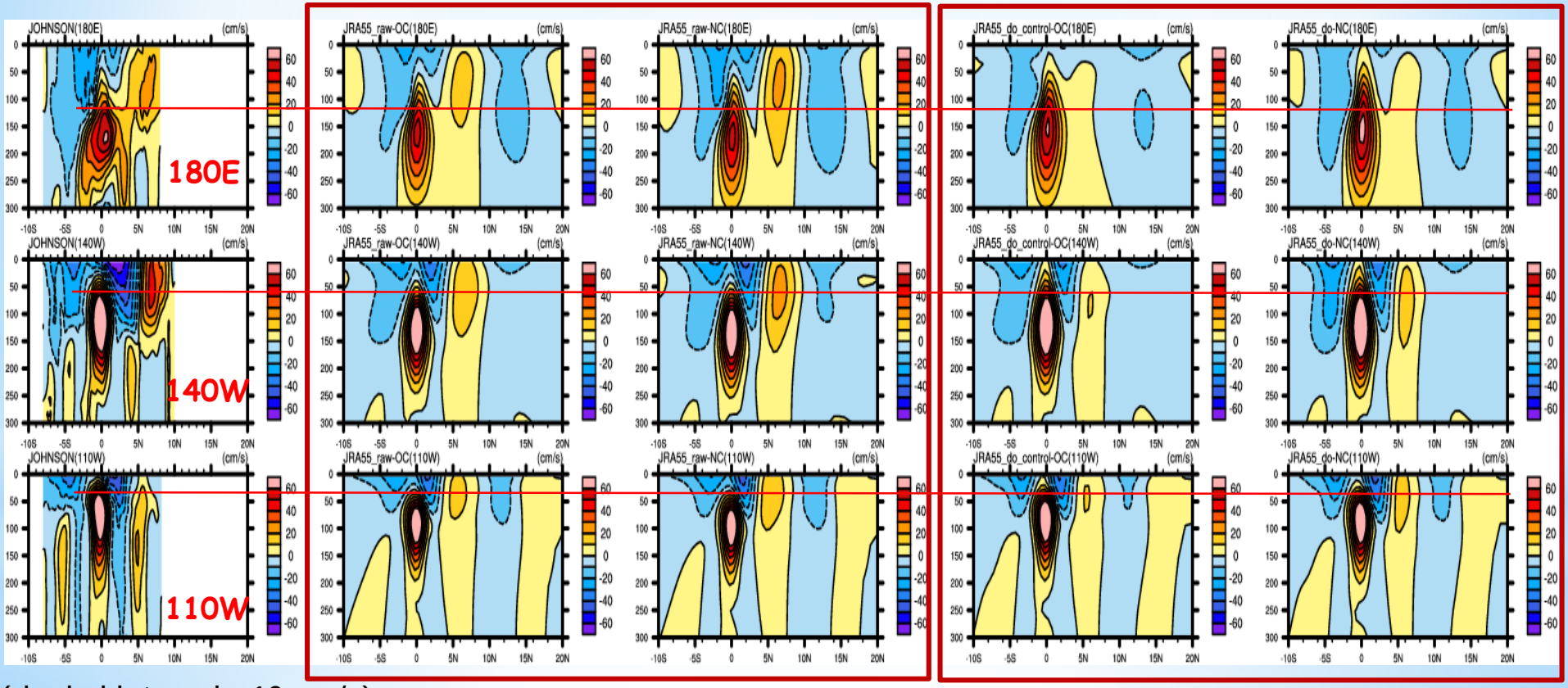
# Meridional-vertical sections of mean zonal current

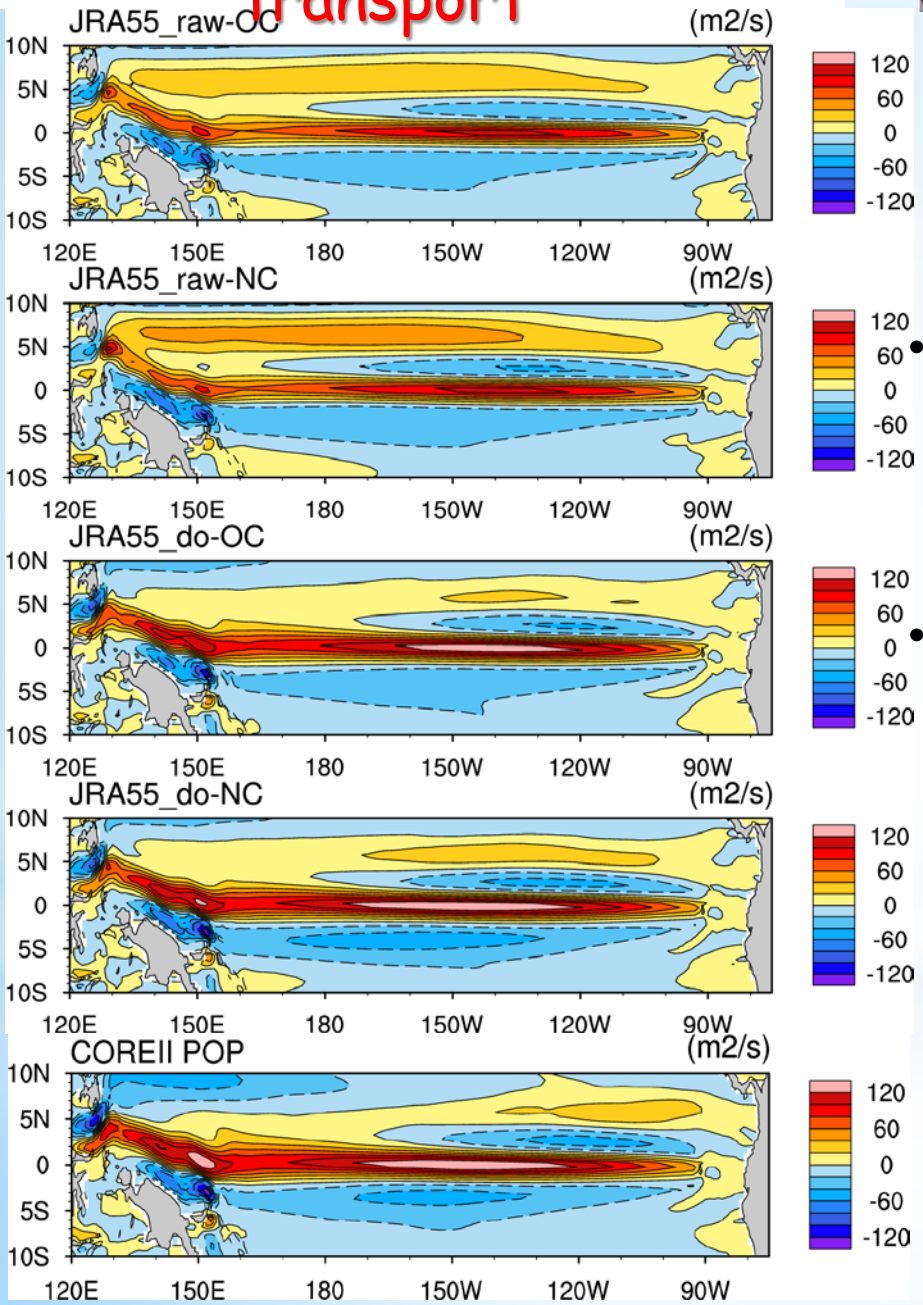
Johnson | JRA55_raw-OC | JRA55_raw-NC | JRA55_do-OC | JRA55_do-NC




(shaded interval : 10 cm/s)

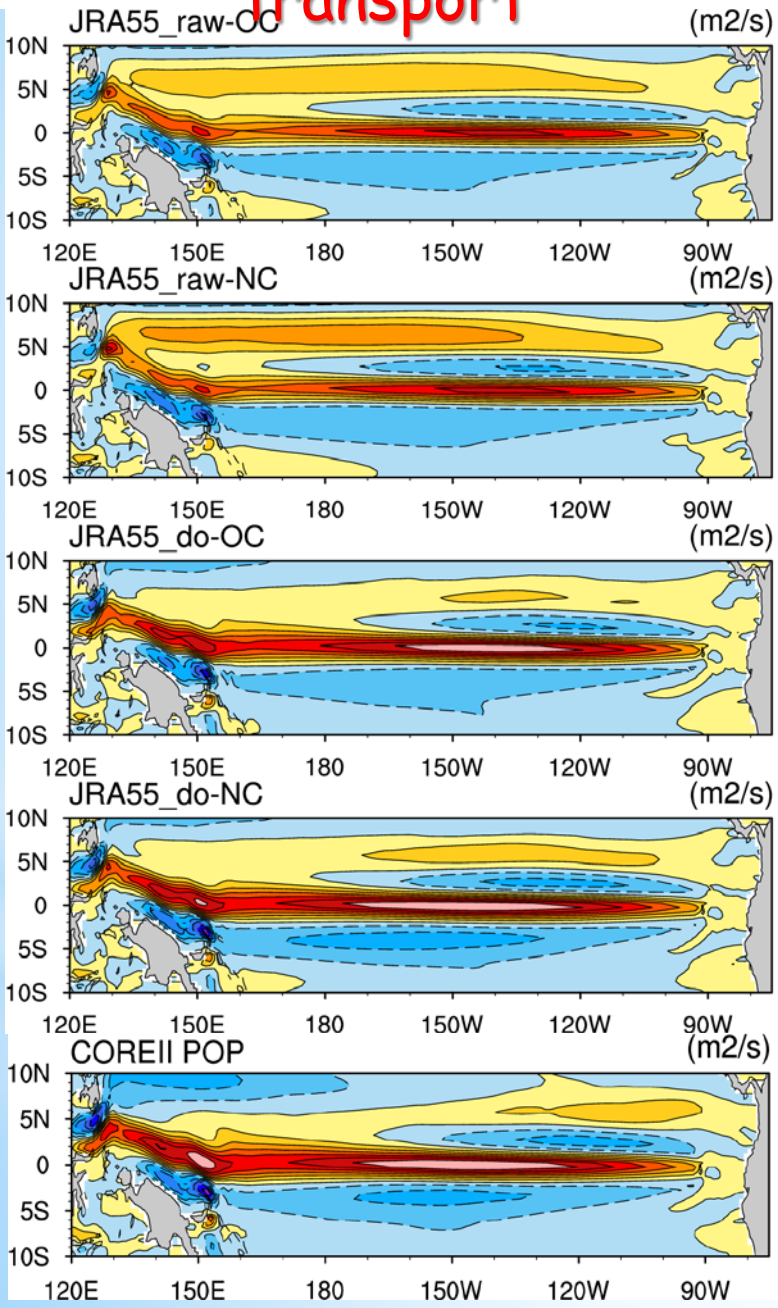
- NECC is generally stronger in NC runs
- NECC is stronger in raw data (without wind correction)
- EUC extends to the surface in the wind corrected runs

# Vertically integrated zonal transport



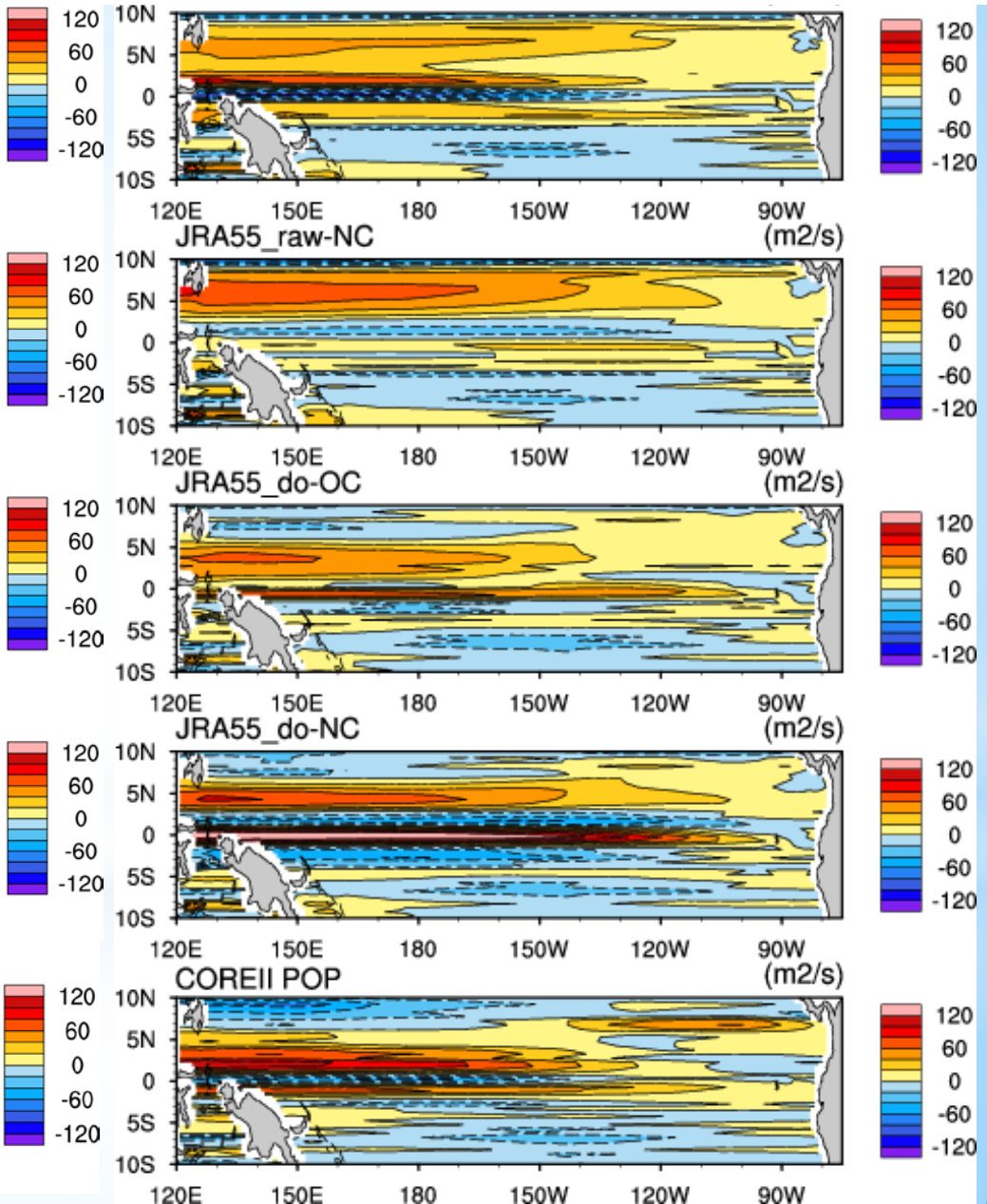

- Stronger NECC transport in JRA55
  - Stronger in raw data
  - Stronger in the NC run
- Stronger EUC in the wind corrected run
  - Maximum velocity depth differs
  - sensitive to the NC/OC

# Vertically integrated zonal transport




# Zonal Sverdrup transport

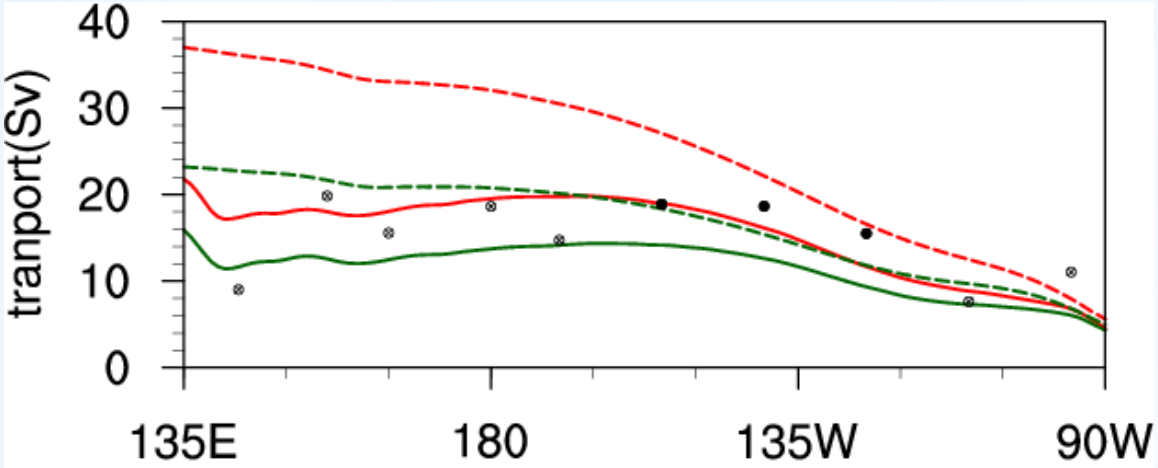
$$U = -\frac{1}{\beta}\int_{EB}^{x} curl(\tau)_y dx + U_{EB}(y)$$



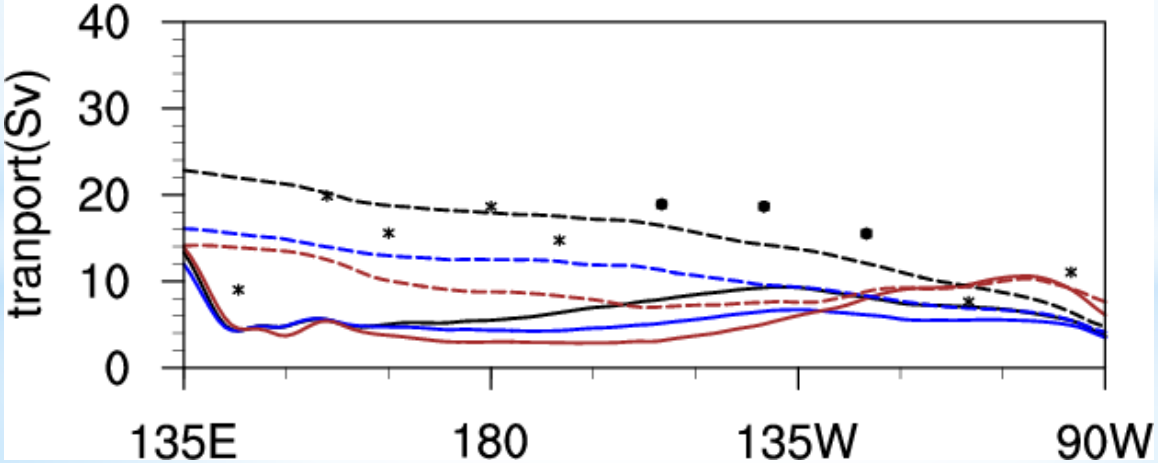
# Zonal Sverdrup transport (ZST) vs modeled transport

NECC: 3-10N

JRA-raw



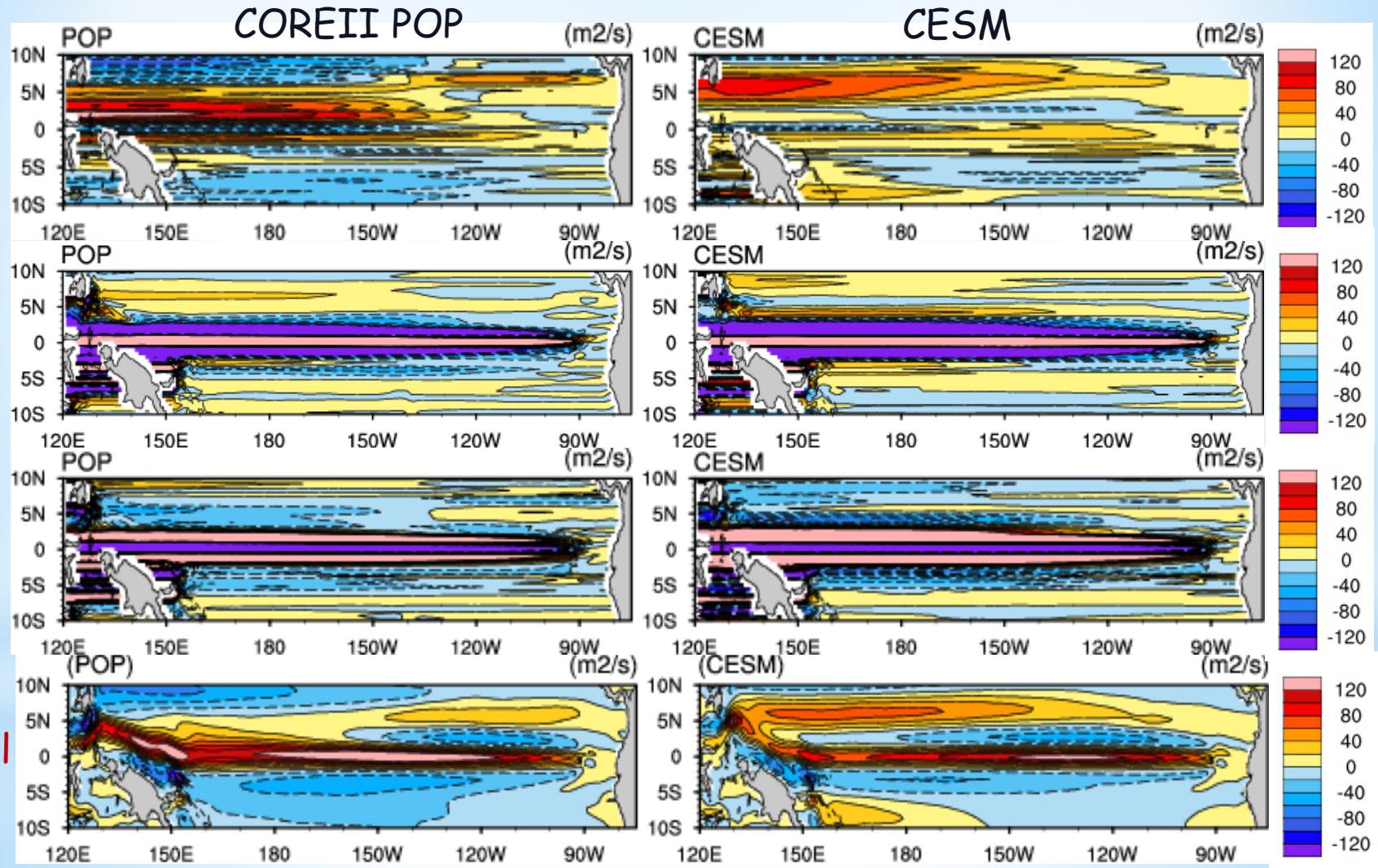

JRA-do




ZST is overestimated in all JRA

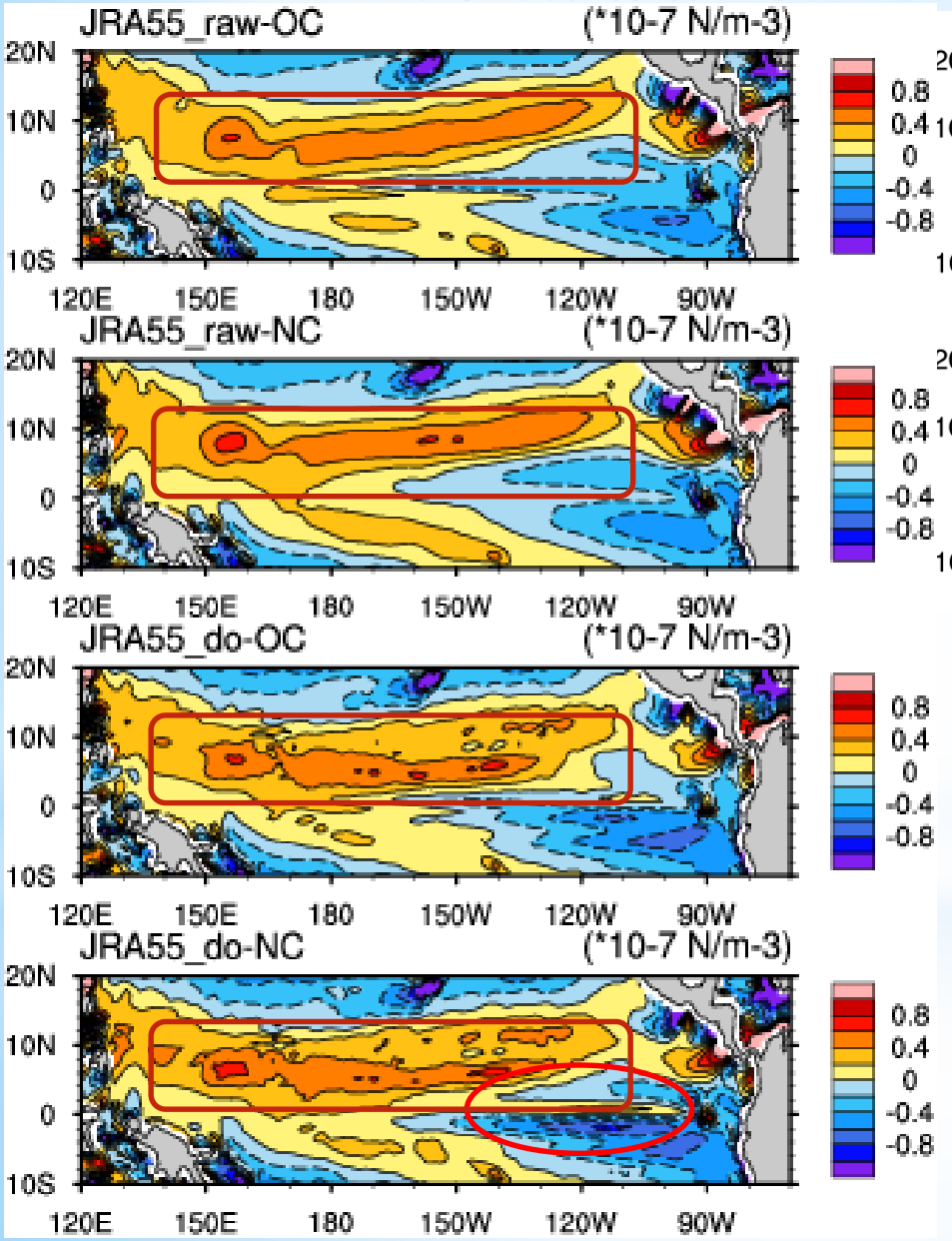
In COREII POP, ZST is overestimated west of 120W only

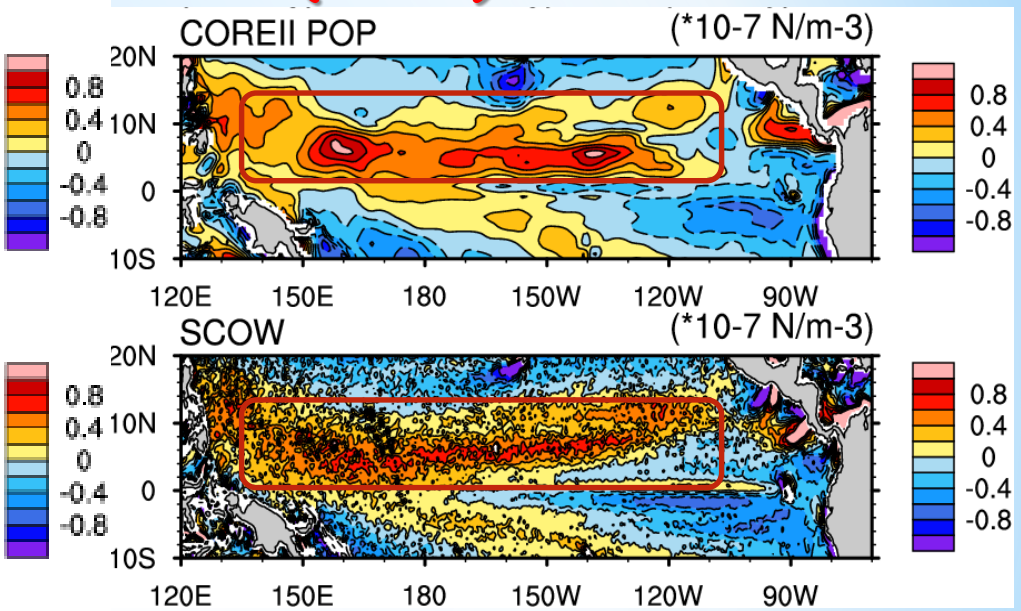
# Different contributions to the zonal transport




Sun et al. (2018, in preparation)

# Mean wind stress curl (WSC)



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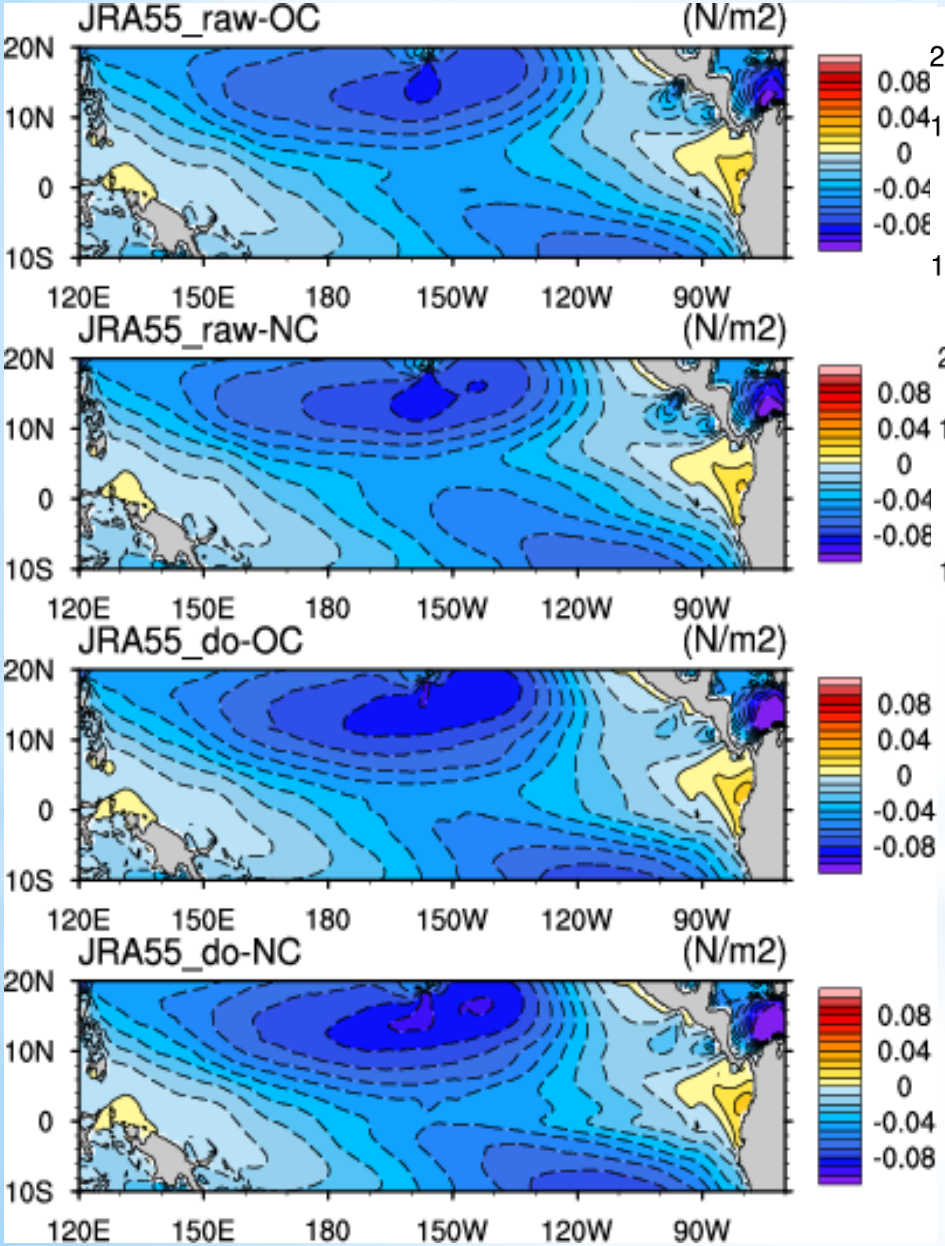
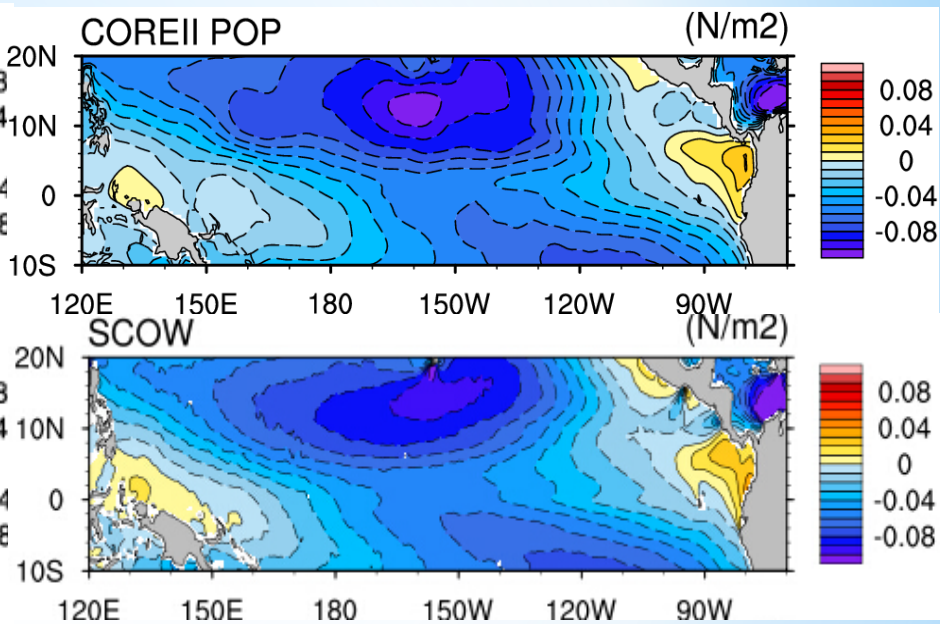
# Mean zonal wind stress

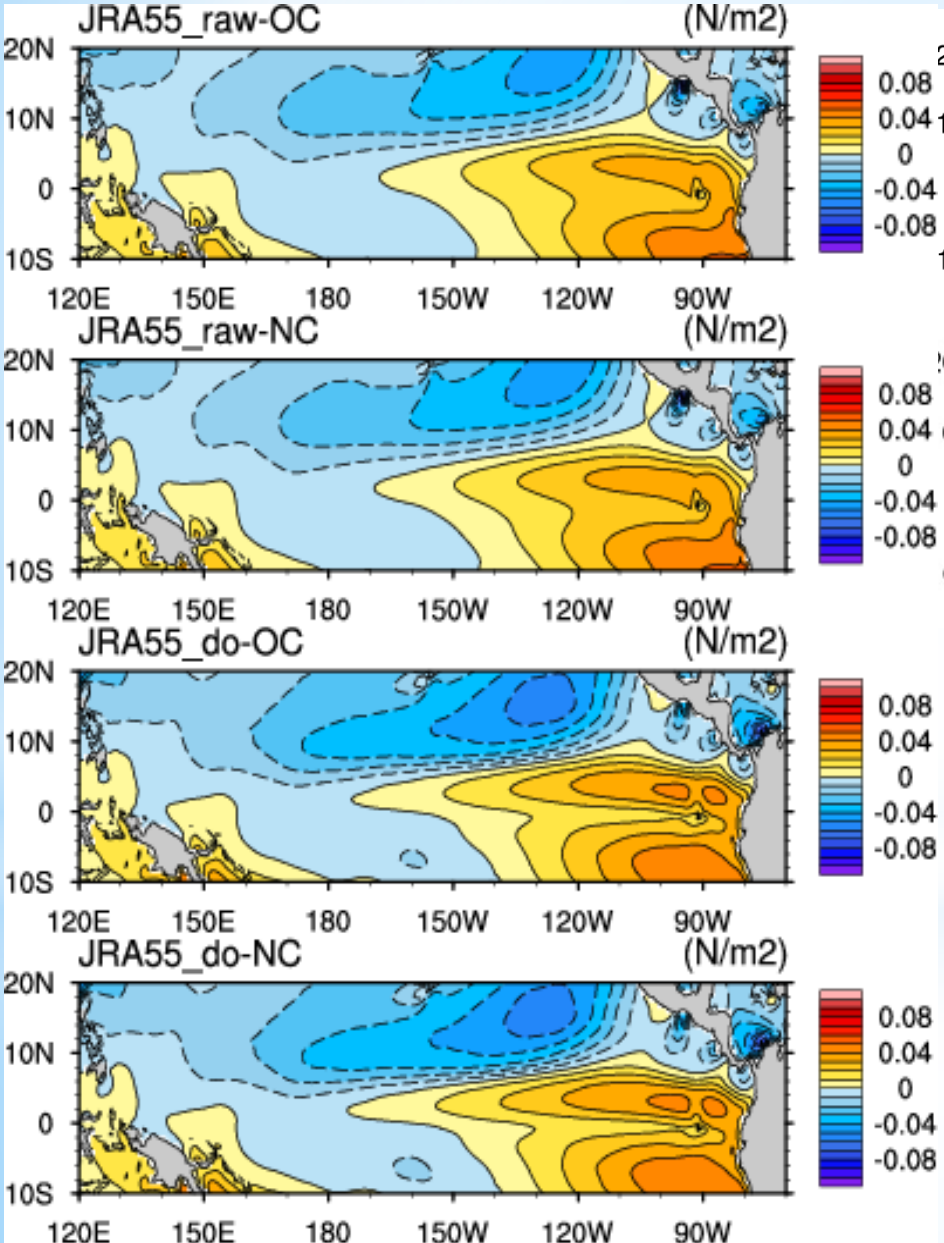


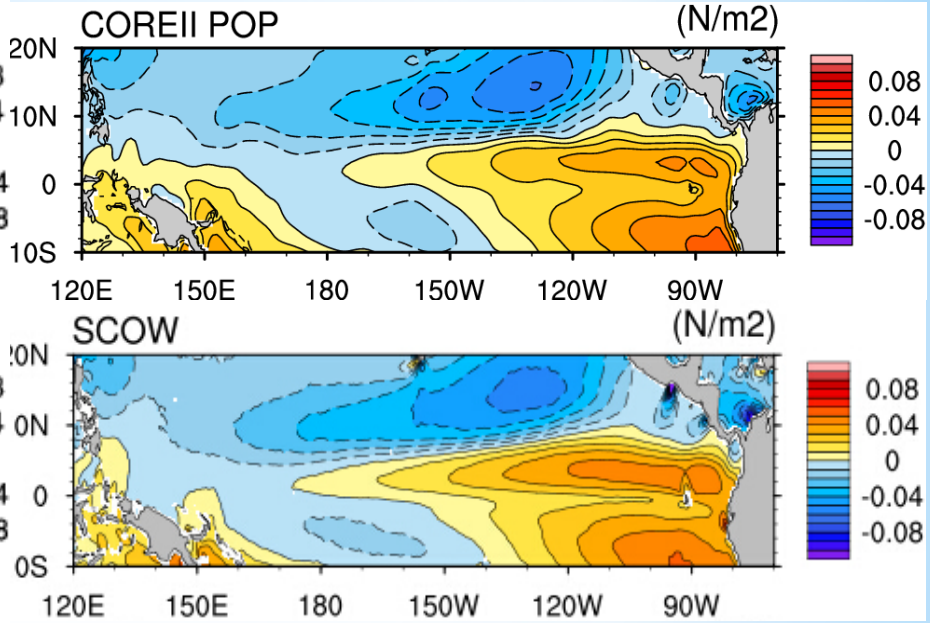




(shaded interval is 0.01 N $m^{-2}$)

Large differences in zonal winds

# Mean meridional wind stress




(The shaded interval is 0.01 N $m^{-2}$)

Differences are smaller in meridional winds

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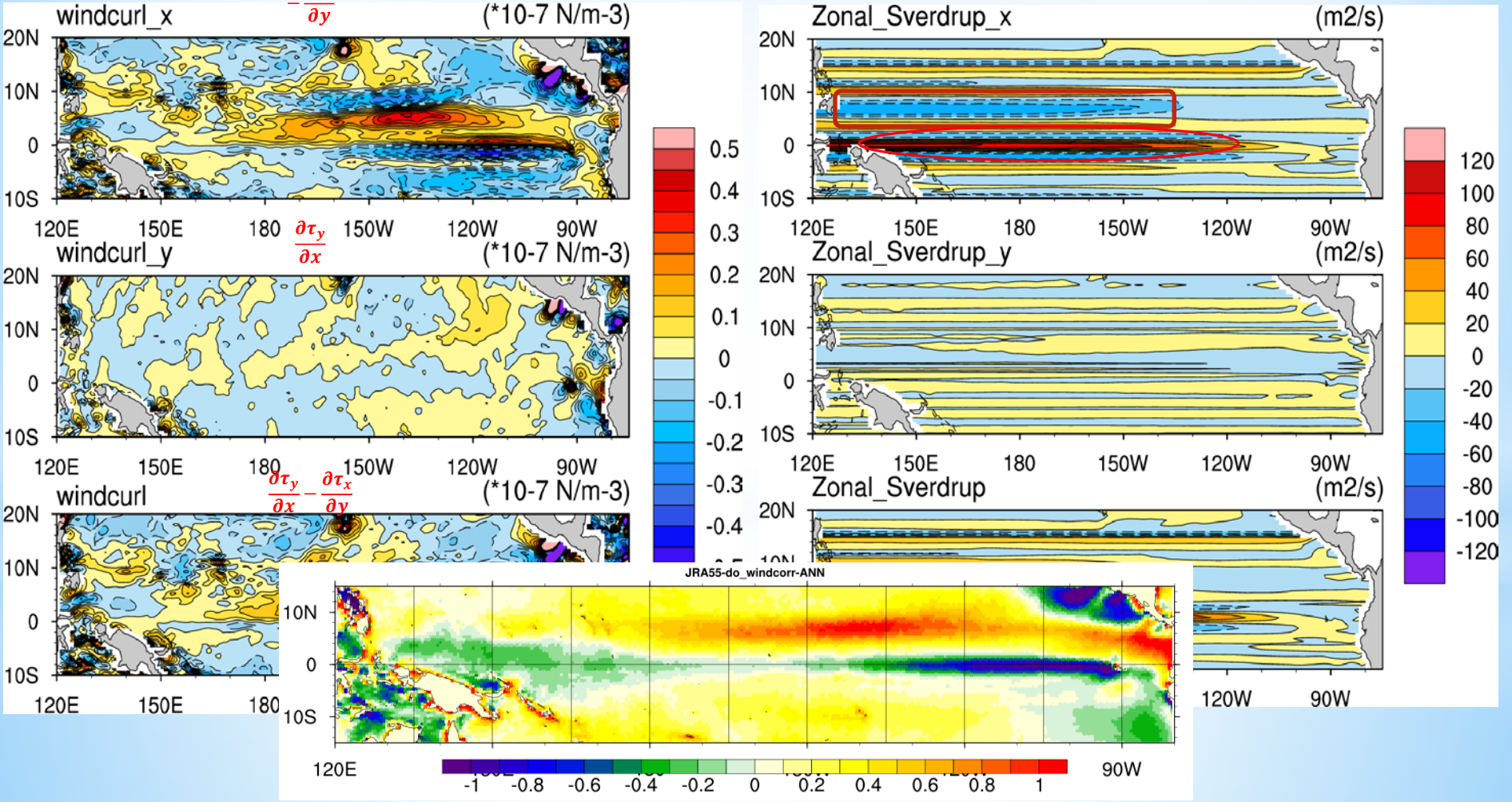
# Impact of wind correction

**JRA55_do-OC - JRA55_raw-OC**

## WSC component

## Resulting Sverdrup transport




Wind speed correction offset

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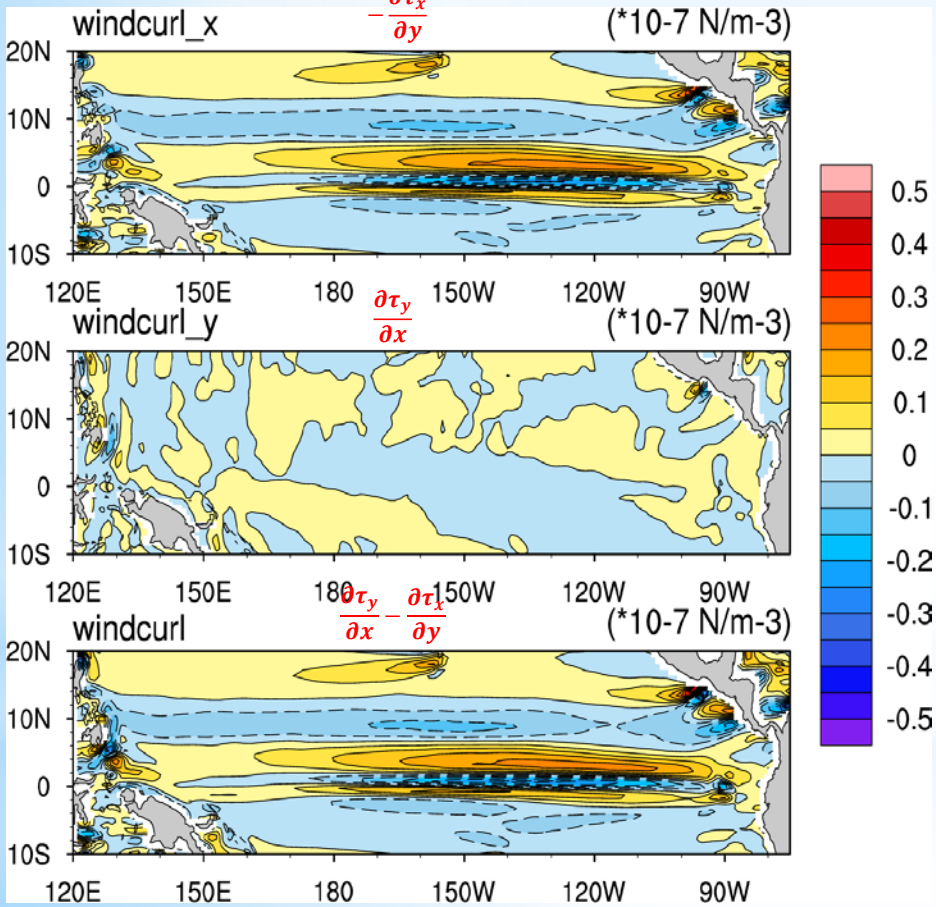
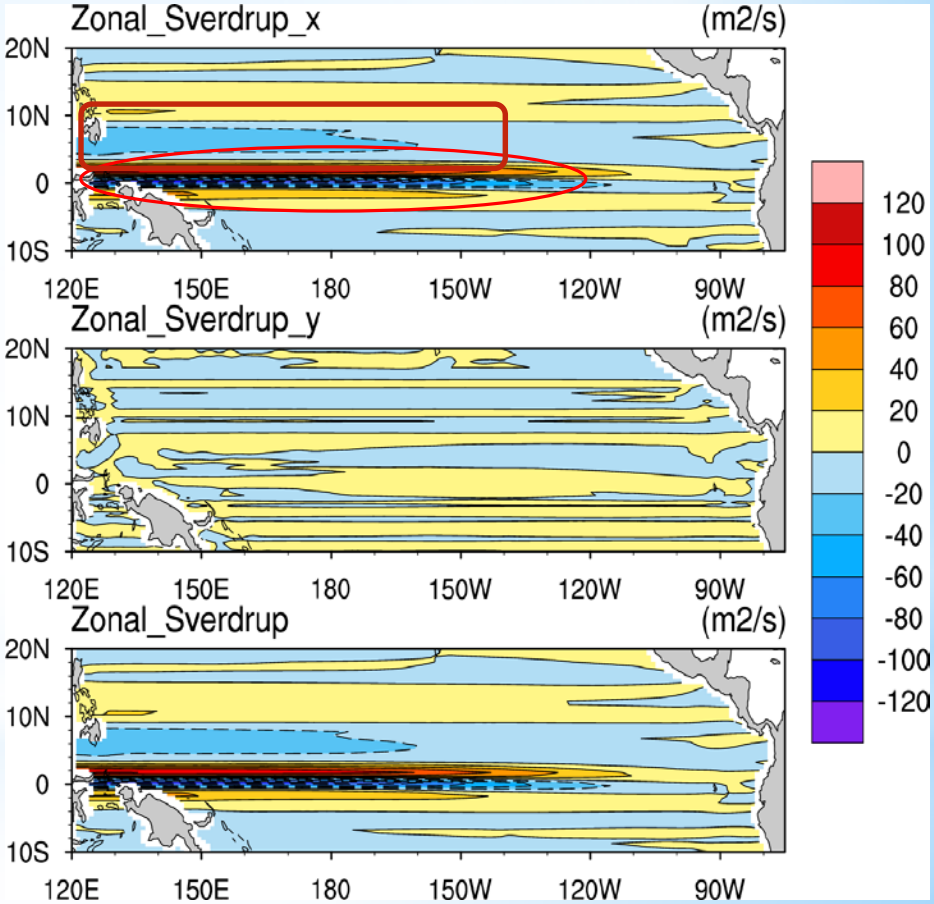
# Impact of including ocean currents

**JRA55_raw-OC - JRA55_raw-NC**

## WSC component




## Resulting Sverdrup transport



# Conclusion

- JRA55 corrected wind has a much closer spatial distribution of WSC to the observed wind fields (regardless of OC/NC).
  - Differences mainly from the zonal winds
  - Linear: WSC + non-linear: advection/friction
- Wind correction:
  - transport is stronger in the raw wind (magnitude is larger)
  - NECC is better but EUC extends to the surface in wind correction runs
- NC *vs* OC:
  - NECC transport is stronger in the NC (magnitude is smaller)
  - Surface currents may be counted twice in OC runs

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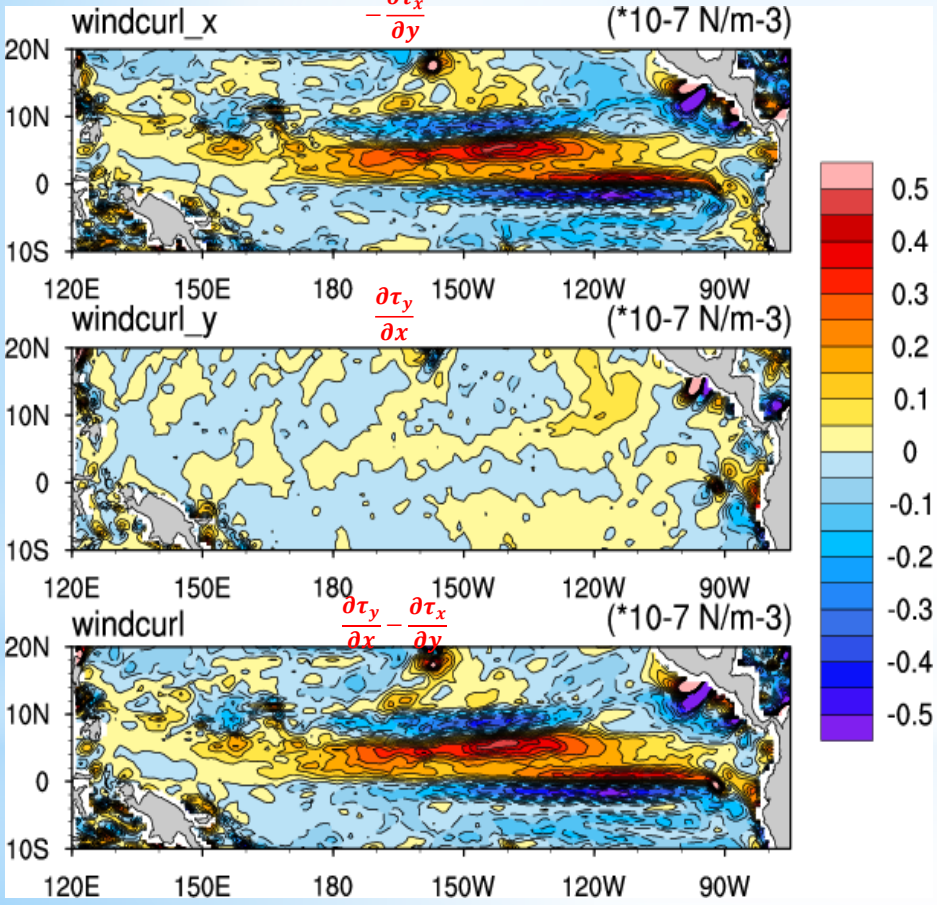
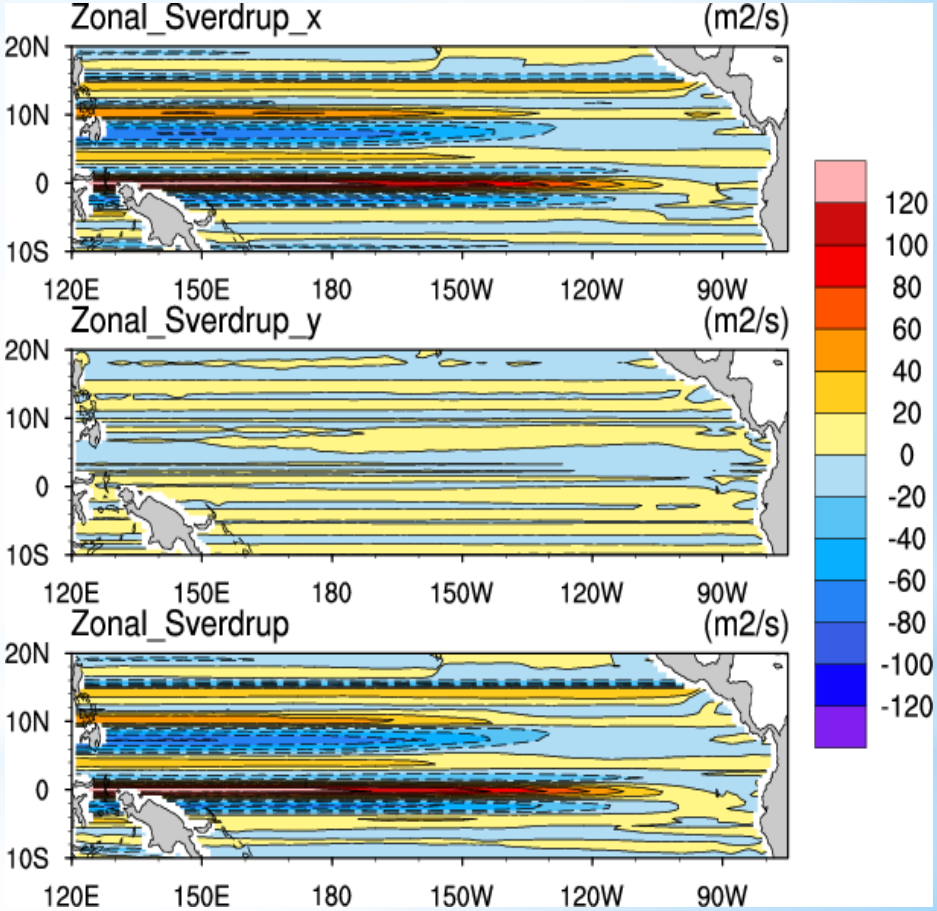
# Impact of wind correction

**JRA55_do-NC - JRA55_raw-NC**

## WSC component




## Resulting Sverdrup transport



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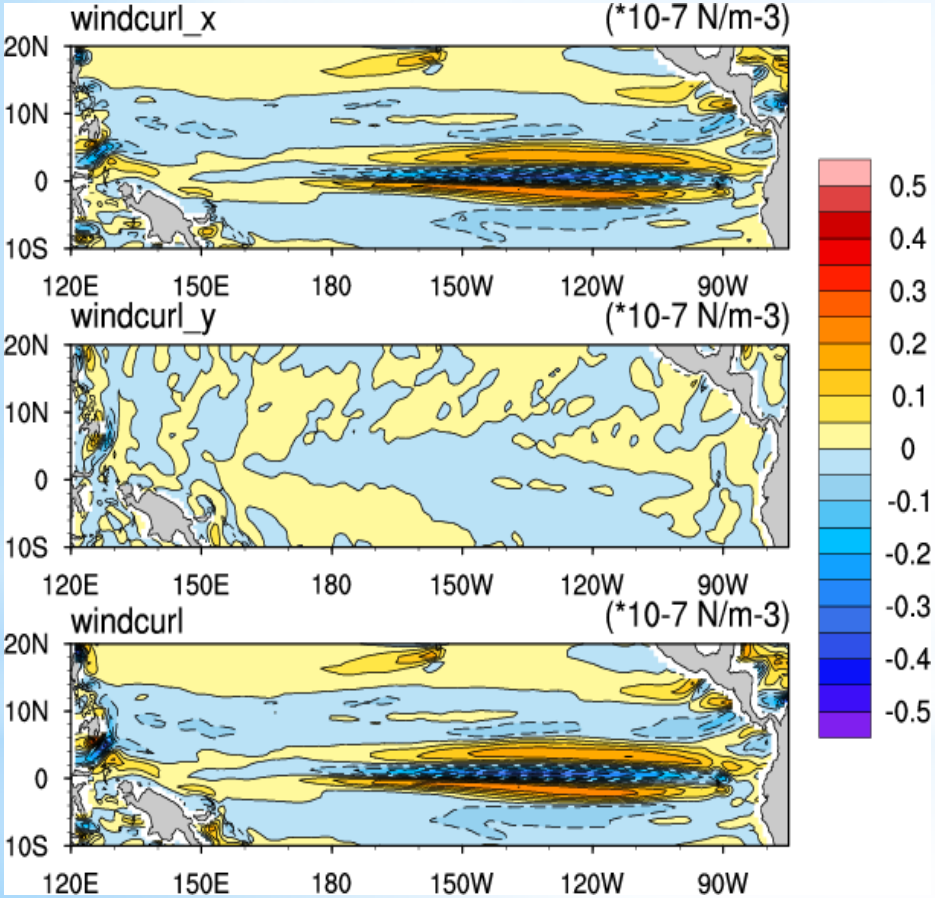
JRA55_do-OC - JRA55_do-NC

## WSC component




## Resulting Sverdrup transport