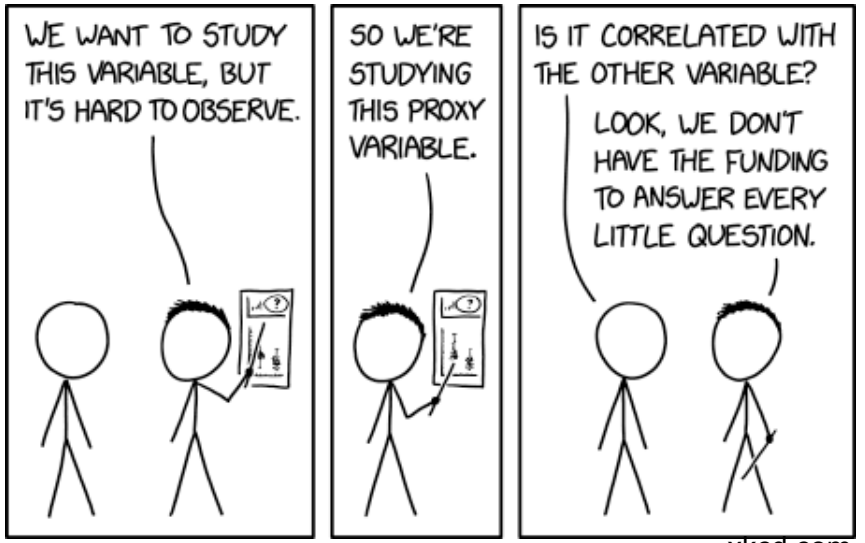
Australian National University

Satellite observations of deep ocean currents

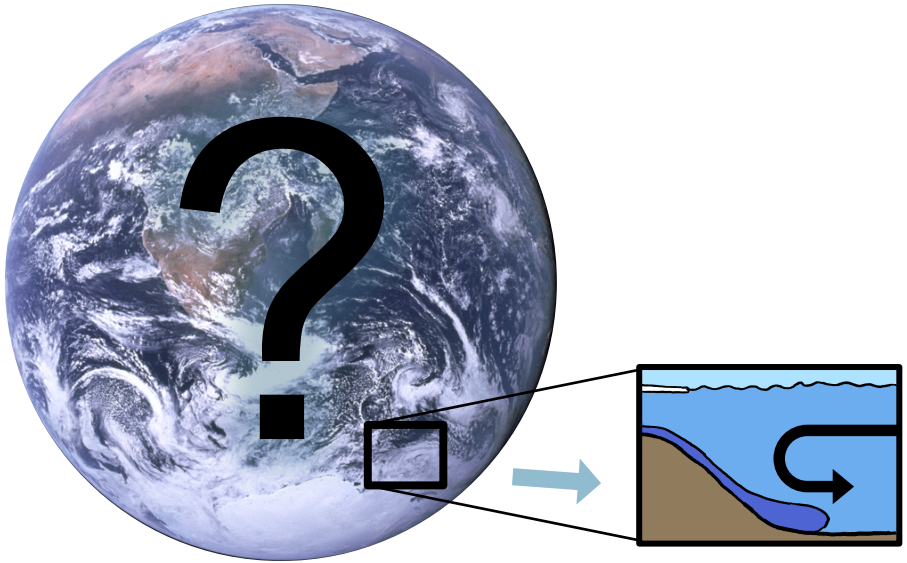


Jemma Jeffree
Andy Hogg
Adele Morrison
Aviv Solodoch
Andrew Stewart

clex

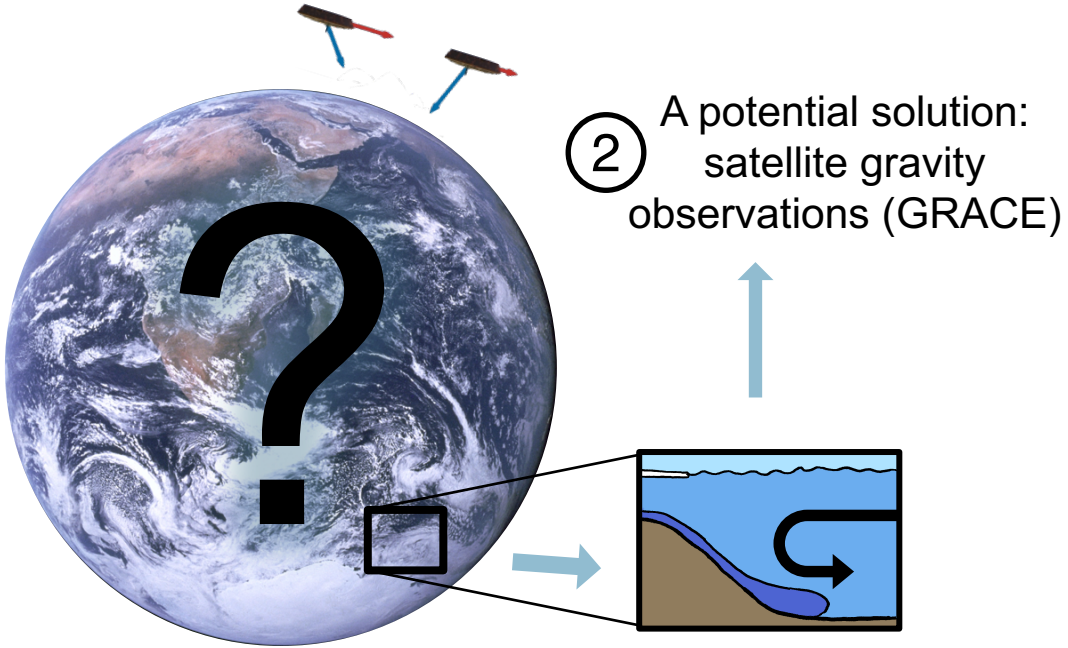
Preview

Preview



1 Unknown: Antarctic Bottom Water (AABW)

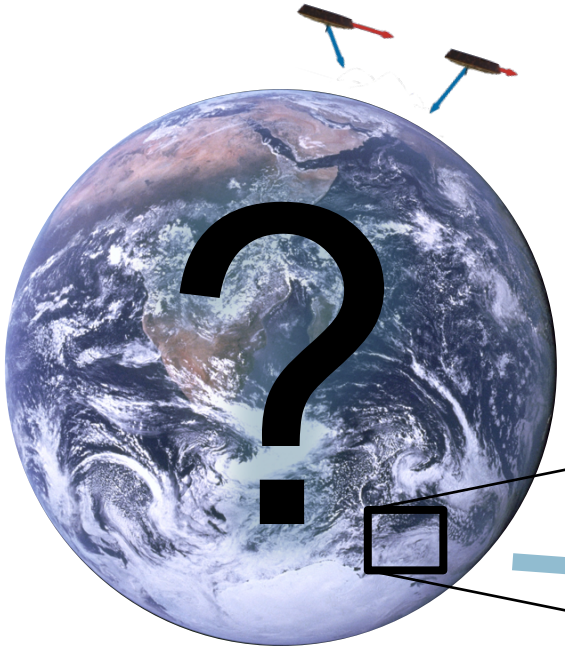
Preview



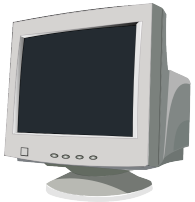
② A potential solution: satellite gravity observations (GRACE)

① Unknown: Antarctic Bottom Water (AABW)

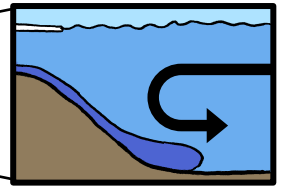
Preview



2 A potential solution: satellite gravity observations (GRACE)

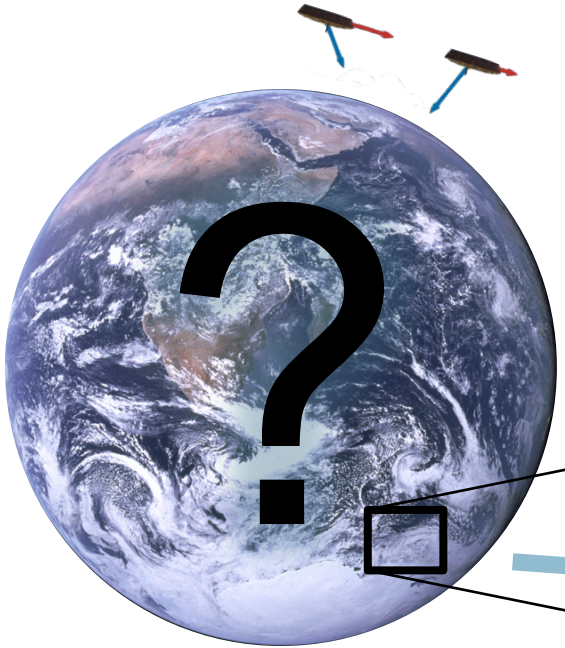


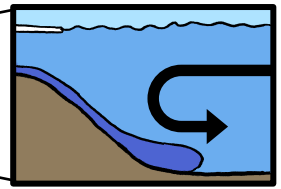
3 Ocean model: to quantify how useful

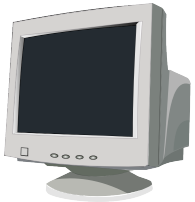


1 Unknown: Antarctic Bottom Water (AABW)

Preview







2 A potential solution: satellite gravity observations (GRACE)

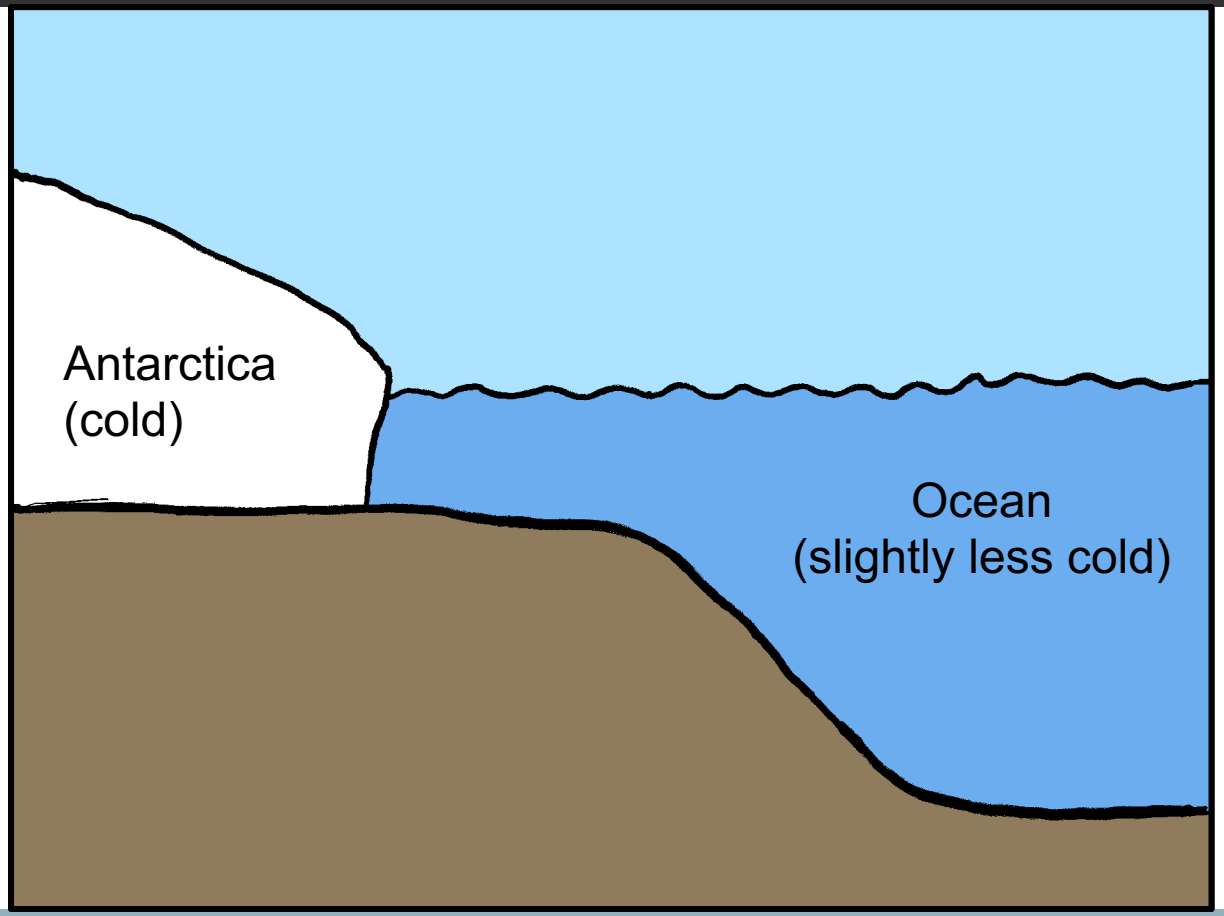
3 Ocean model: to quantify how useful

4 A few results

1 Unknown: Antarctic Bottom Water (AABW)

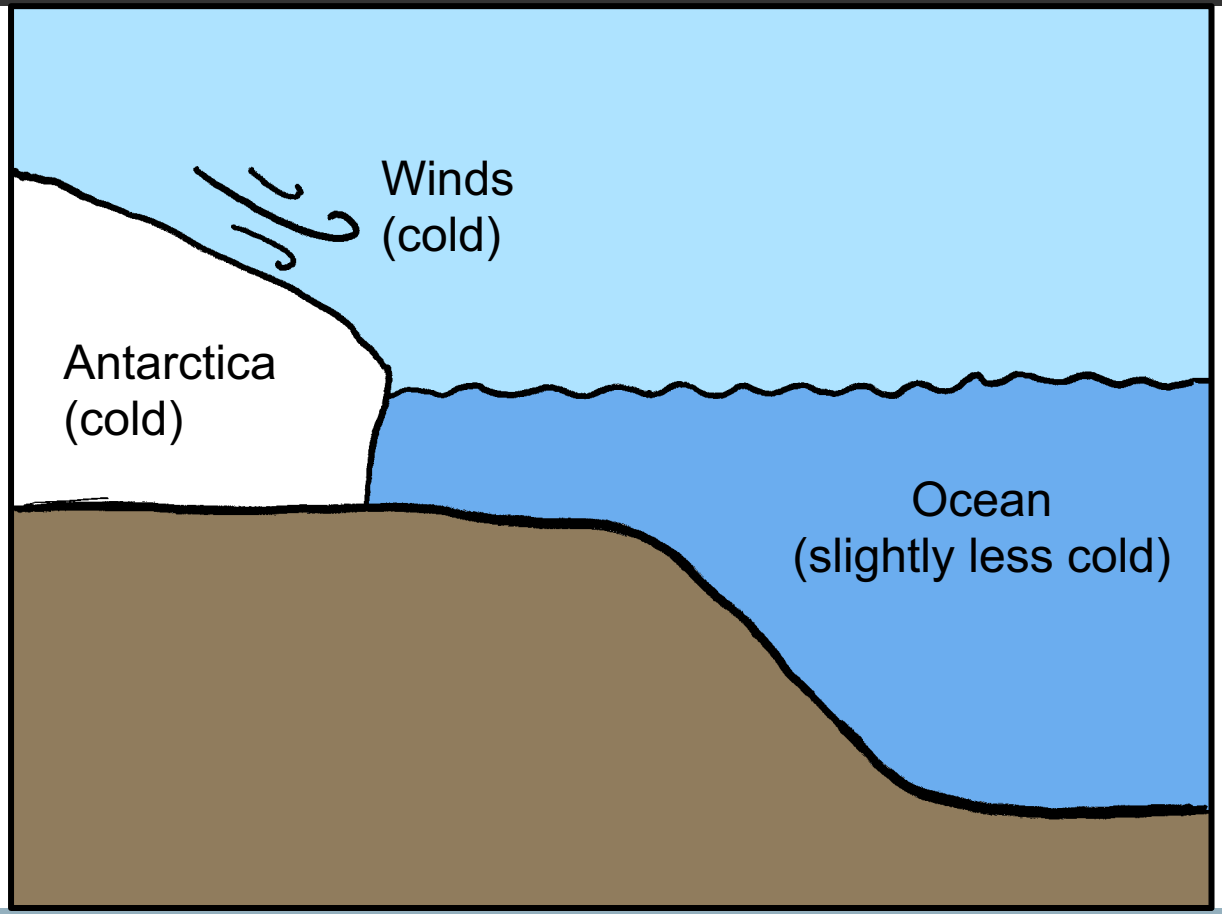
AABW

(**A**nt**a**rctic **B**ottom **W**ater)



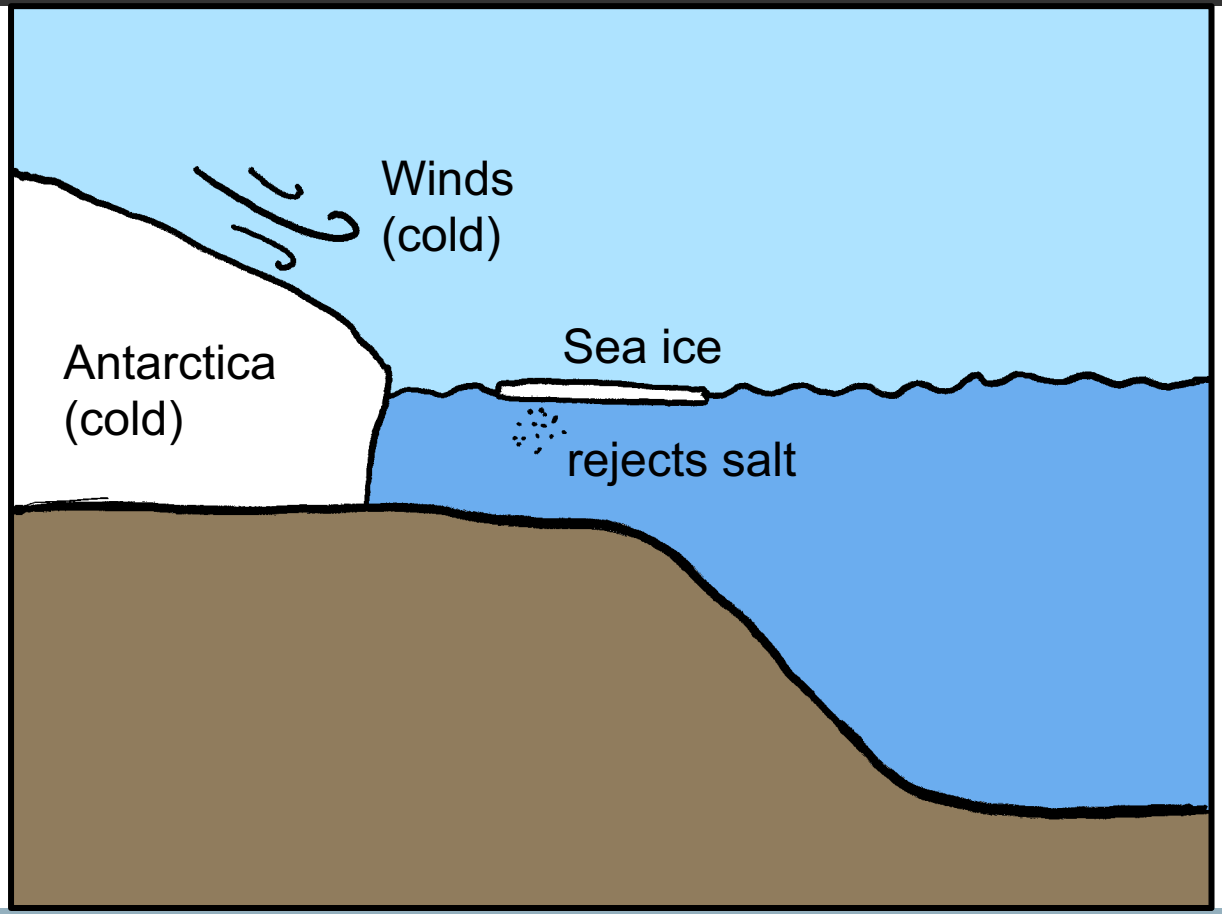
AABW

(**A**nt**a**rctic **B**ottom **W**ater)



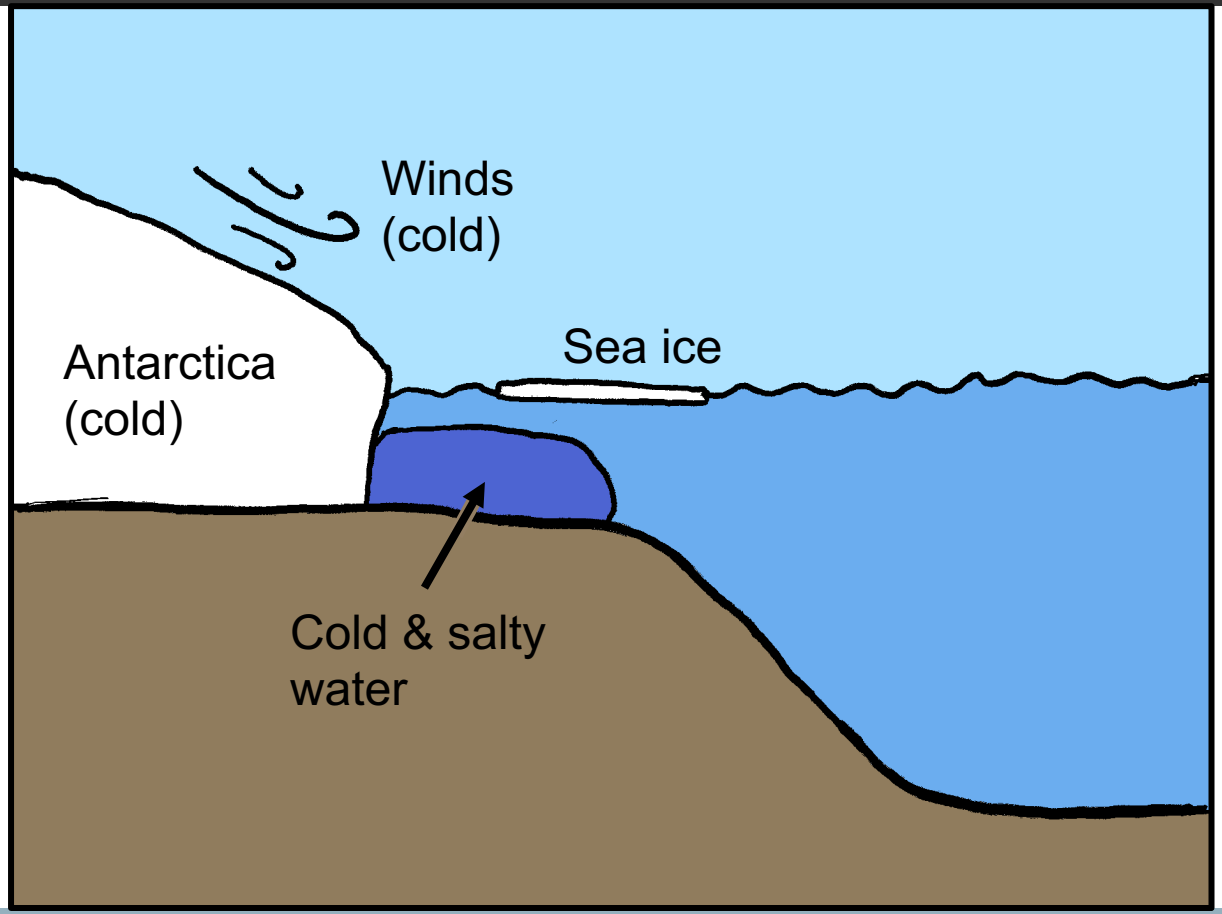
AABW

(**A**nt**a**rctic **B**ottom **W**ater)



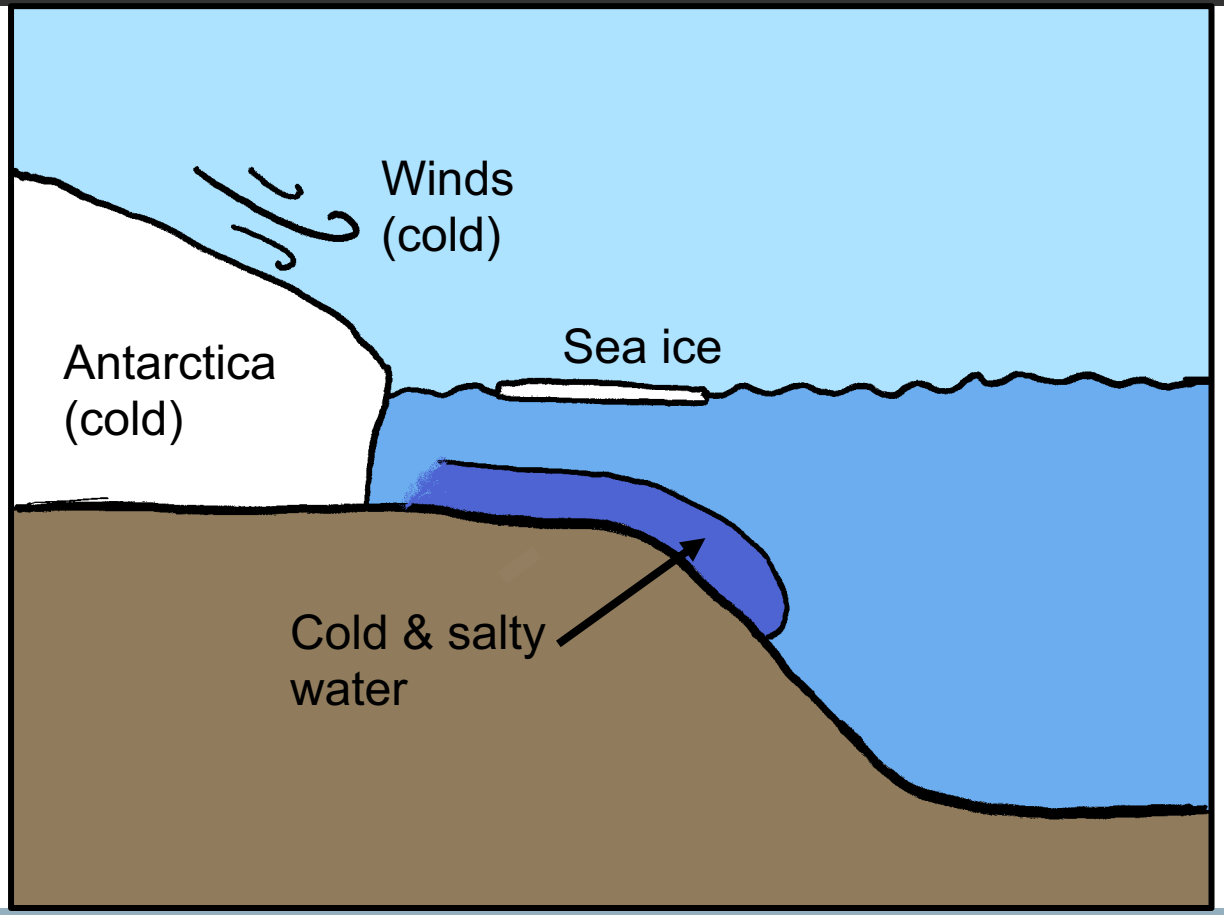
AABW

(**A**nt**a**rctic **B**ottom **W**ater)



AABW

(**A**nt**a**rctic **B**ottom **W**ater)



AABW

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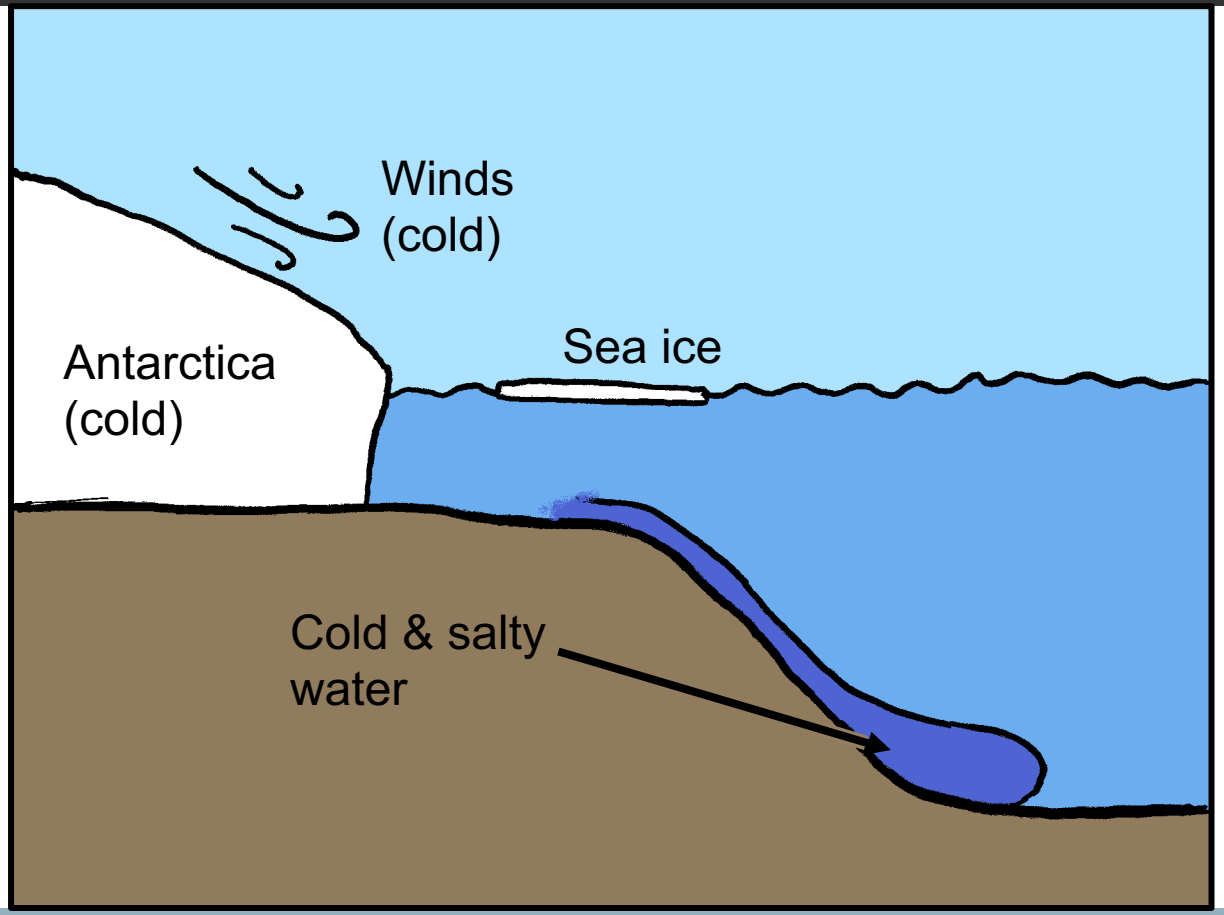
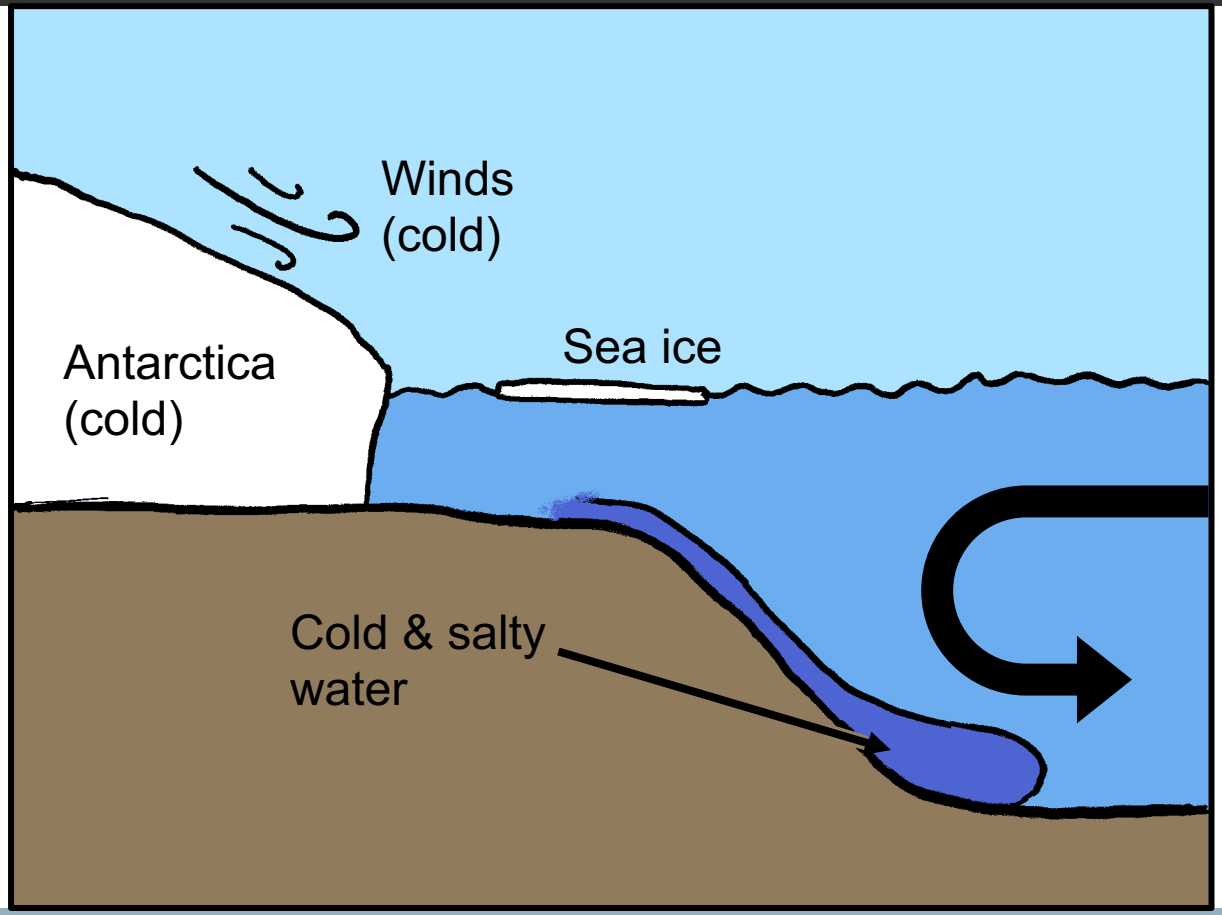


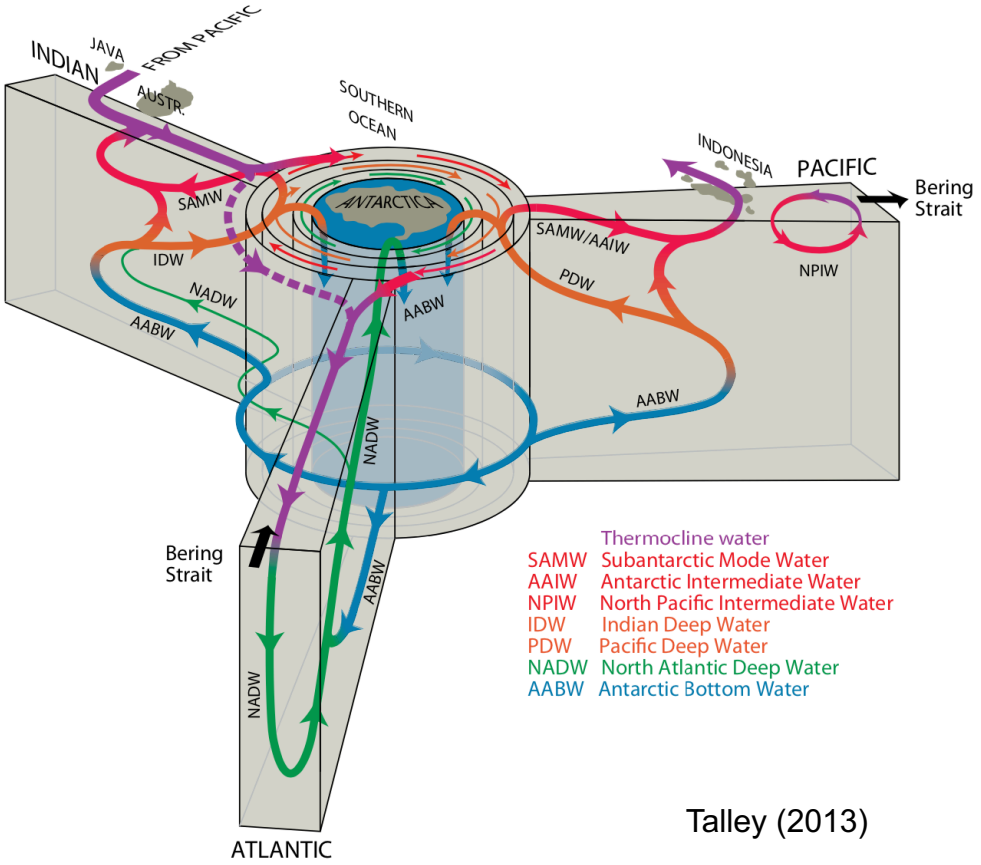
AABW

(**A**nt**a**rctic **B**ottom **W**ater)



AABW

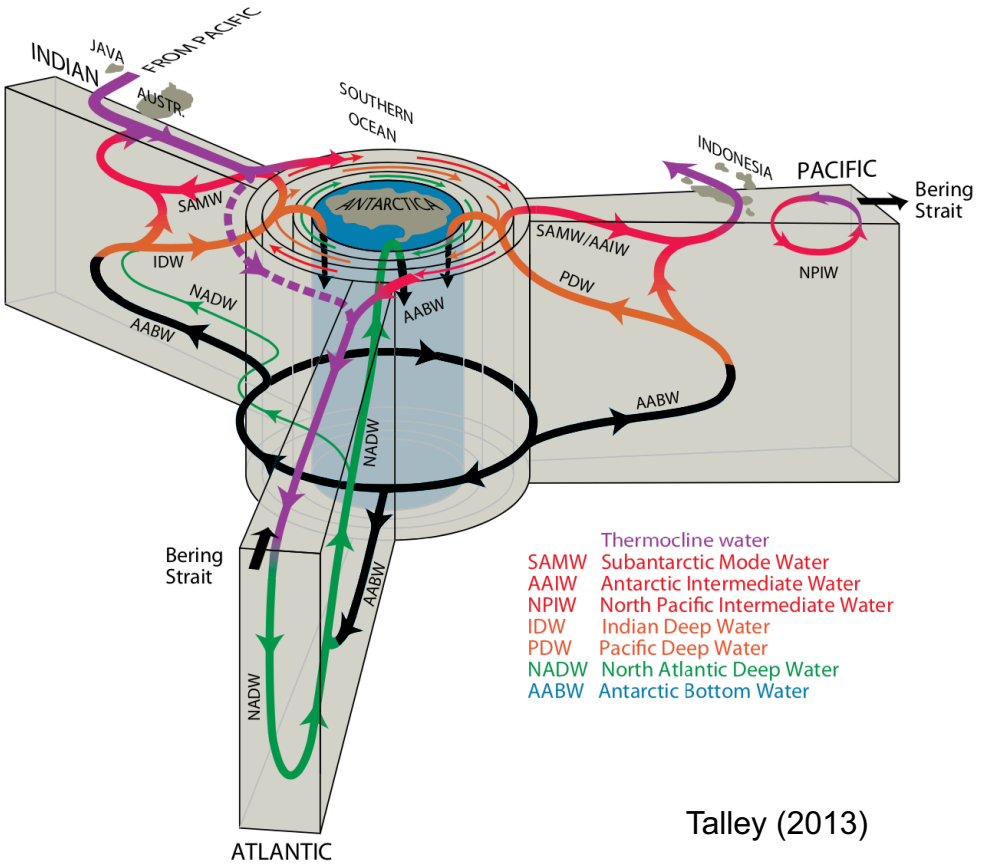
(**A**nta**a**rctic **B**ottom **W**ater)



Talley (2013)

AABW

(**A**nta**a**rctic **B**ottom **W**ater)

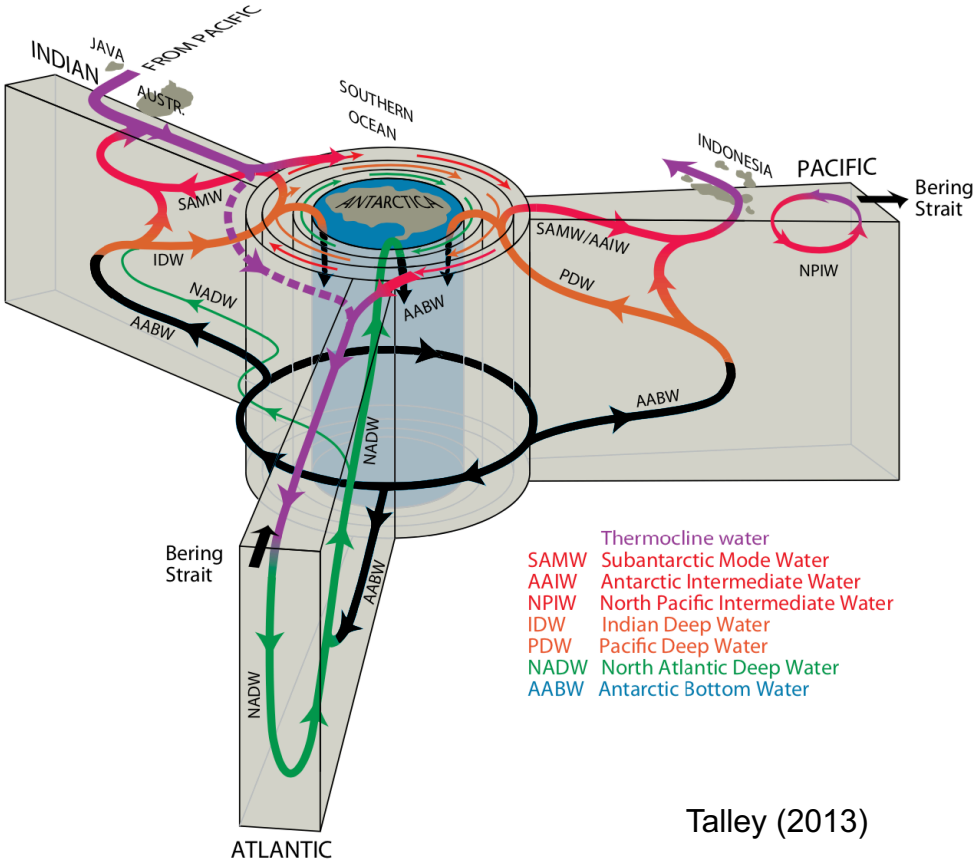


Talley (2013)

AABW

(**A**nt**a**rctic **B**ottom **W**ater)

- Impacts climate

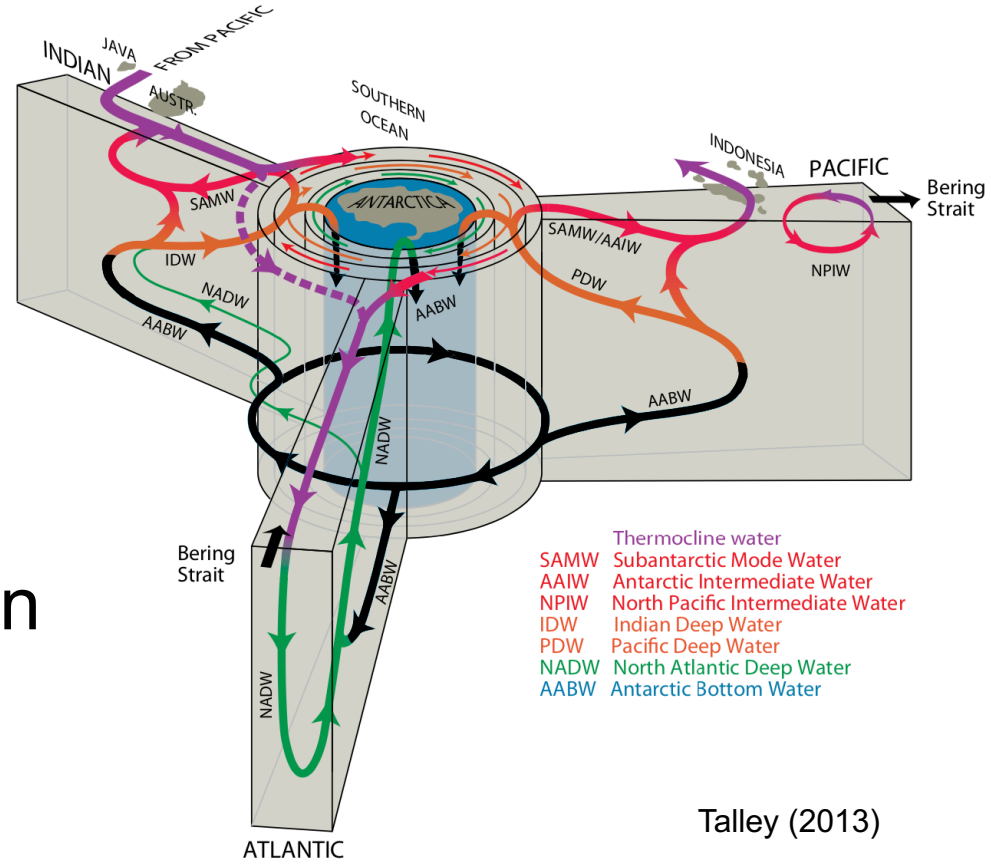


Talley (2013)

AABW

(**A**nta**a**rctic **B**ottom **W**ater)

- Impacts climate
- Variability unknown

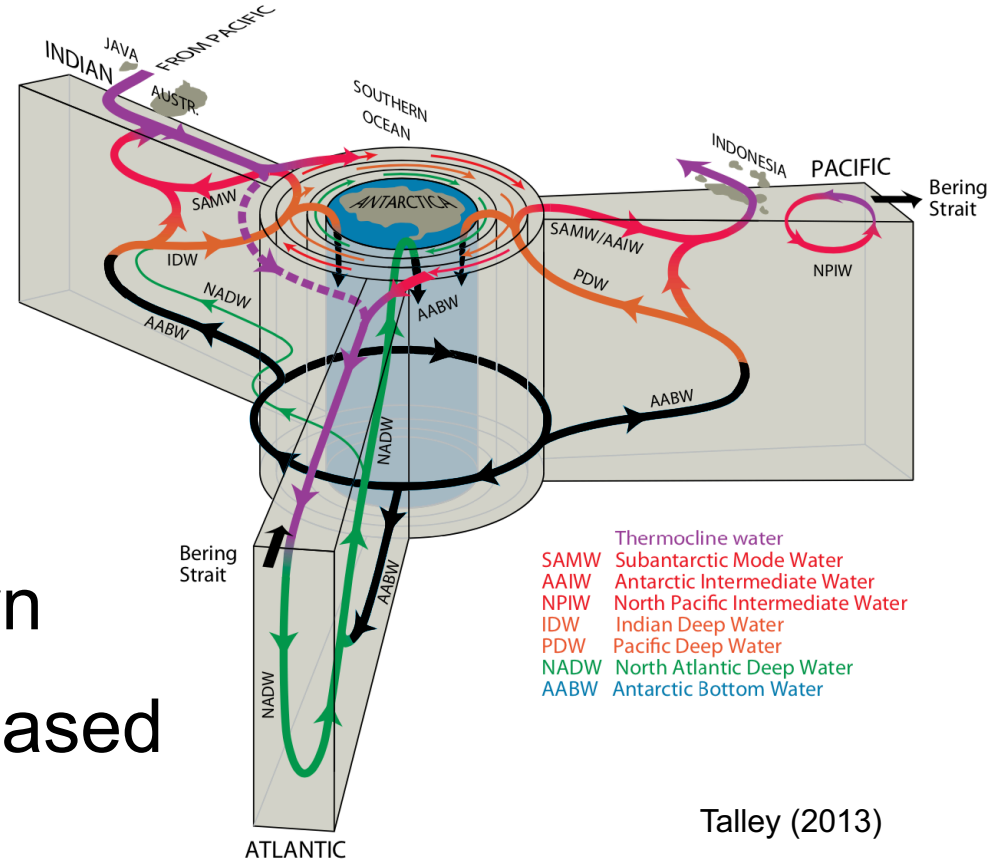


Talley (2013)

AABW

(**A**nta**a**rctic **B**ottom **W**ater)

- Impacts climate
- Variability unknown
- Volume has decreased

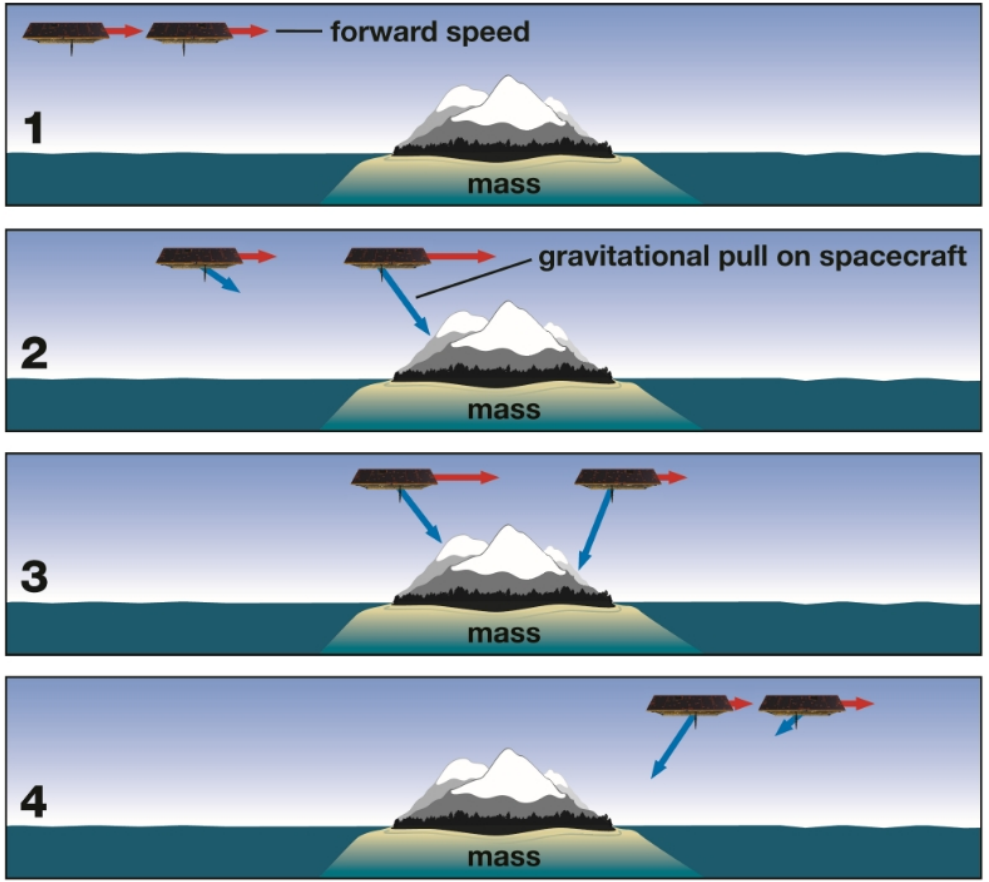


Talley (2013)

GRACE mission

(**G**ravity **R**ecovery **a**nd **C**limate **E**xperiment)

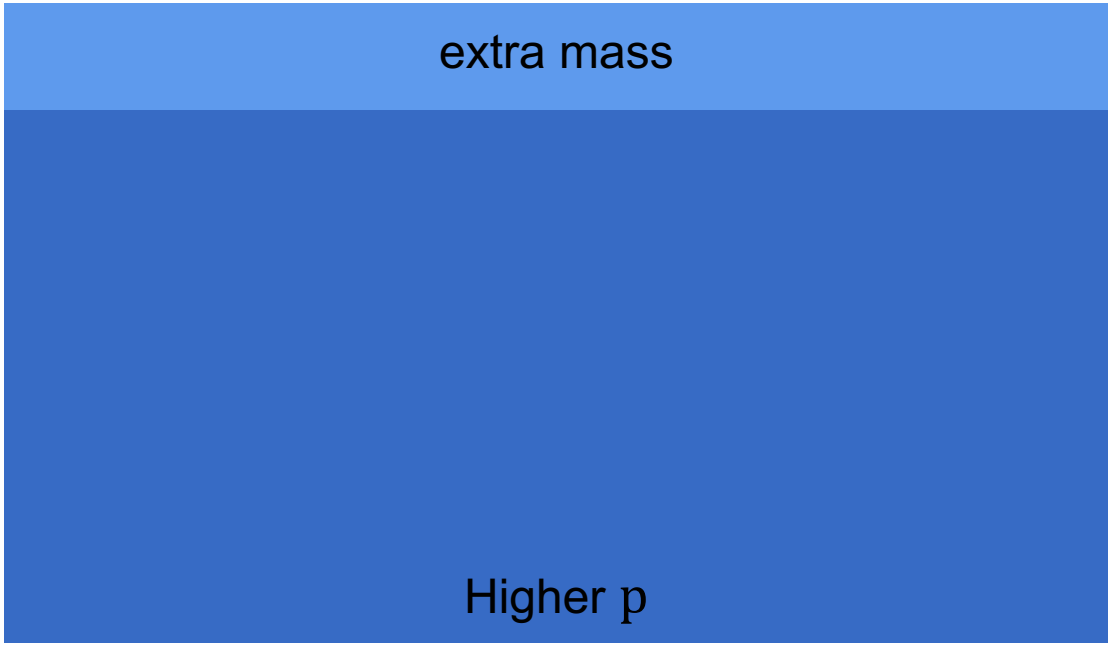
- Measures mass anomalies



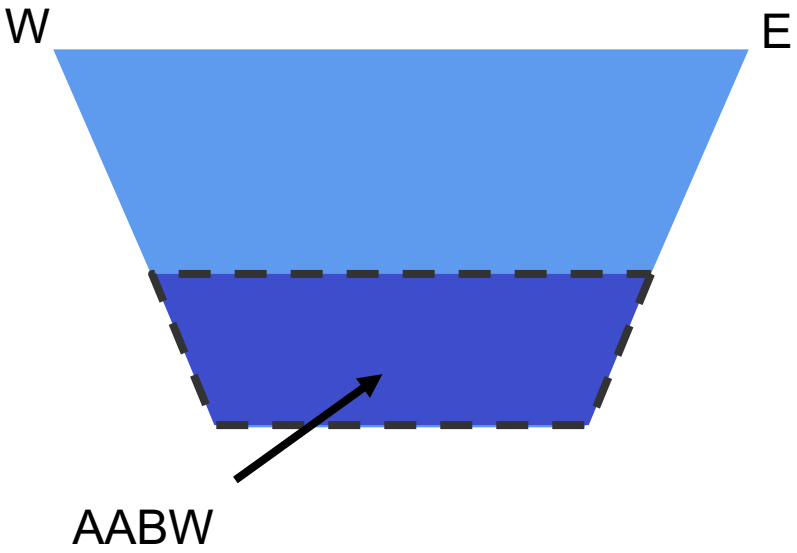
NASA (2022)

GRACE mass observations ≈ pressure

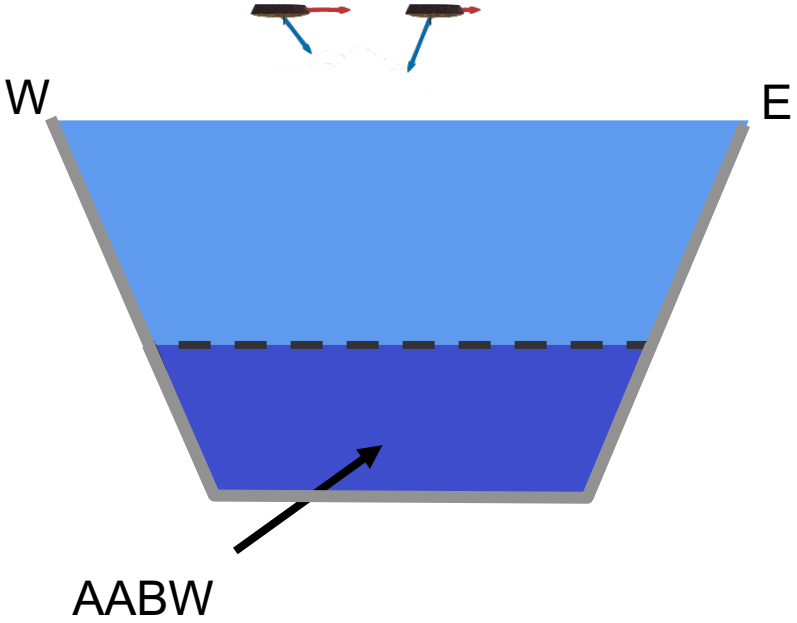
GRACE mass observations ≈ pressure



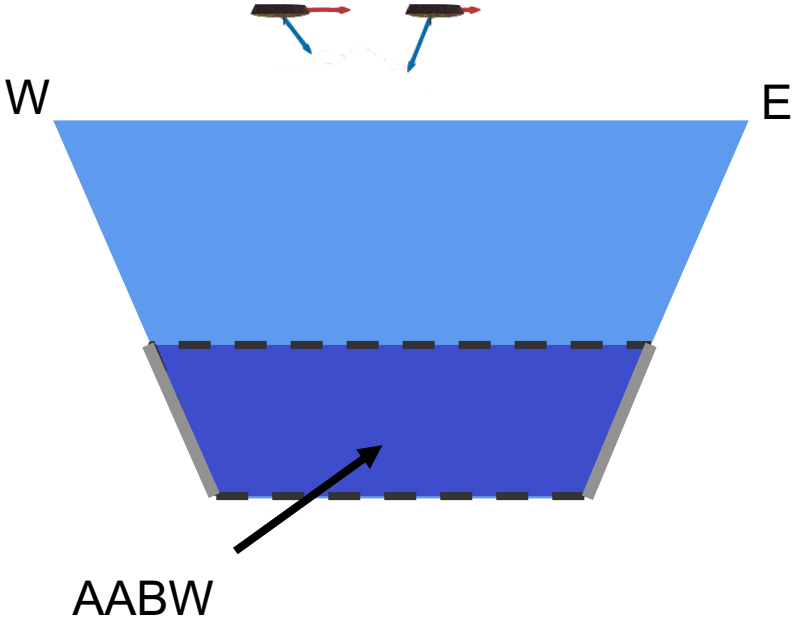
Why GRACE should be useful



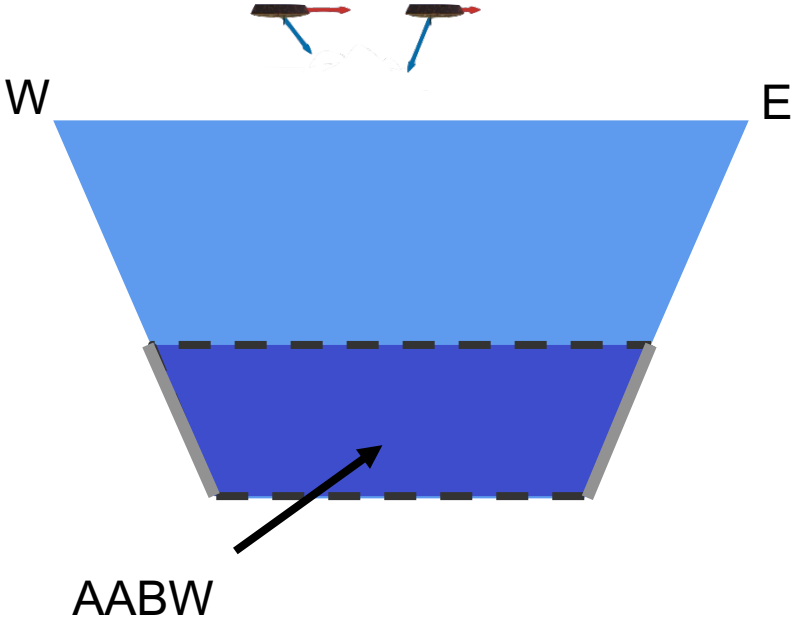
Why GRACE should be useful



Why GRACE should be useful



Why GRACE should be useful



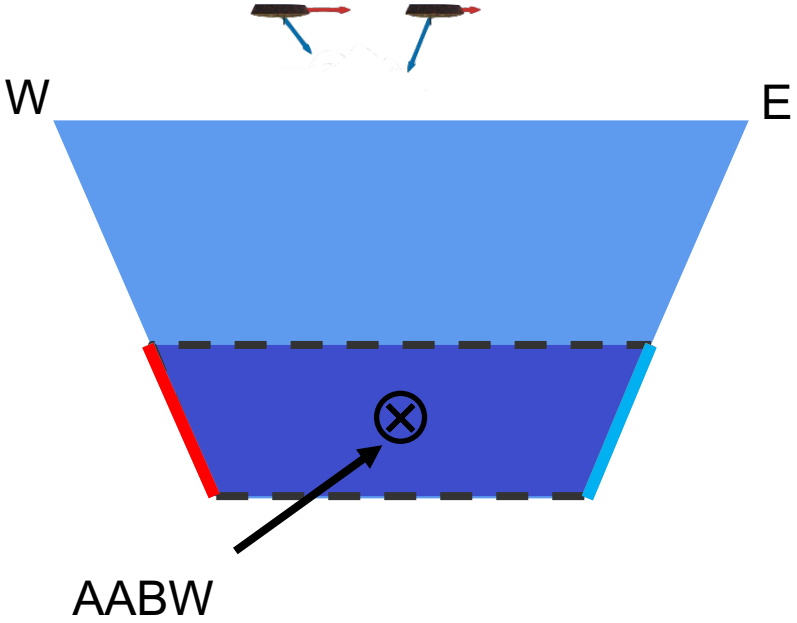
pressure change with longitude

$$\frac{1}{\rho}\frac{\partial p}{\partial x} = f v$$

northward velocity

constant

Why GRACE should be useful



pressure change with longitude

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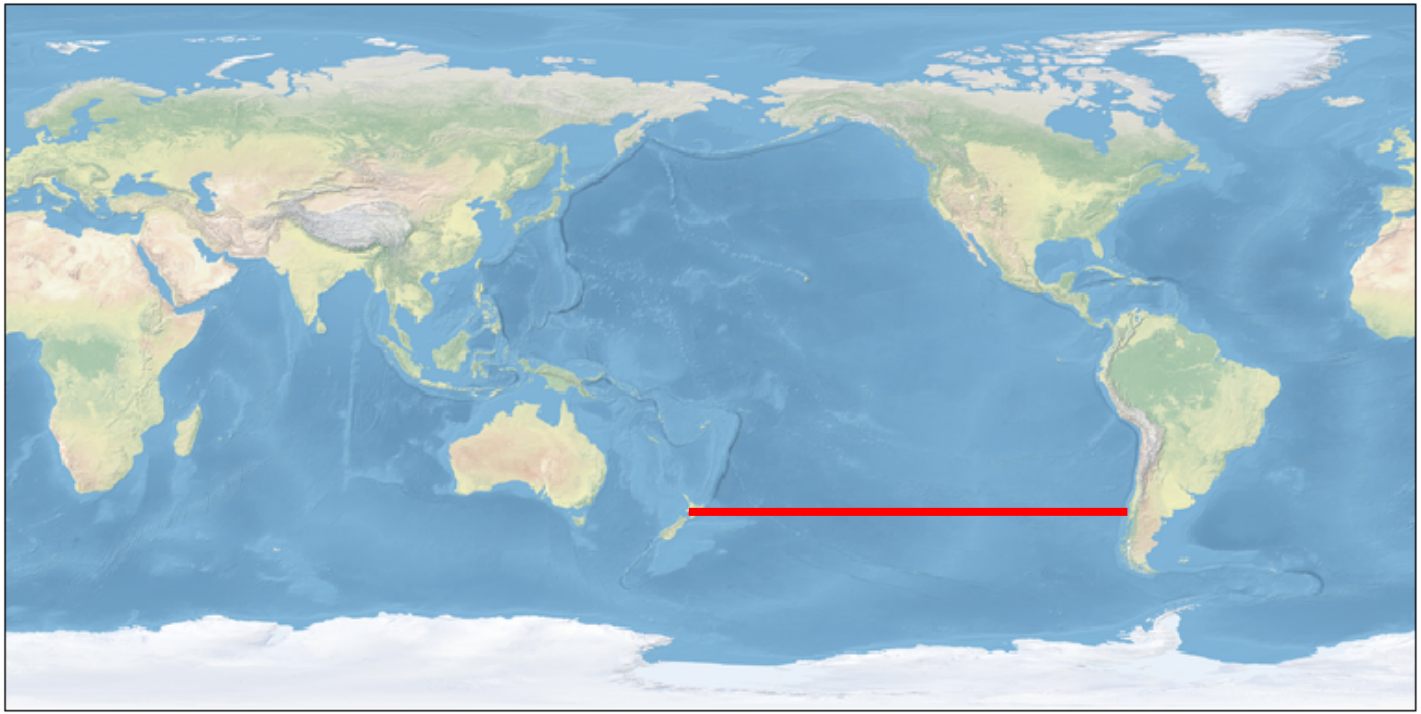
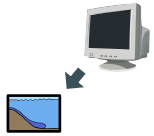
northward velocity

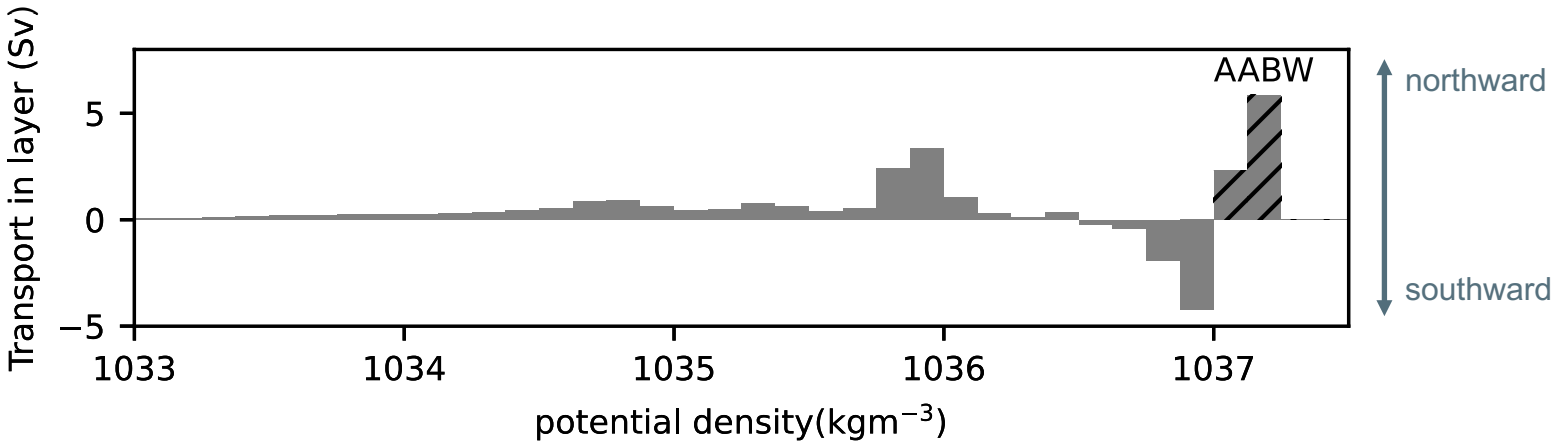
constant

AABW in ACCESS-OM2-01

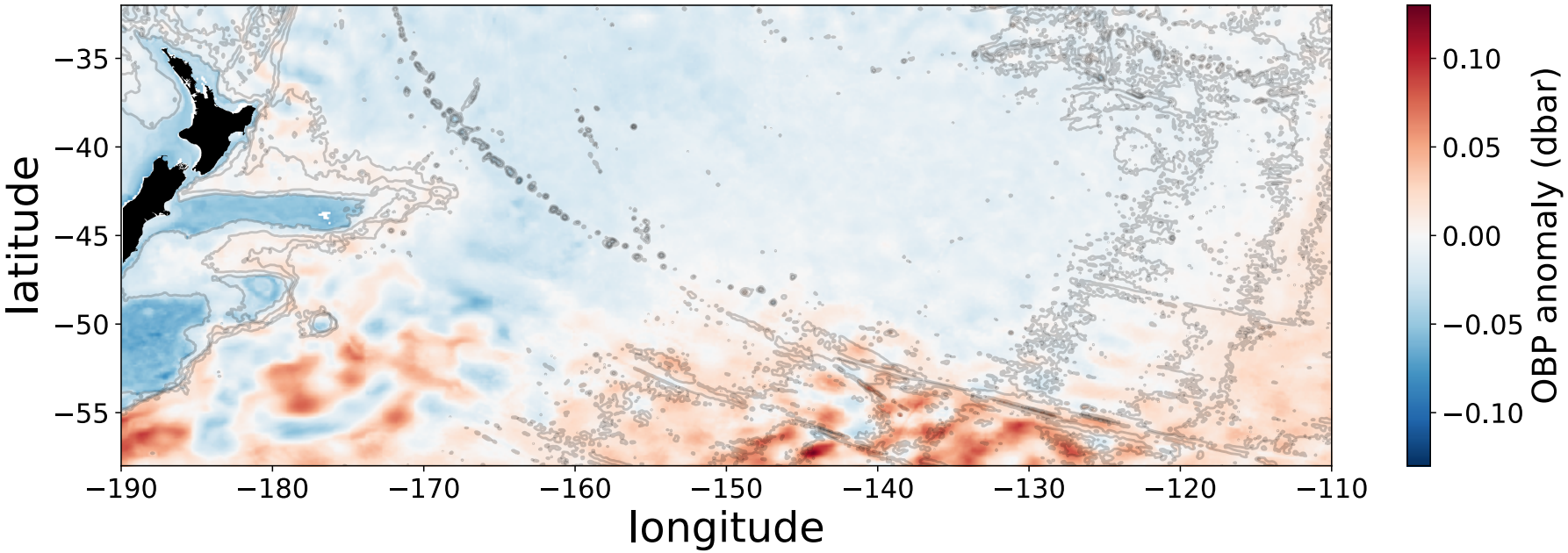


AABW in ACCESS-OM2-01

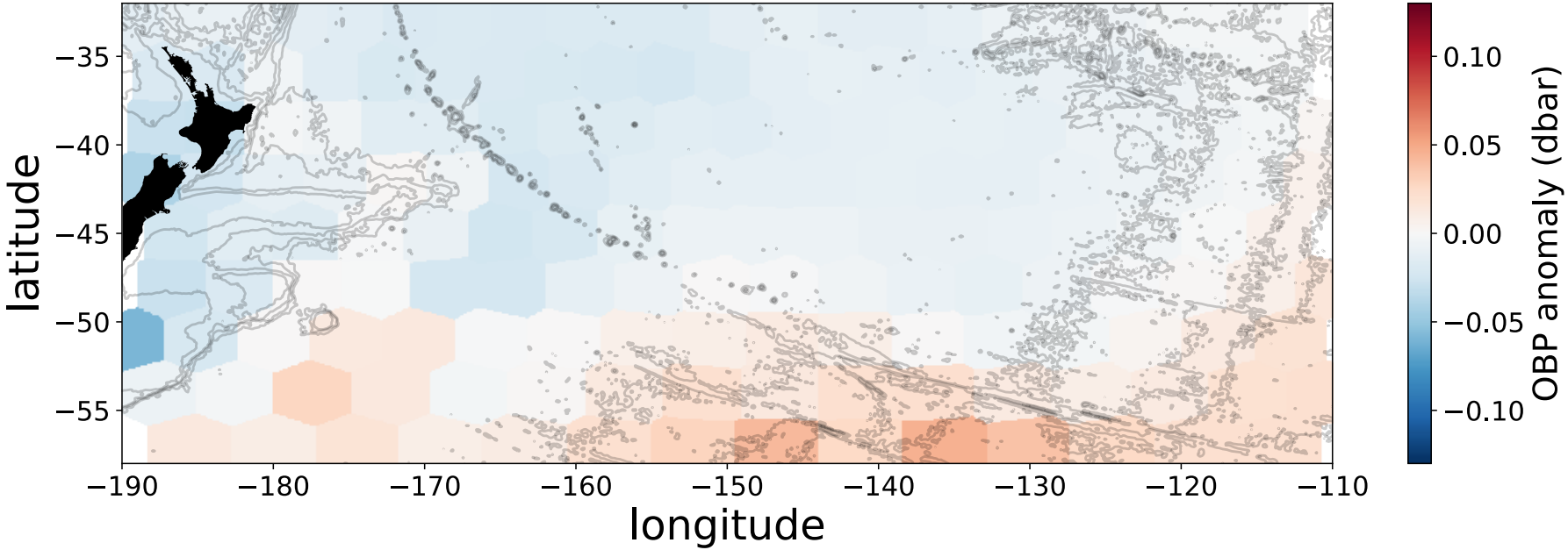




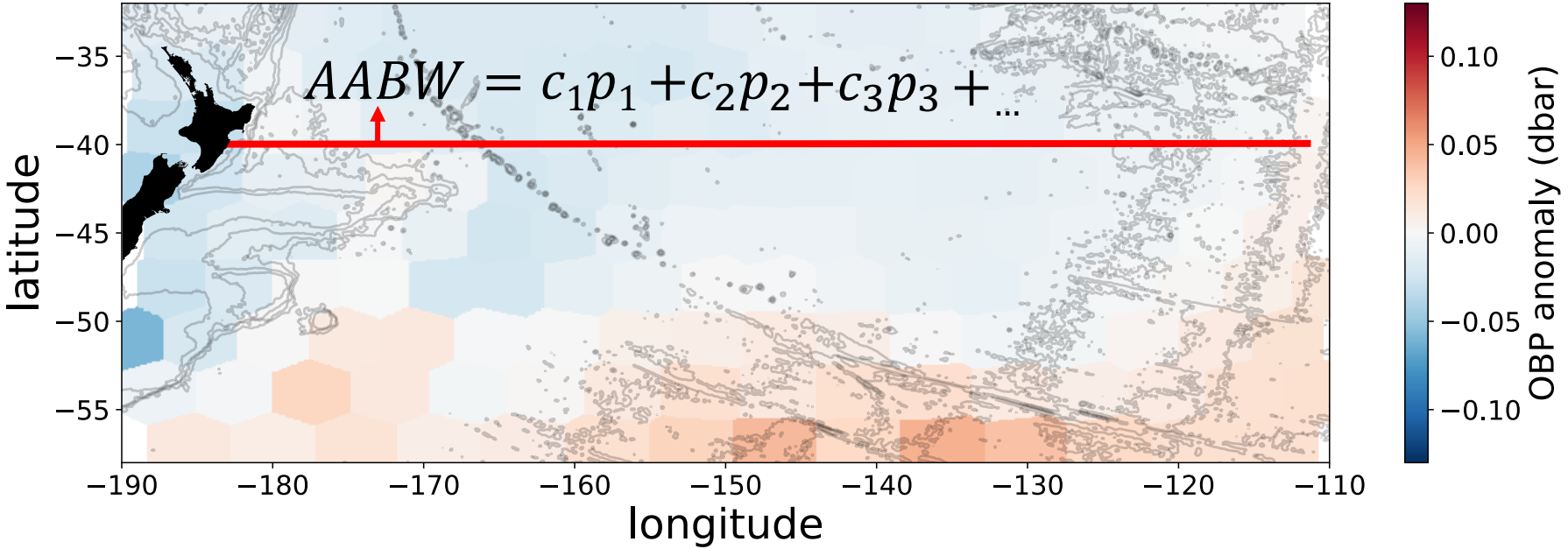
GRACE in ACCESS-OM2-01



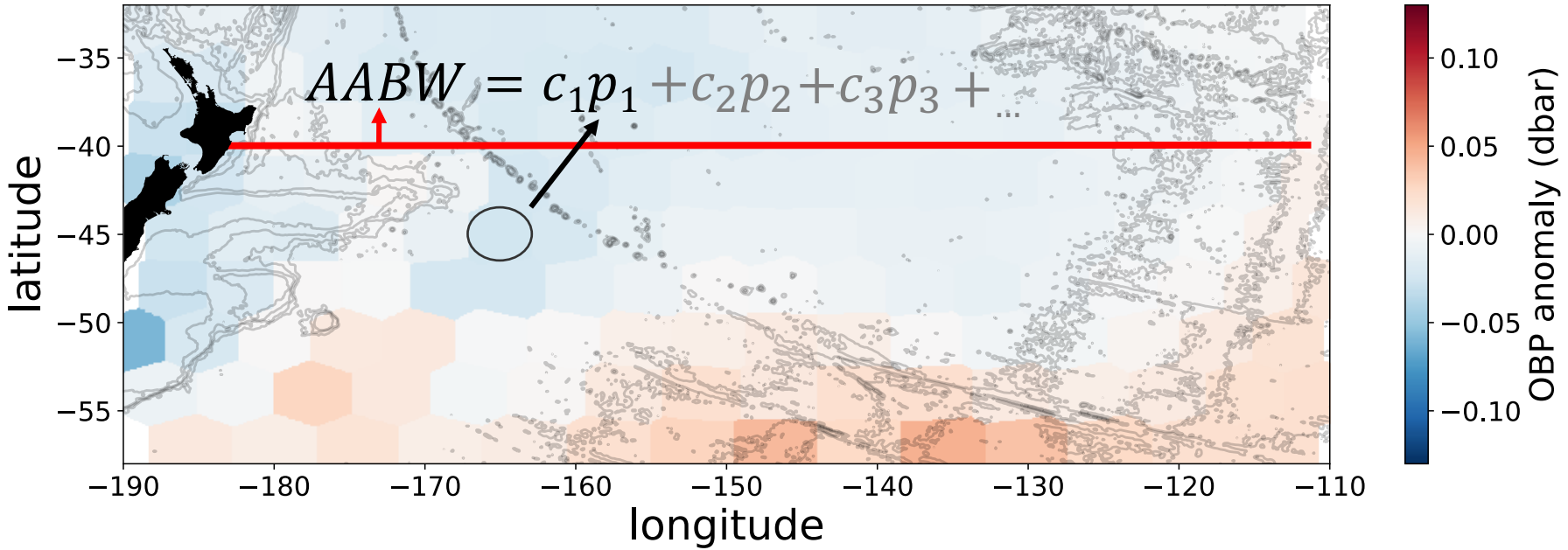
GRACE in ACCESS-OM2-01



Link AABW to GRACE



Link AABW to GRACE



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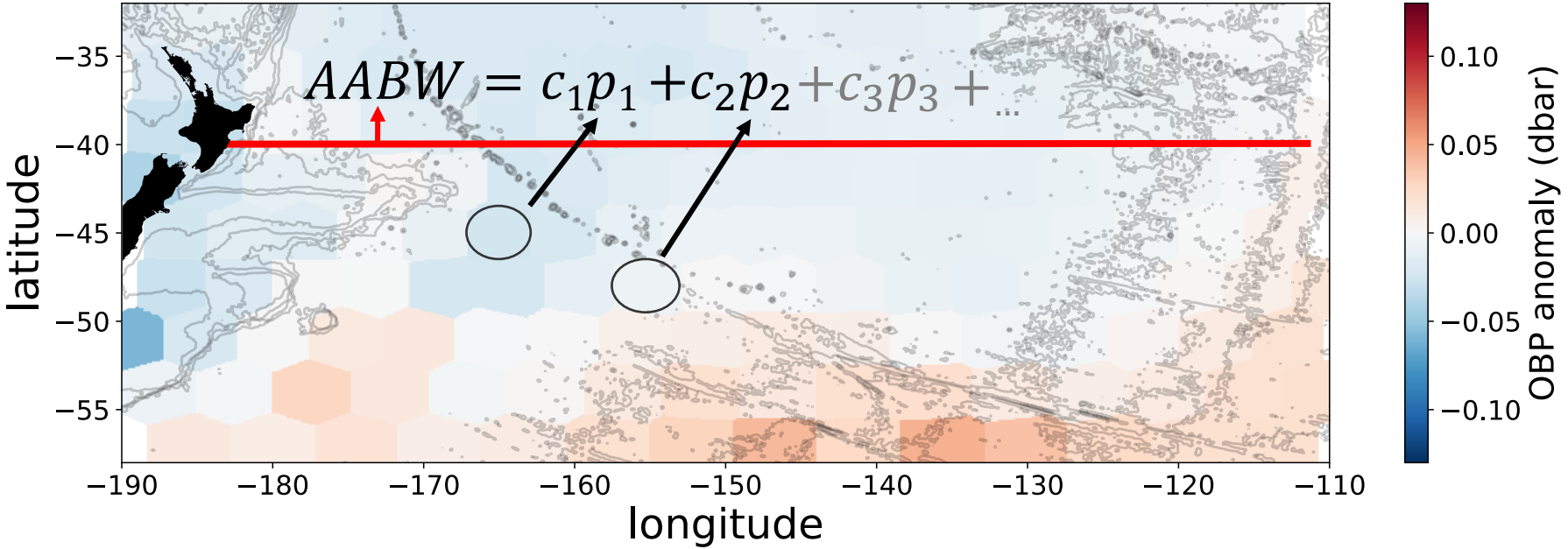
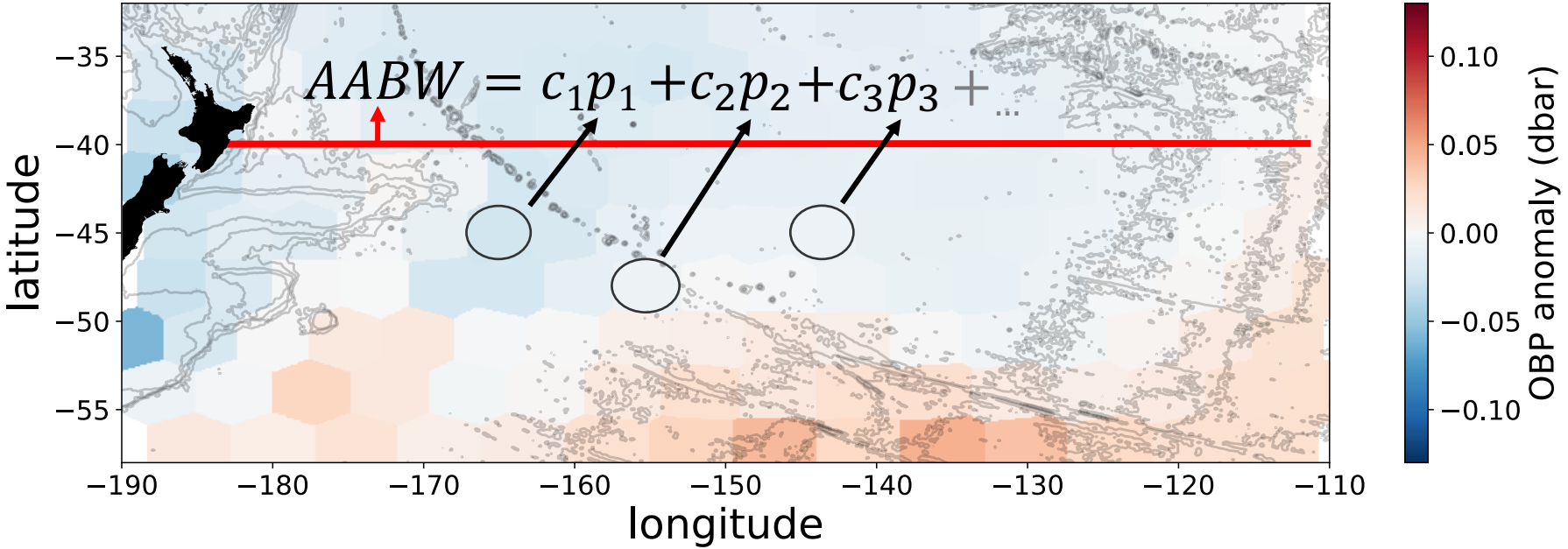
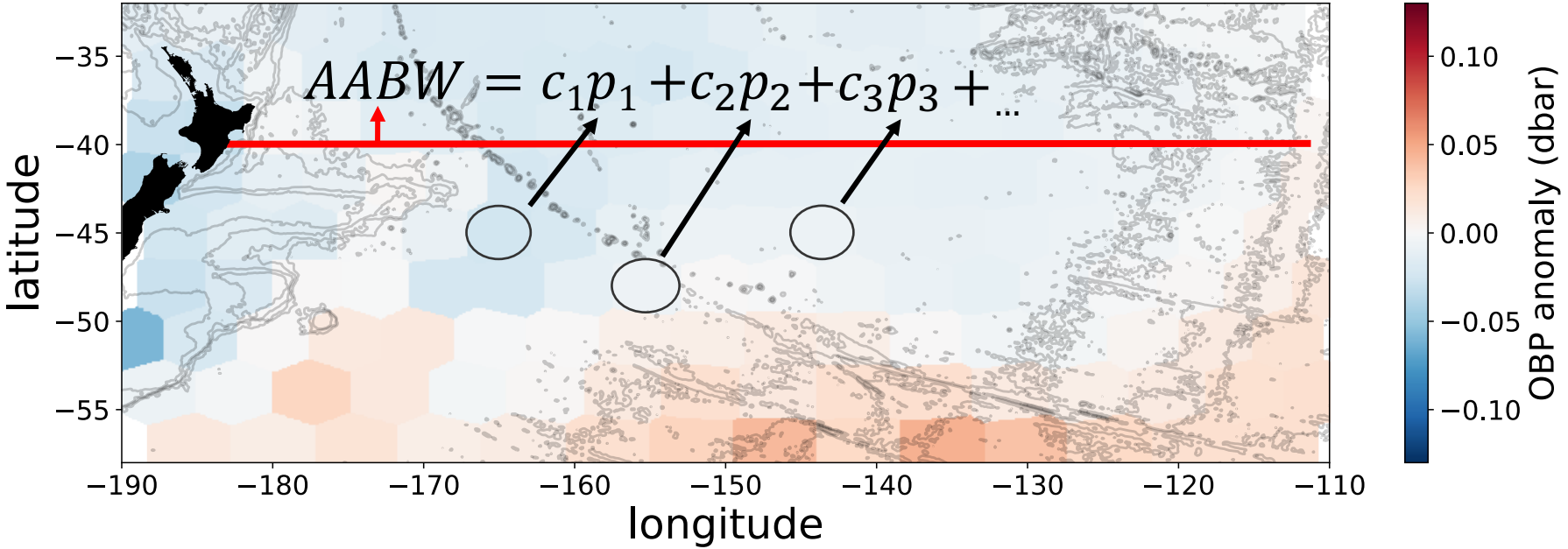


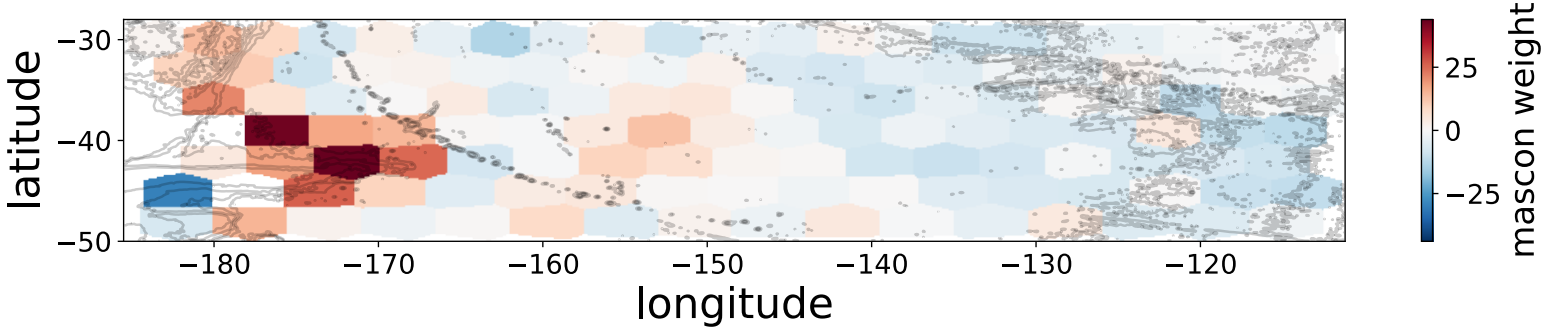
Link AABW to GRACE



Link AABW to GRACE

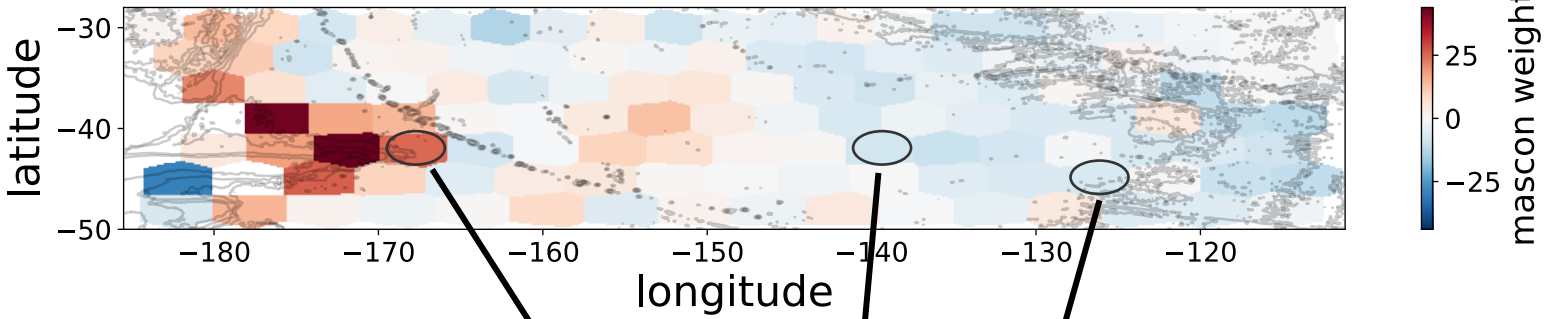


Linear regression result in model



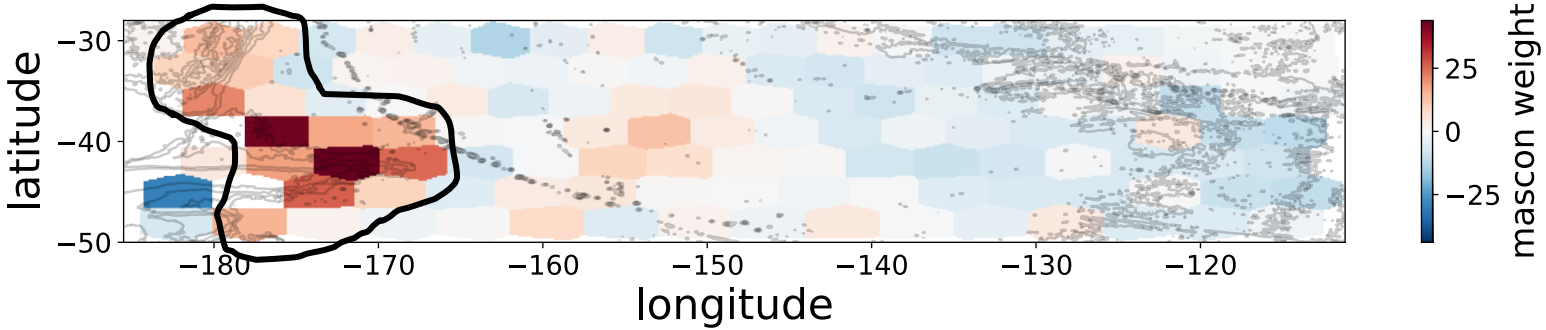
$$AABW = c_1 p_1 + c_2 p_2 + c_3 p_3 \ldots$$

Linear regression result in model



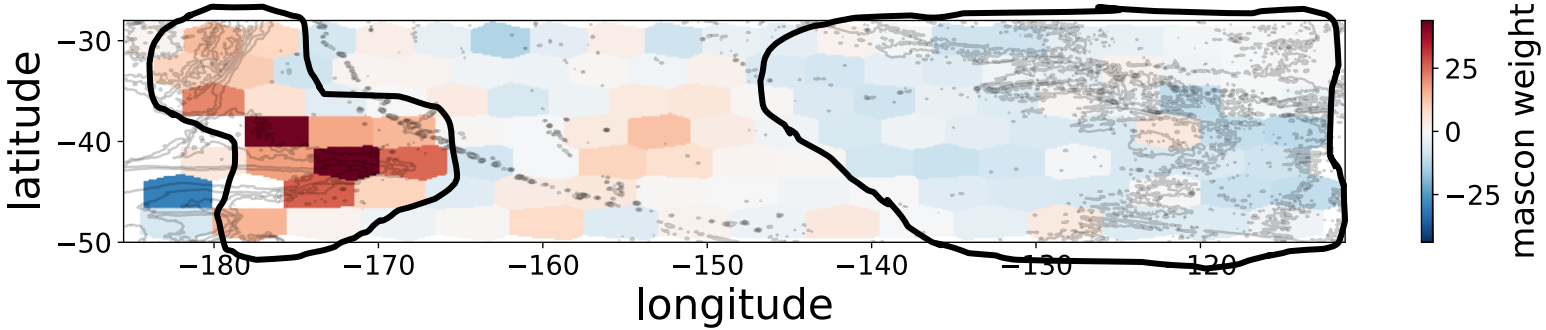
$$AABW = c_1 p_1 + c_2 p_2 + c_3 p_3 \ldots$$

Linear regression result in model



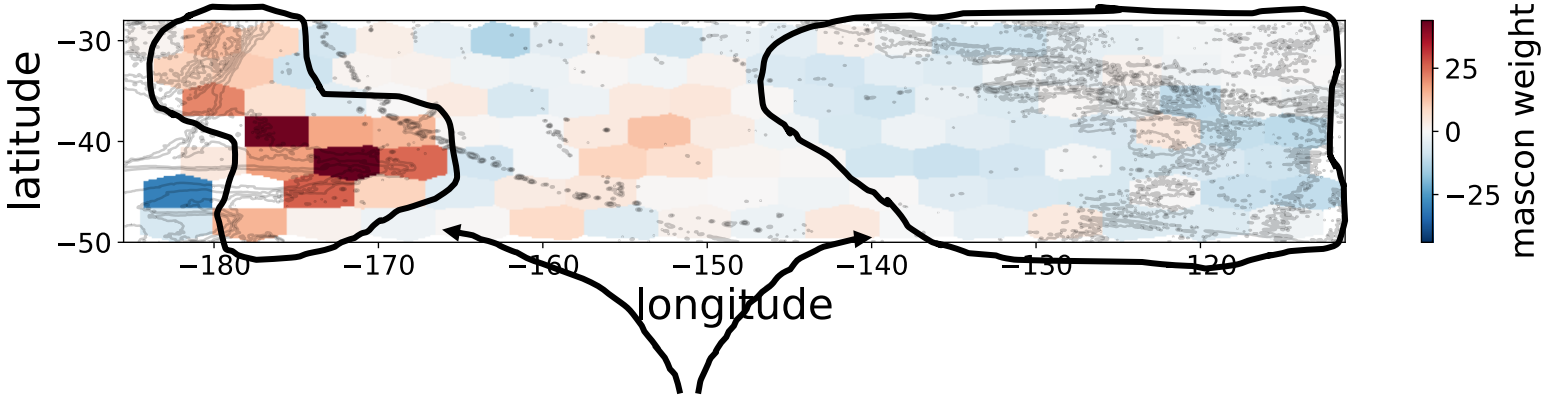
$$AABW = c_1 p_1 + c_2 p_2 + c_3 p_3 \ldots$$

Linear regression result in model



$$AABW = c_1 p_1 + c_2 p_2 + c_3 p_3 \ldots$$

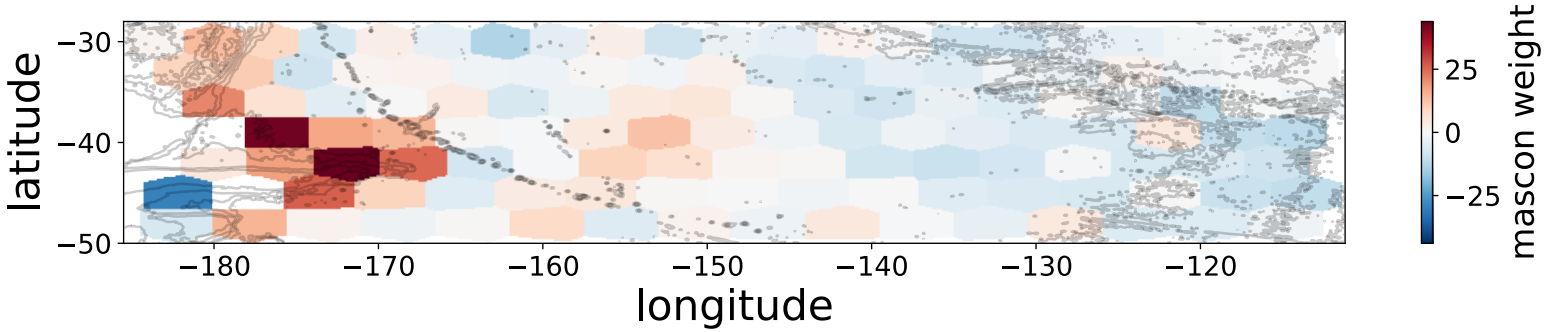
Linear regression result in model

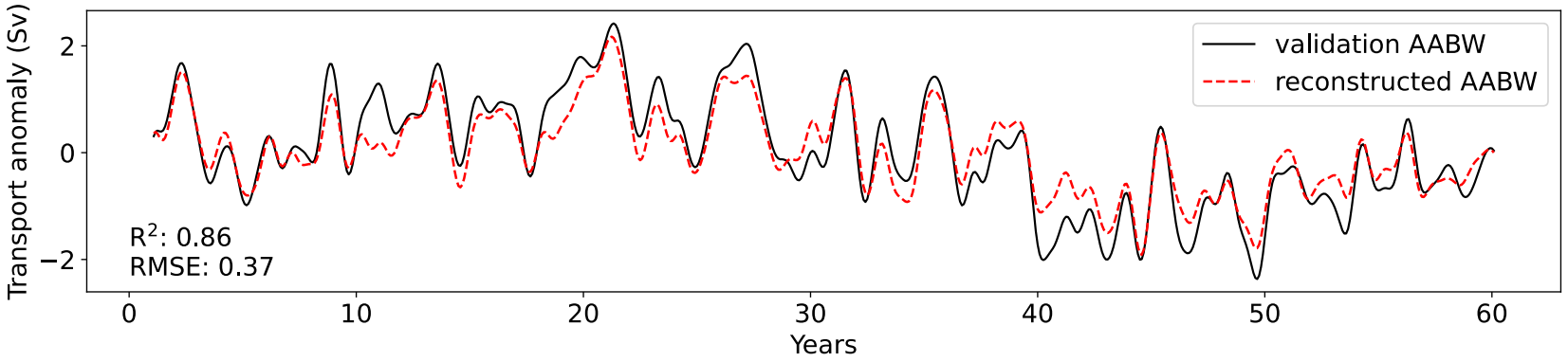


$$\frac{1}{\rho}\frac{\partial p}{\partial x} = fv$$

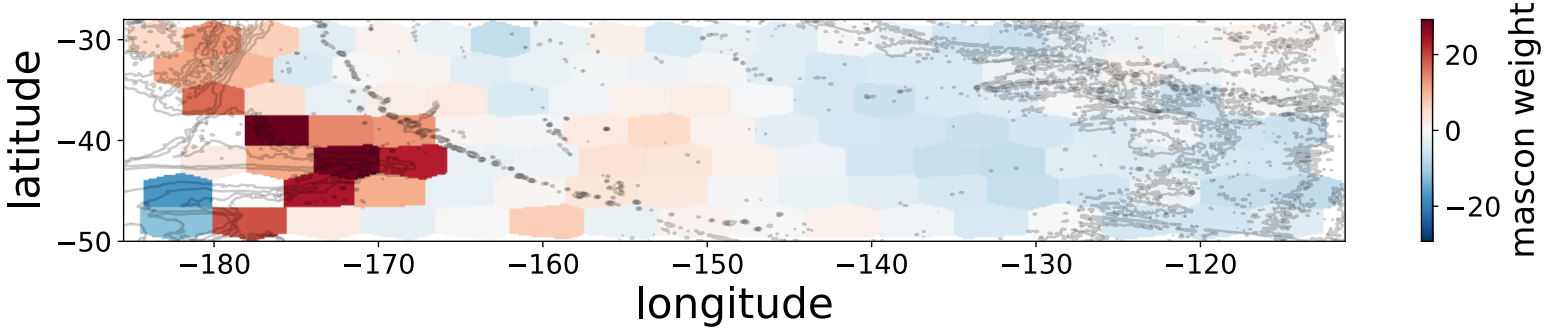
$$AABW = c_1 p_1 + c_2 p_2 + c_3 p_3 \ldots$$

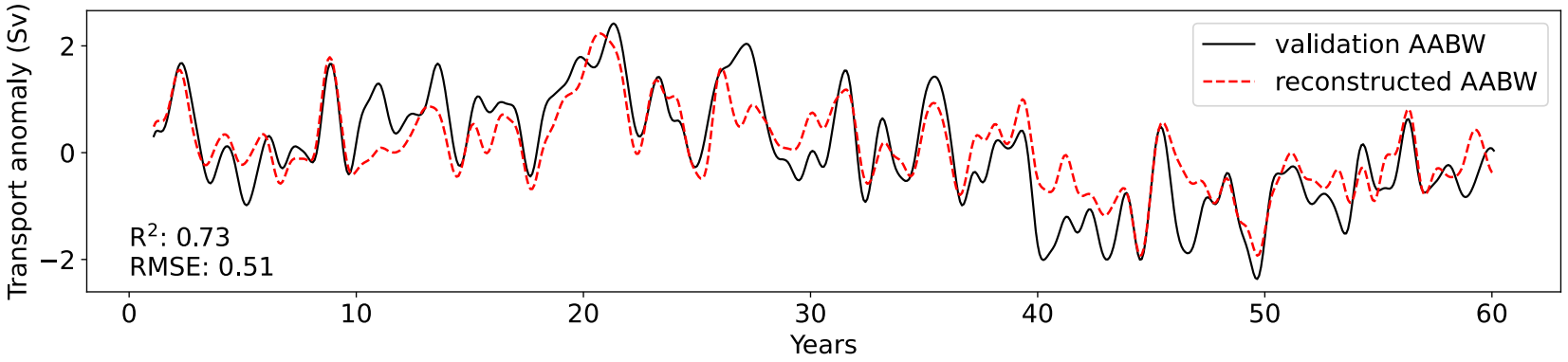
Linear regression result in model



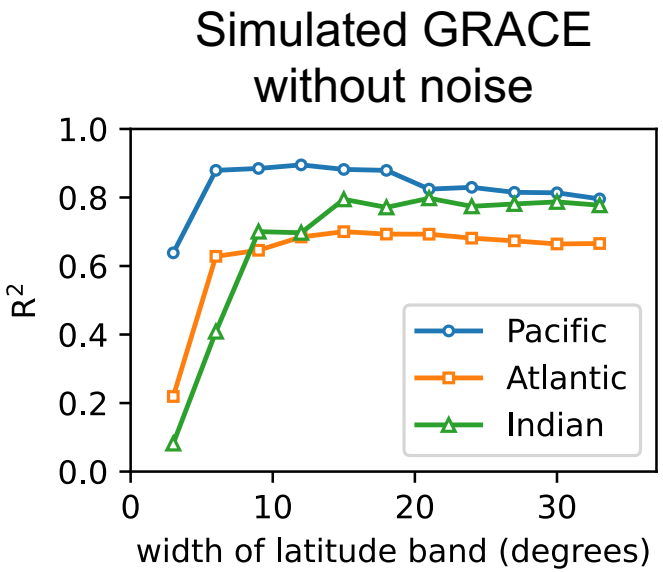


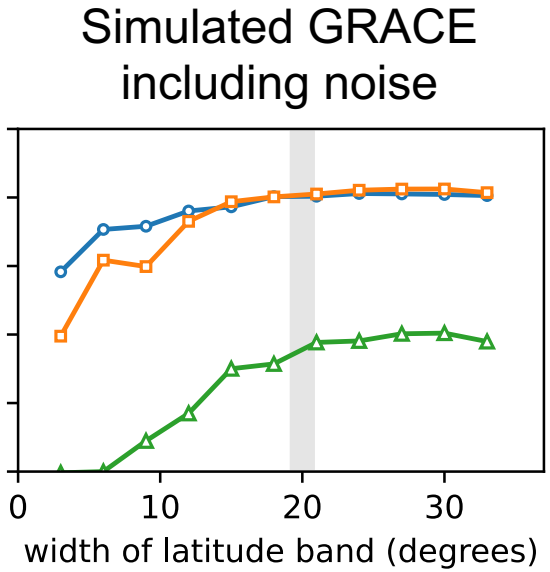
Linear regression result in model (noisy)



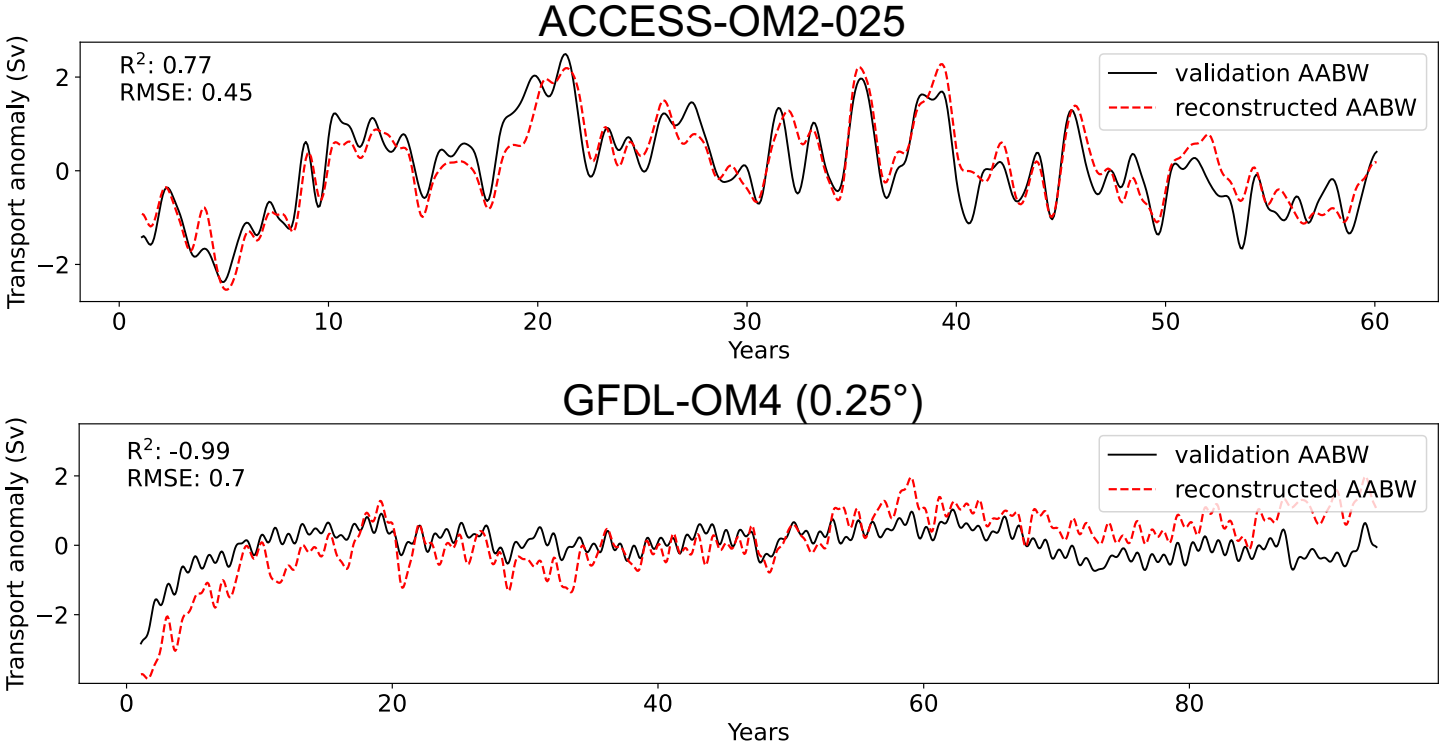


Optimisation example: latitude

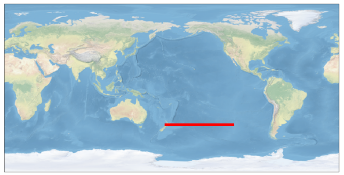


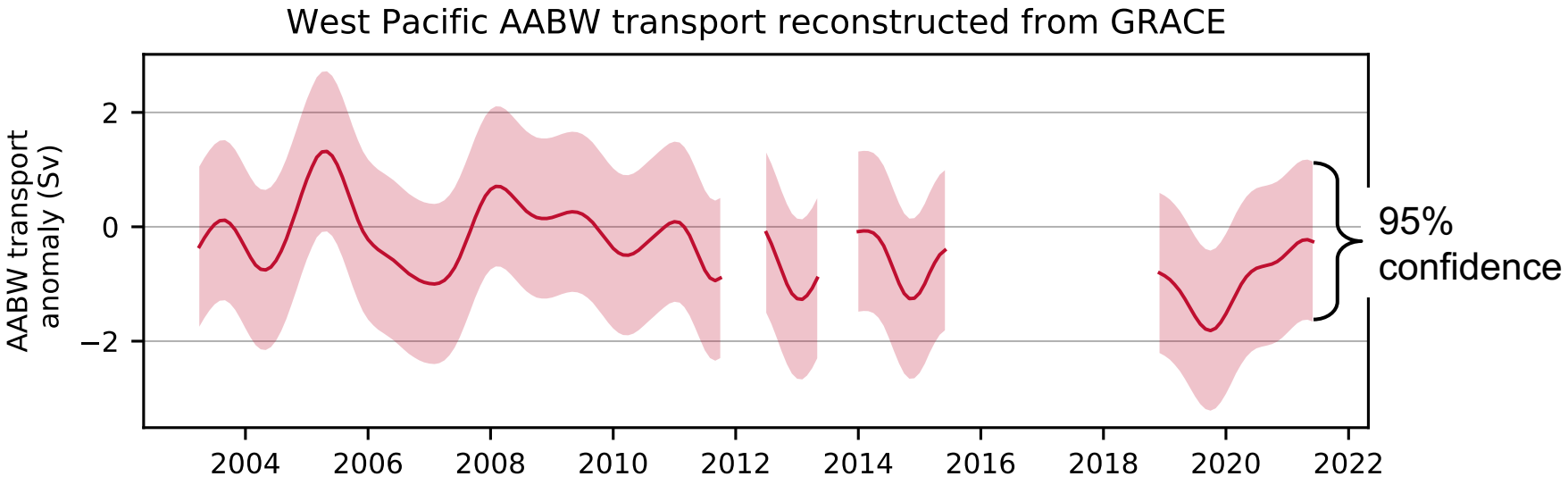


Test in other models (with noise)

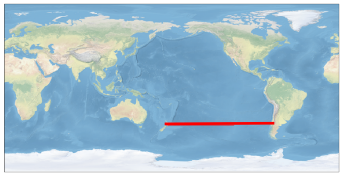


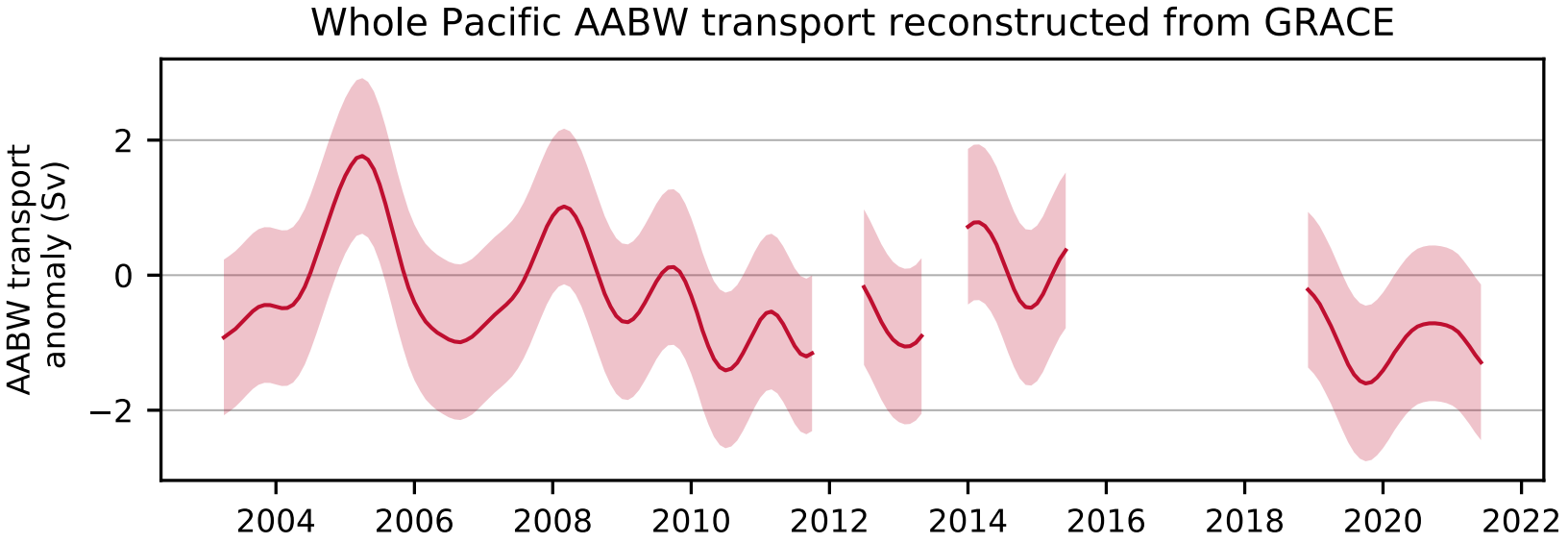
An estimate of AABW transport



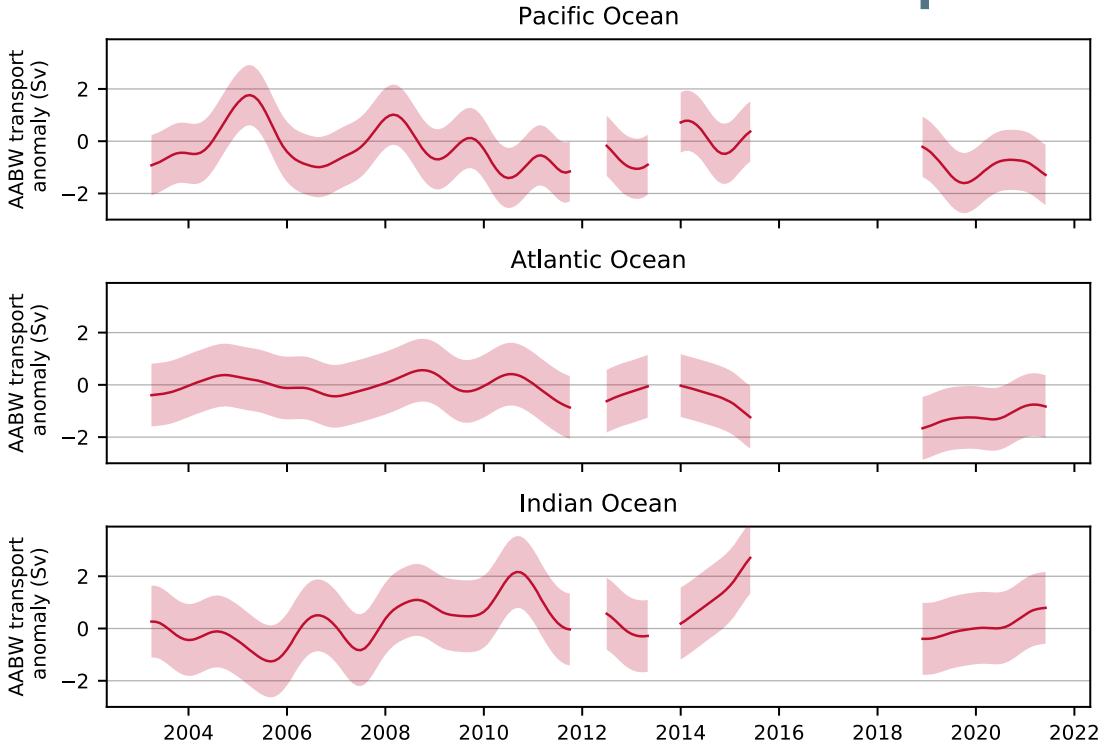


An estimate of AABW transport



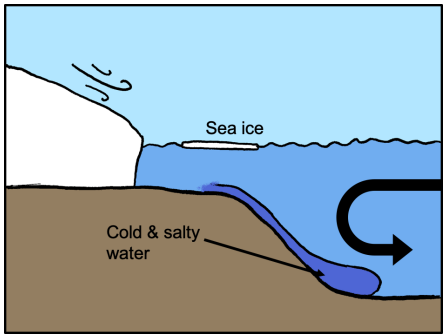


An estimate of AABW transport



Conclusions

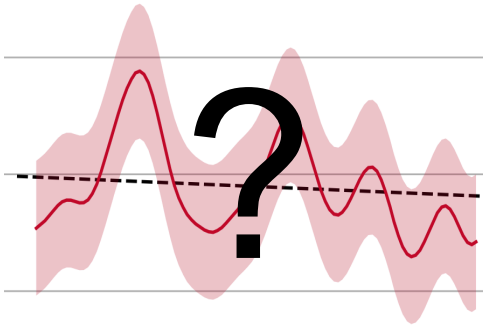
First estimate of AABW transport variability



Conclusions

First estimate of AABW transport variability

- No clear response to climate change

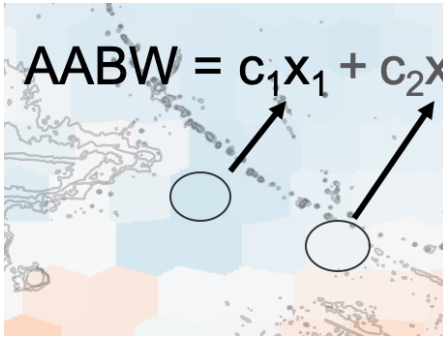


Conclusions

First estimate of AABW transport variability

⇢ No clear response to climate change

Modelling satellite data shows how it might be used



Conclusions

First estimate of AABW transport variability

⇢ No clear response to climate change

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