Salinity Variation in Seawater

Dielectric Model Function

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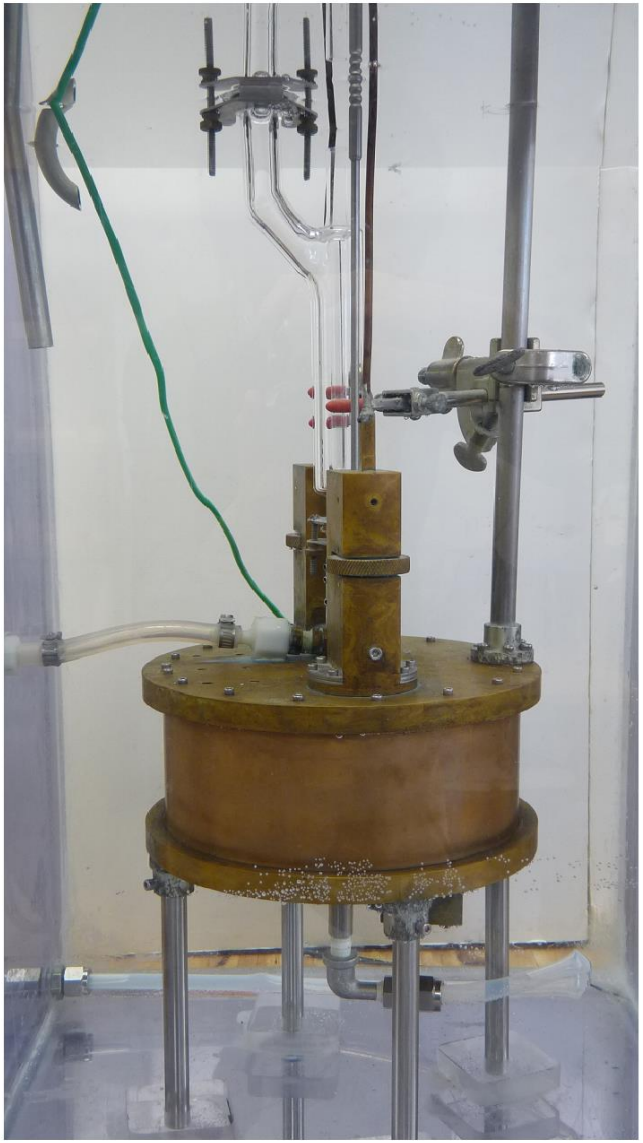
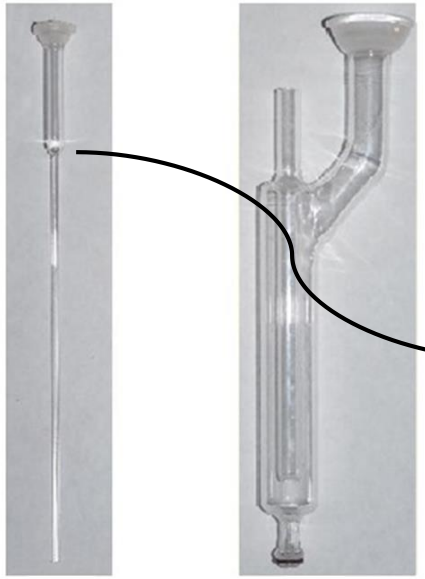
Outline

- GW 2017 model
- Linearity of SSS variation and Updated Model
- Salinity Retrieval Results

Experiment Setup

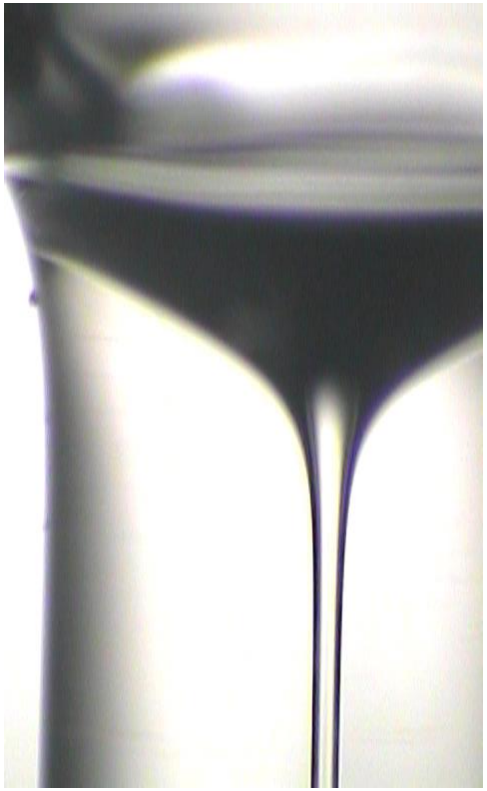


A



B C

D



2017 Model

- GW Model Function is expressed in terms of a polynomial in *S* and *T*,

$$\varepsilon_{GW}(S,T) = \sum_{m=0}^{3}\sum_{n=0}^{3} p_{m,n} S^m T^n$$

where,

$$p_{m,n} = p'_{m,n} + jp''_{m,n}$$

- Obtain more accurate fit compared with the Debye expression at a single frequency
- linearly related to the model function --- direct solution by SVD method

New measurements

PSU T	-1.5	-1	0	2	3	5	10	15	20	25	30	35
0												
10												
20												
30												
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34												
35												
36												
38												

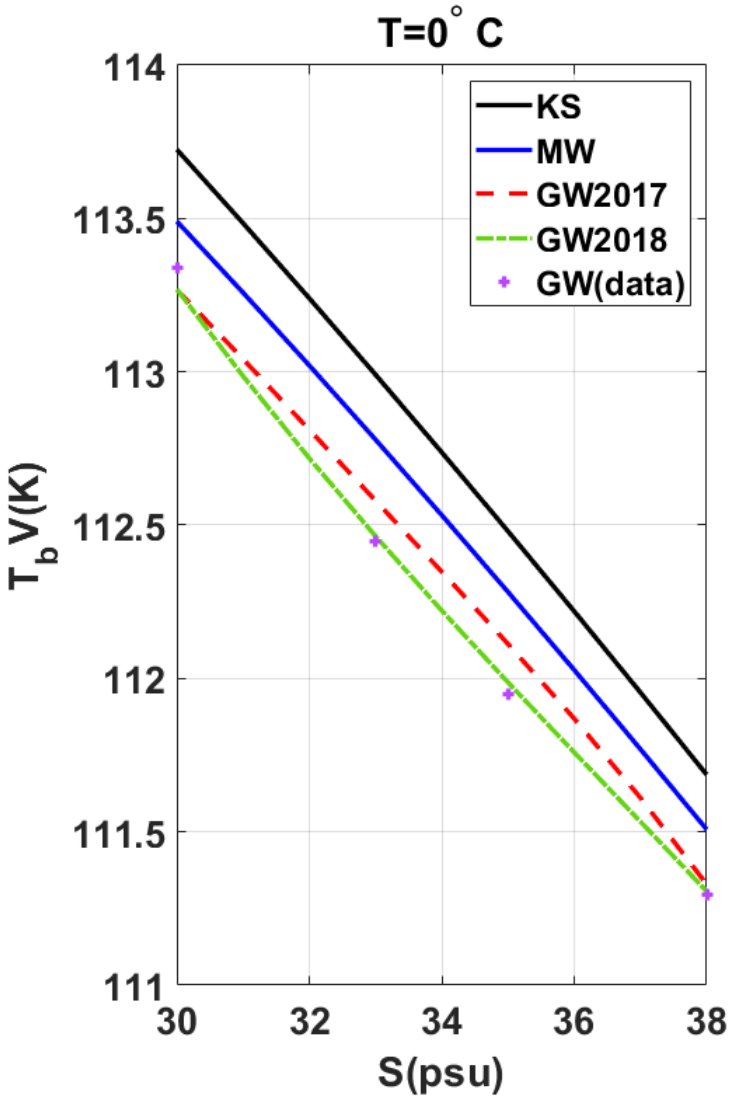
Original Measurements (GW2017)

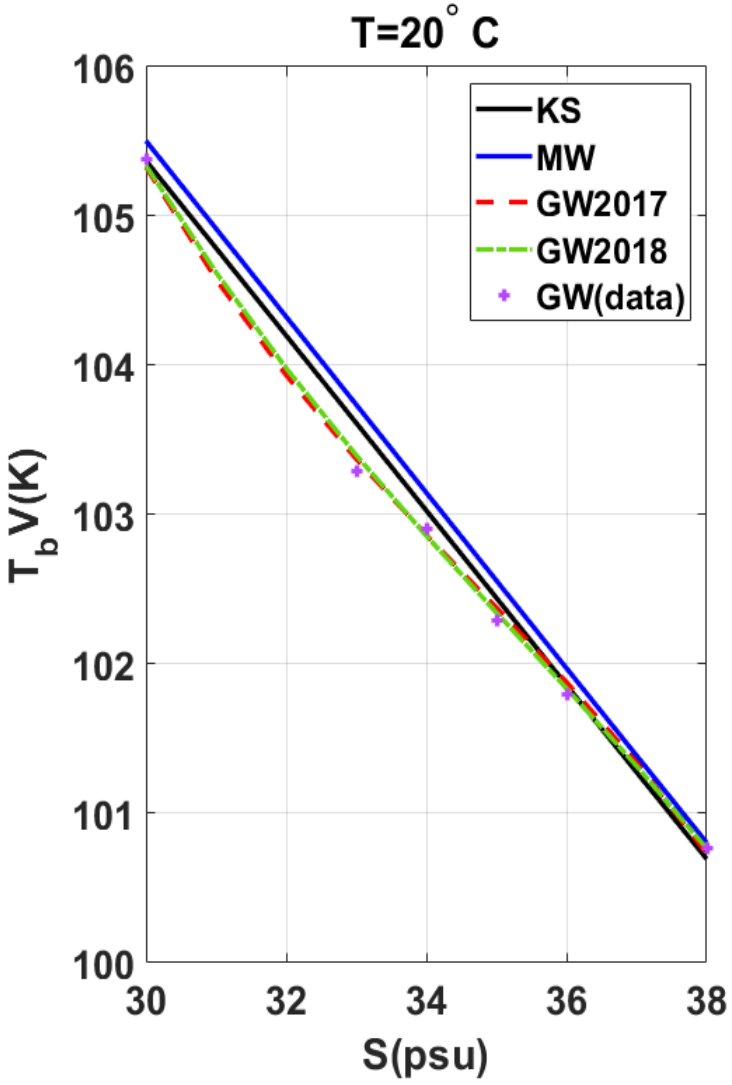
Recent Measurements

Measurements ongoing

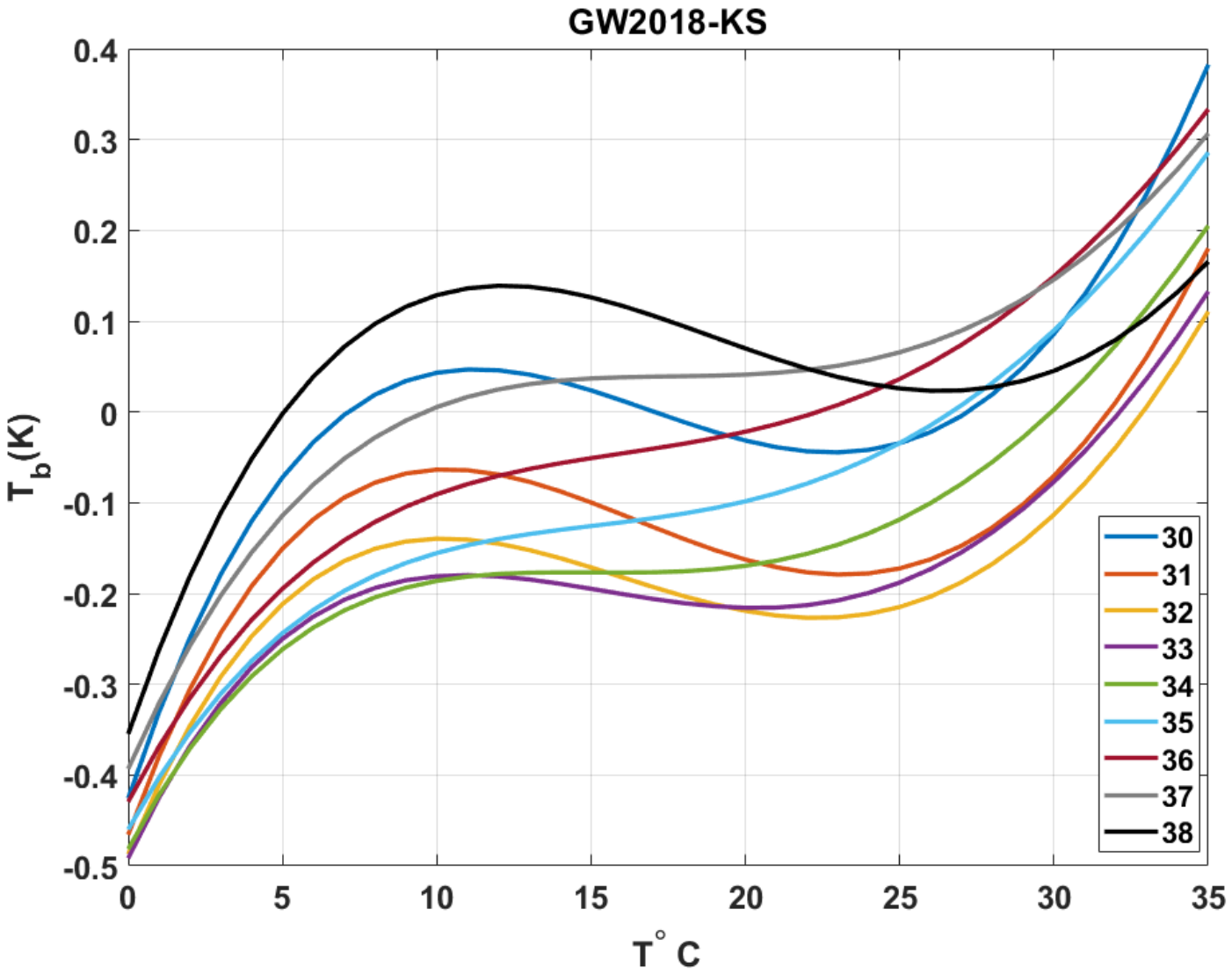
GW2018, GW2019

Brightness Temperature vs Salinity

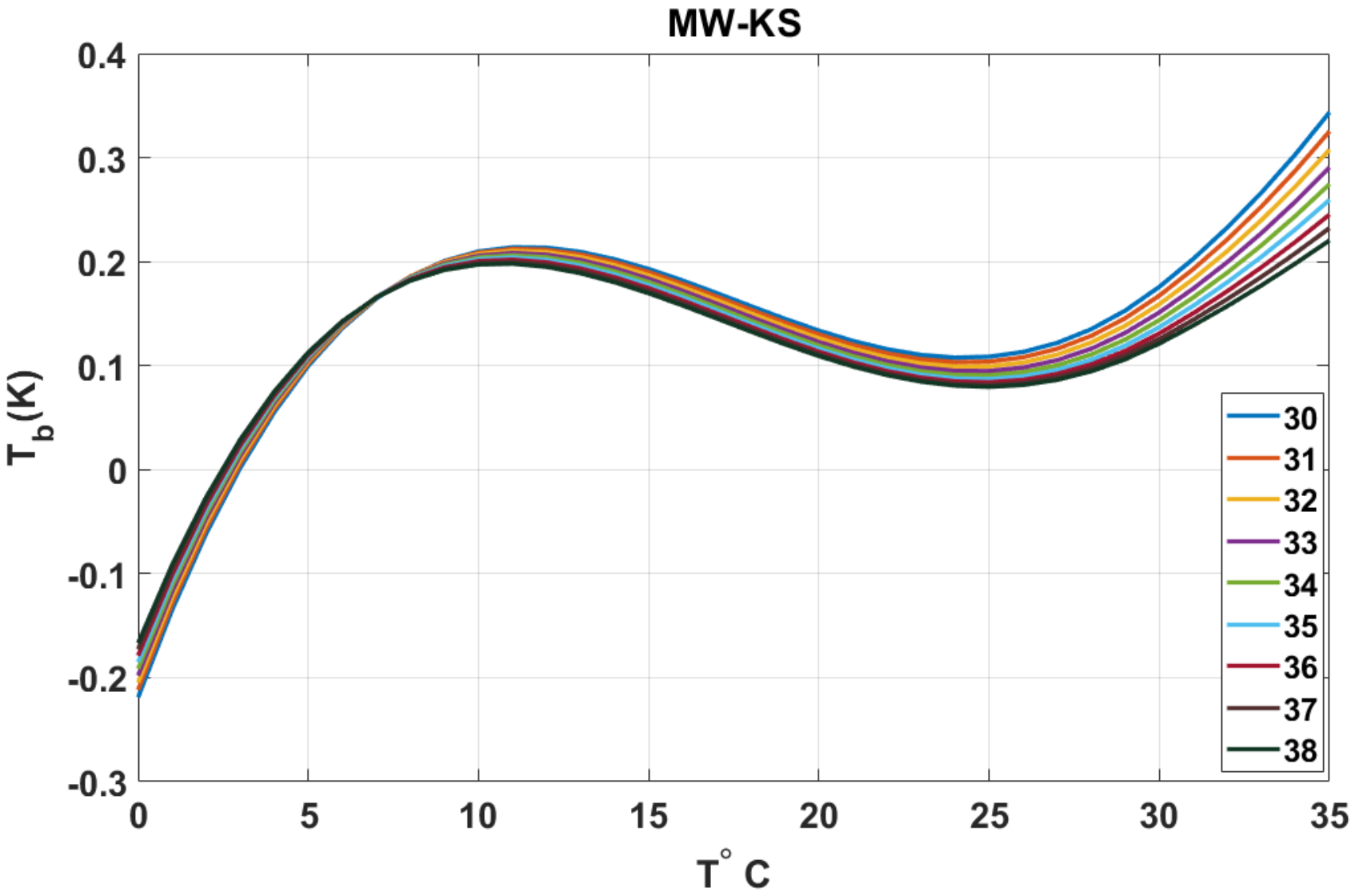




Difference in Brightness Temperature



Difference in Brightness Temperature



Linearity of SSS variation and Updated Model

$$\varepsilon_r(\omega,T,S)=\varepsilon_\infty(T)+\frac{\varepsilon_s(T)(1-\alpha(T)S)-\varepsilon_\infty(T)}{1+j\omega\tau(T)}-\frac{j\sigma(T,S)}{\omega\varepsilon_0}$$

Somaraju and Trumpf,
"Frequency, Temperature and Salinity Variation of the Permittivity of Seawater"
, TAP, vol. 54, no. 11, 2006

Linearity of SSS variation and Updated Model

$$\varepsilon_{GW}(S,T) = \sum_{m=0}^{3}\sum_{n=0}^{3} p_{m,n} S^m T^n$$

$$RMSE' = 0.09$$

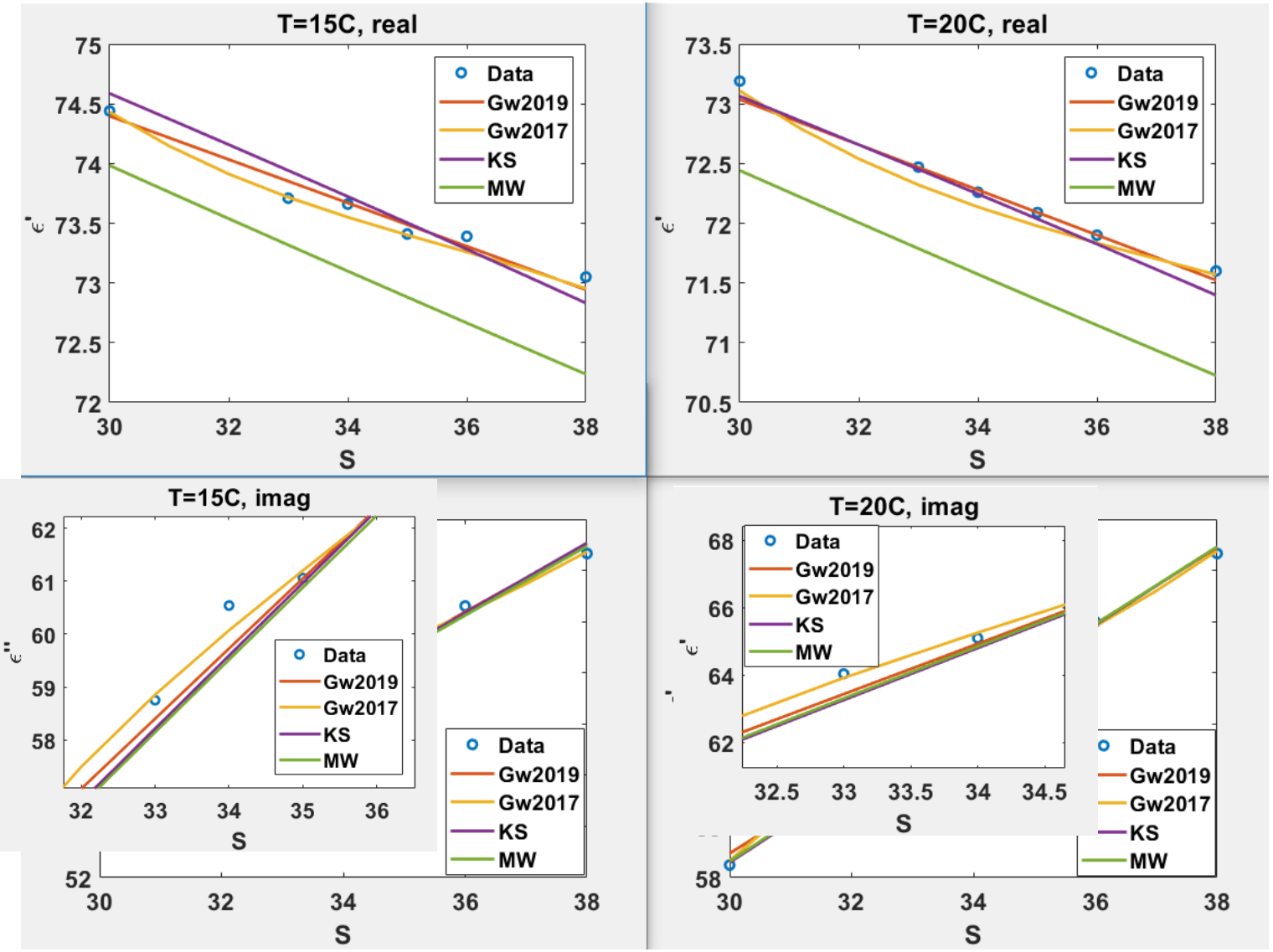
$$RMSE'' = 0.2$$

$$\varepsilon_{GW\,2019}(S,T) = \sum_{m=0}^{1}\sum_{n=0}^{3} p_{m,n} S^m T^n$$

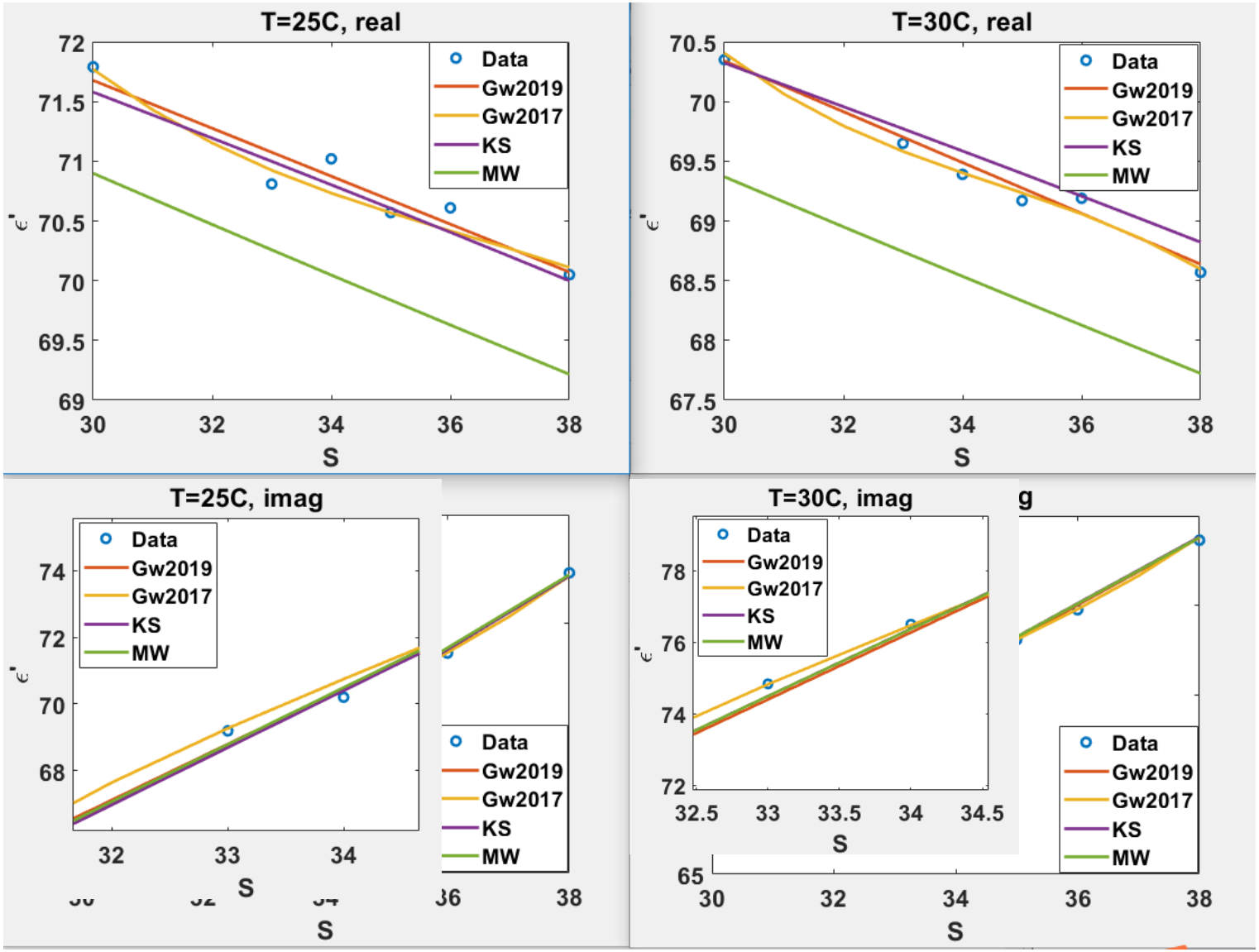
$$RMSE' = 0.1$$

$$RMSE'' = 0.3$$

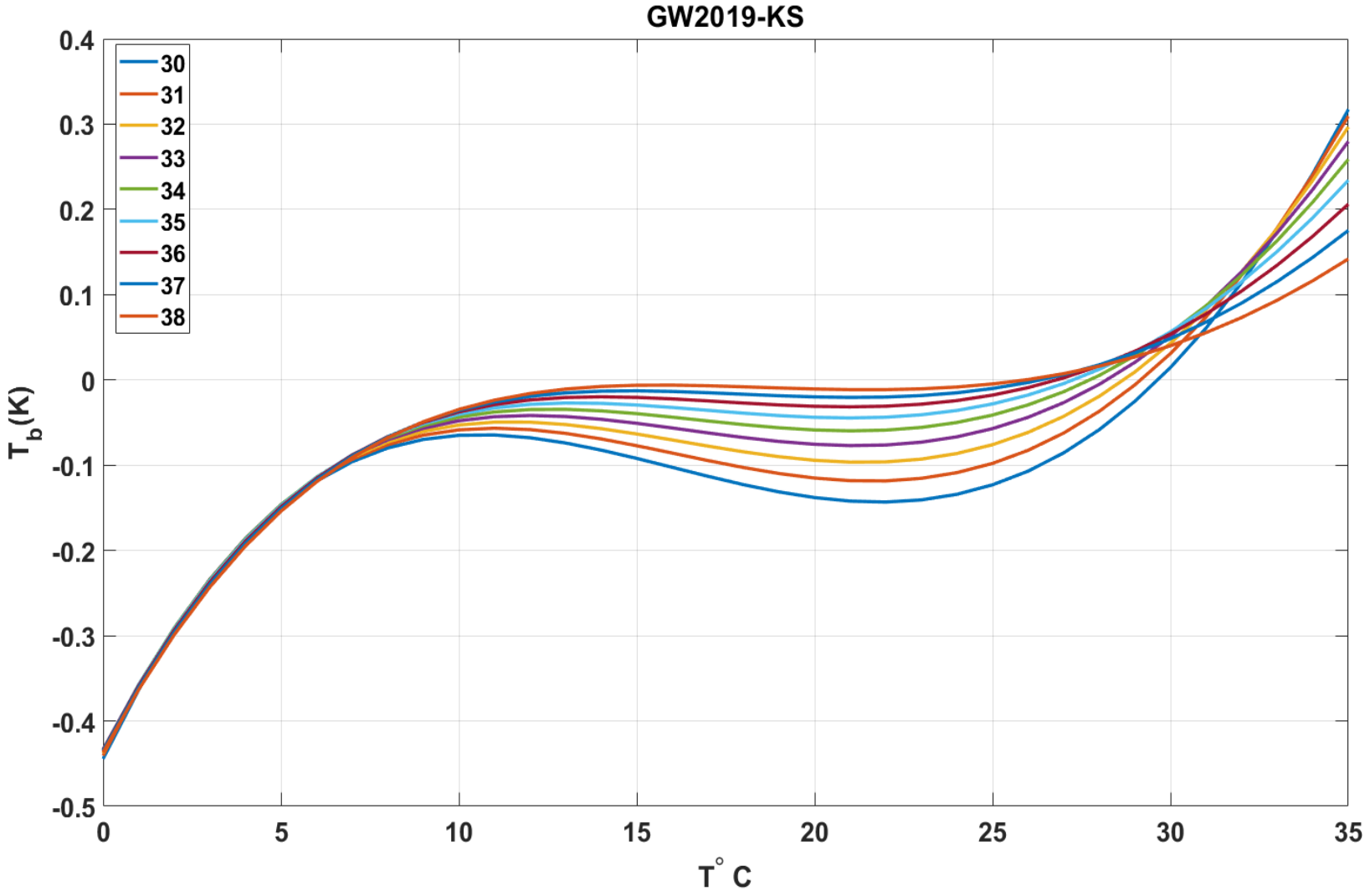
Dielectric Model Comparison



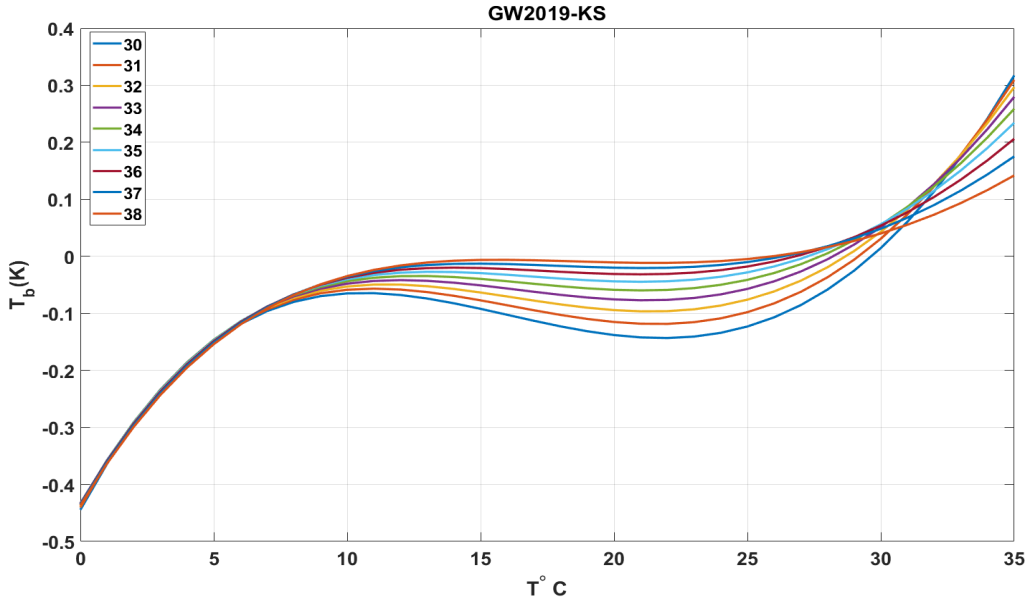
Dielectric Model Comparison

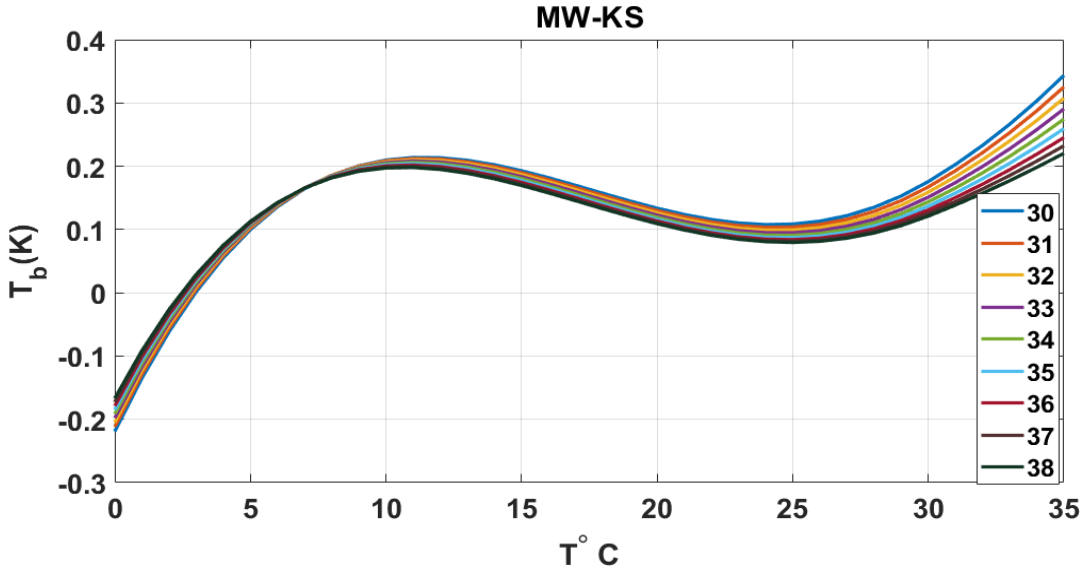


Difference in Brightness Temperature

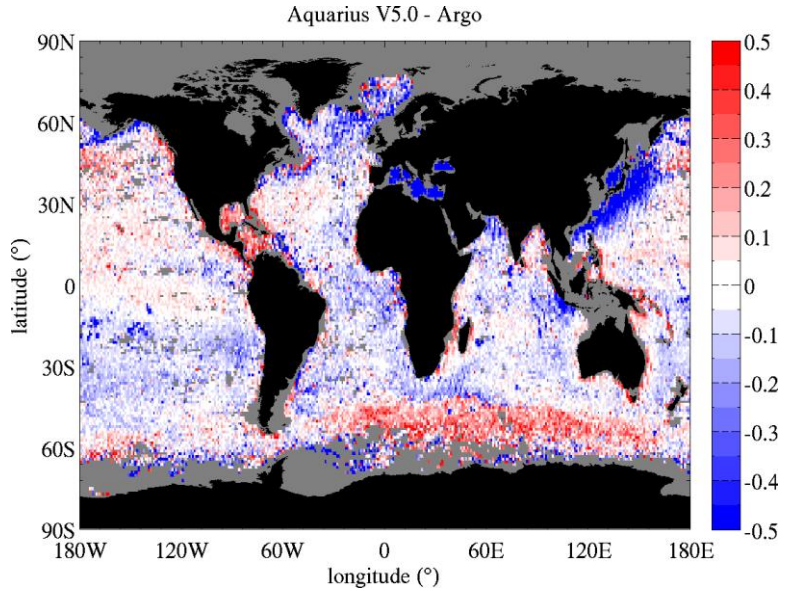


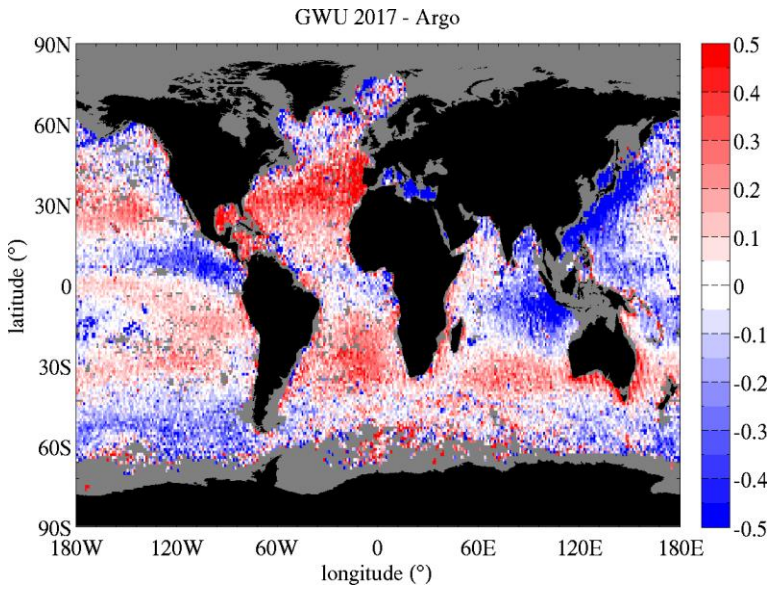
Difference in Brightness Temperature

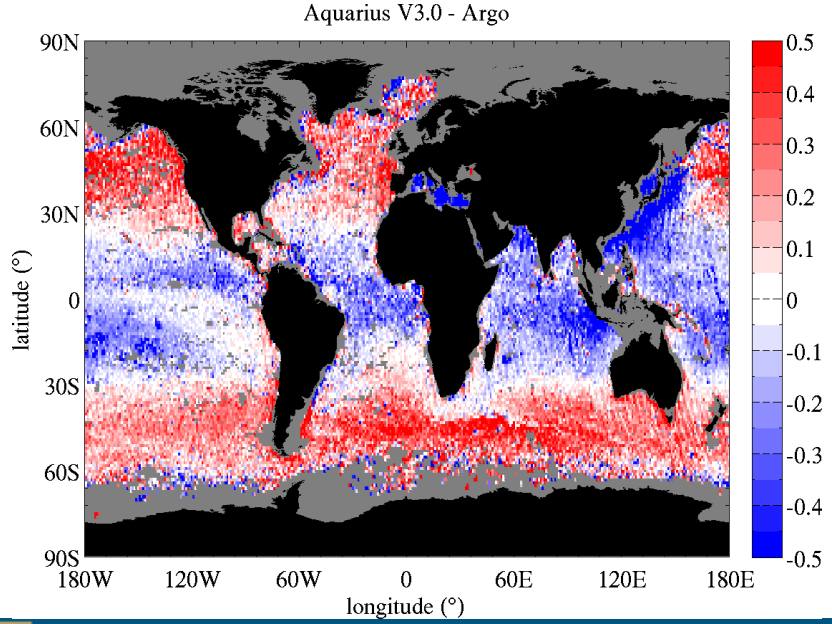


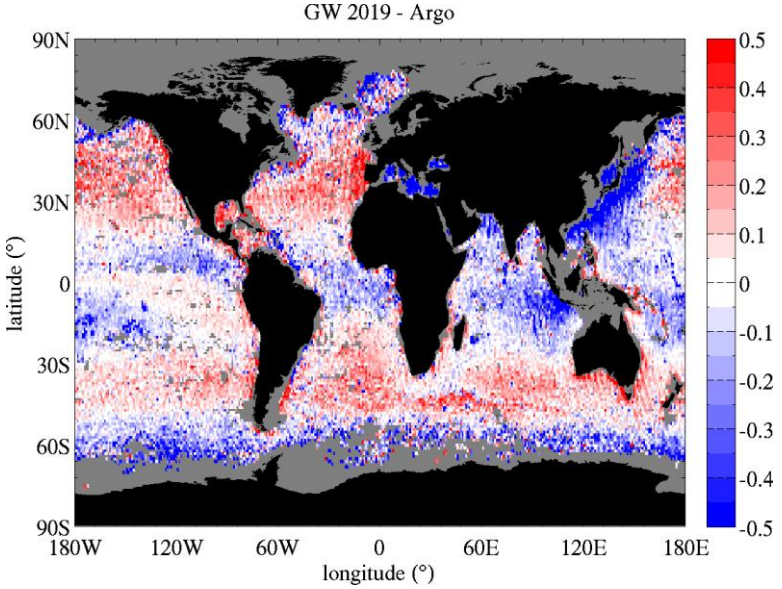


SSS difference maps long term averages

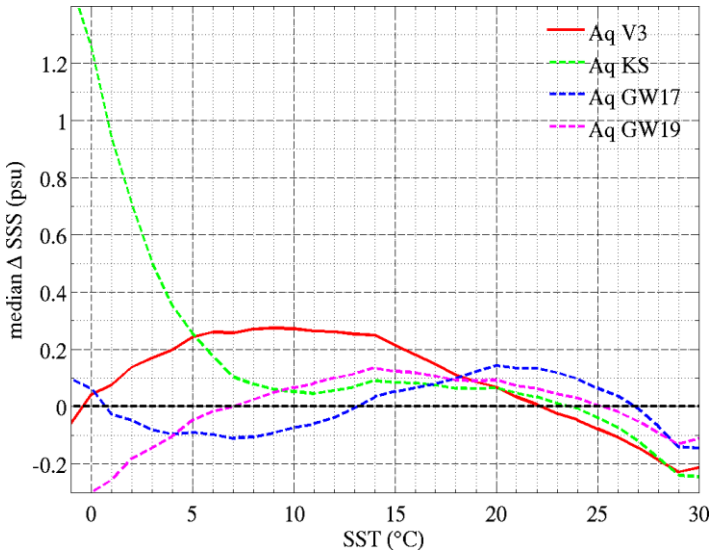


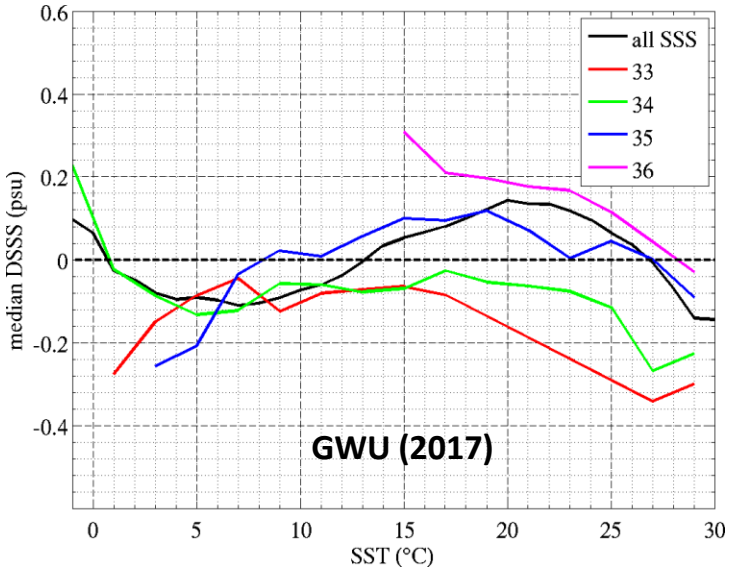


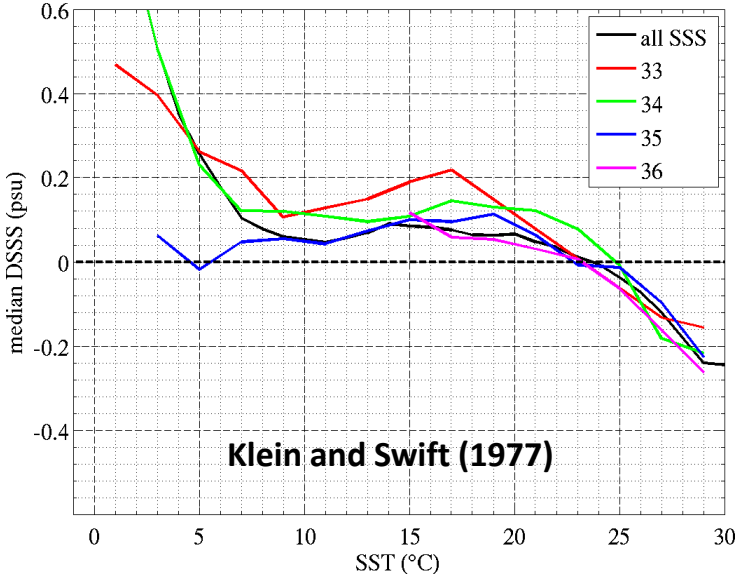


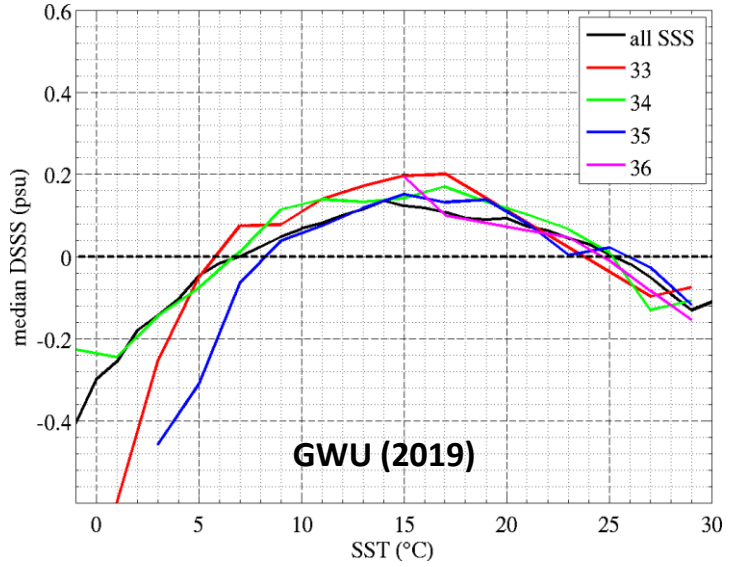


SSS median difference as function of SST

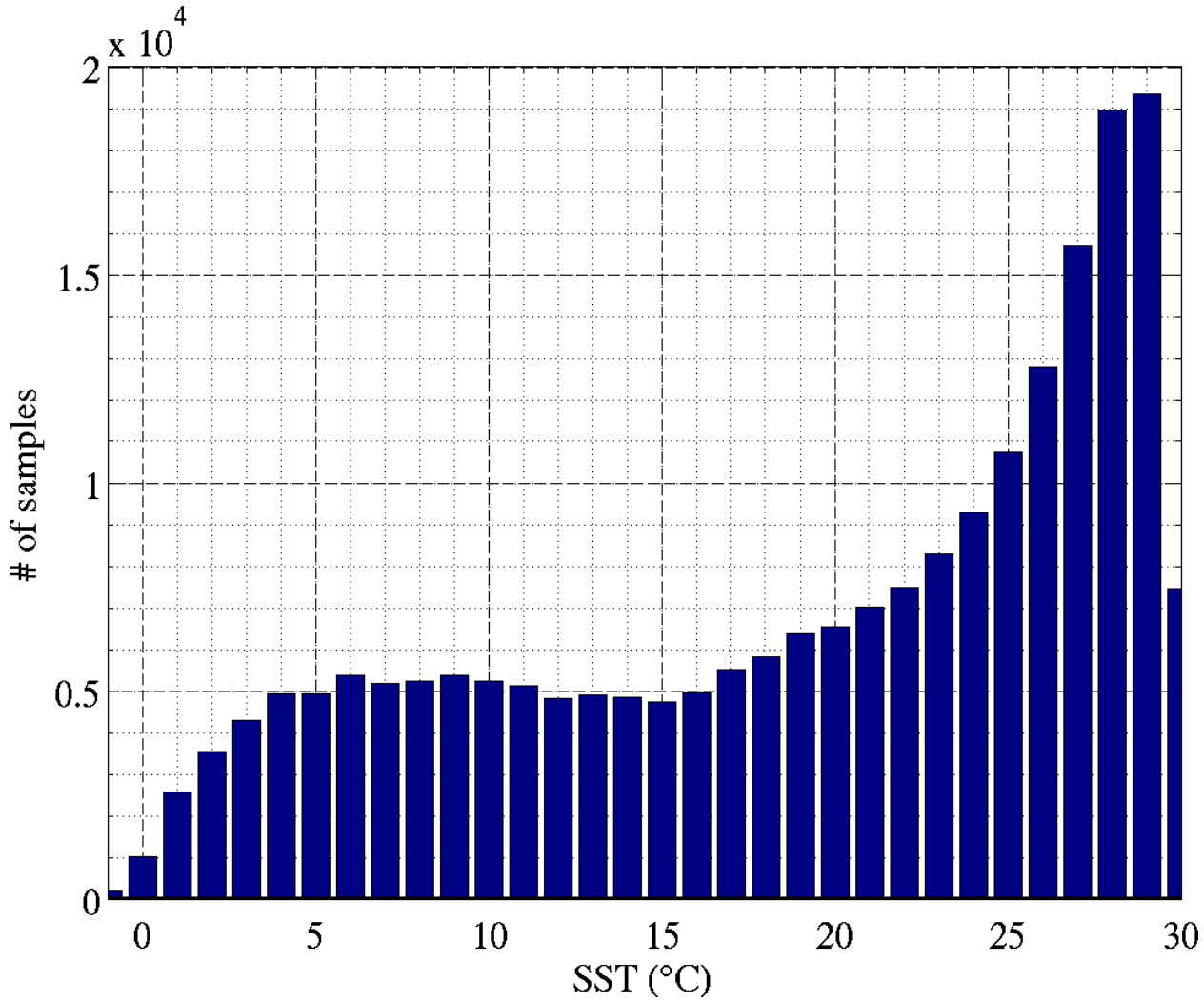




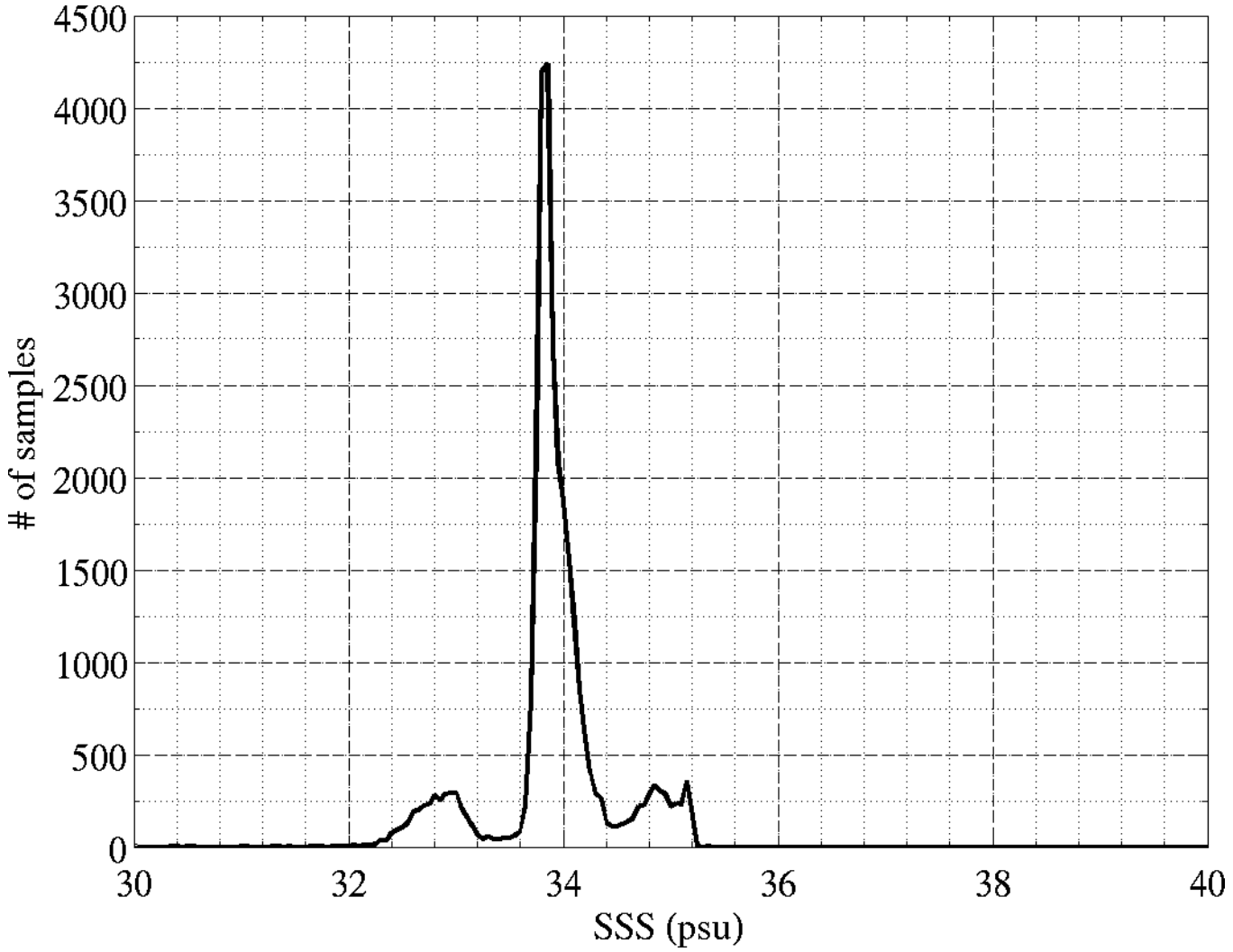




Number of samples as a function of SST



Number of samples in cold region (0°<T<5°C)



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Original Measurements (GW2017)

Recent Measurements

Measurements ongoing

GW2018, GW2019

Conclusions

- The GW model has been improved by the assumption of linear dependence in SSS.
- Regularization method will be applied to polynomial curve fitting –using this method curve stiffness can be adjusted
- It is suspected that the conductivity term is nonlinear for low salinities values (S<20 psu). New measurements are being made.
- Measurements at 34 psu for -1.5<T<5 will be made since this is the predominant salinity for small T.