

**PML**

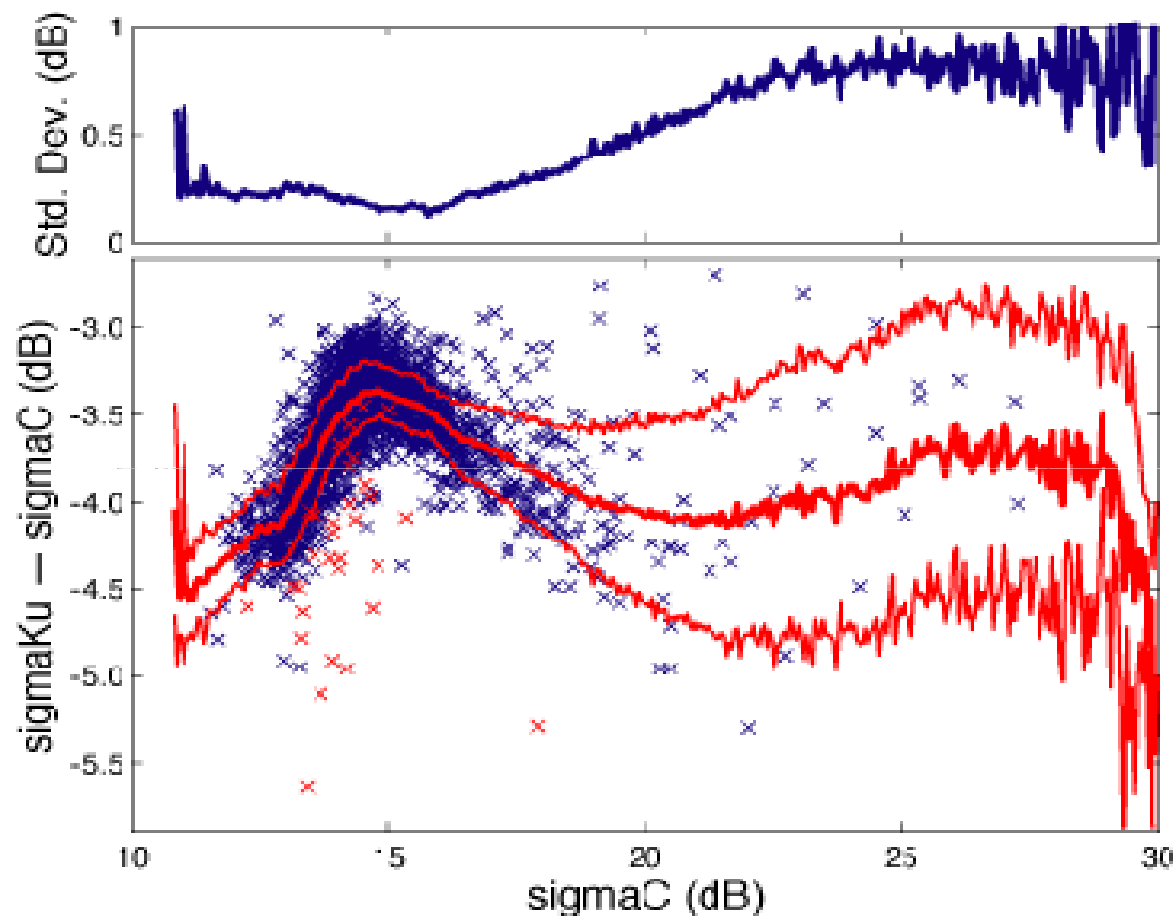
Plymouth Marine  
Laboratory

Listen to the ocean

# Improved rain-flagging for the Jason altimeters

**Graham Quartly**

## Ancient History

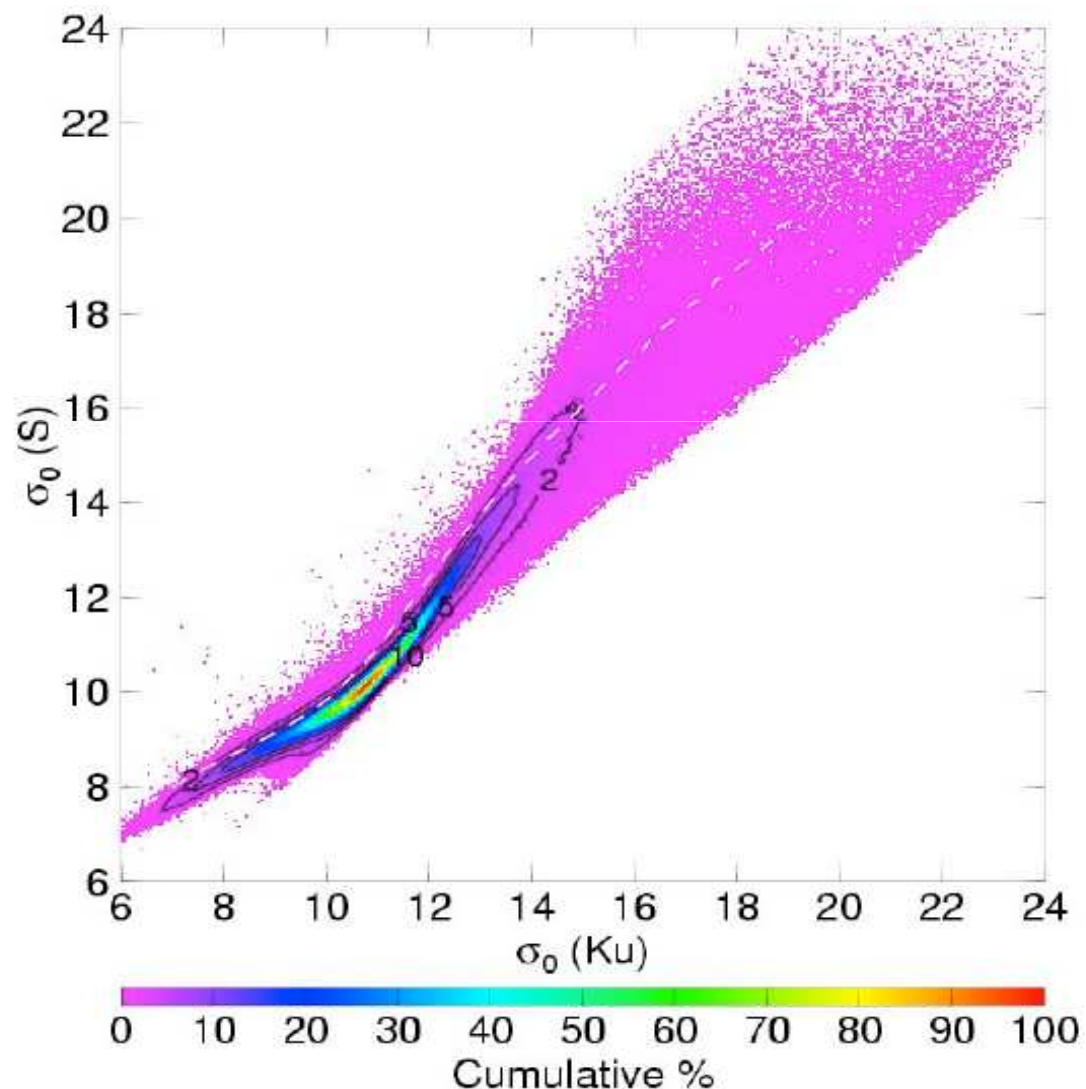


Quartly G.D., T.H. Guymer and M.A. Srokosz [1996](#), The effects of rain on [Topex](#) radar altimeter data *J. Atmos. Oceanic Tech.* **13**, 1209-1229.

1/4 dB → 1/16 dB

## What do we mean by rain-flagging?

- Fixed threshold below or simply 2 s.d.?
- Flag above and below line?



Lillibridge, J., R. Scharroo and G. Quartly, 2005, [Rain and ice flagging](#) of Envisat altimeter and MWR data, Envisat & ERS symposium (Salzburg)

## MLE-4

MLE-4 retracker fits mispointing ( $\psi^2$ ) as well as  $h$ ,  $H_s$  &  $\sigma^0$   
 (Amarouche et al., 2004)

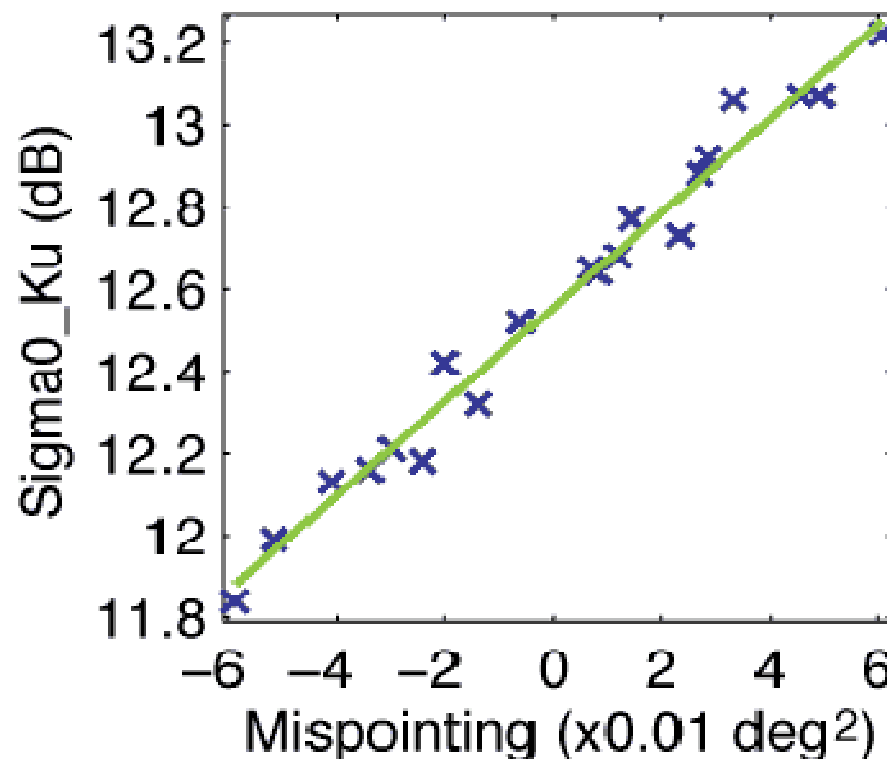
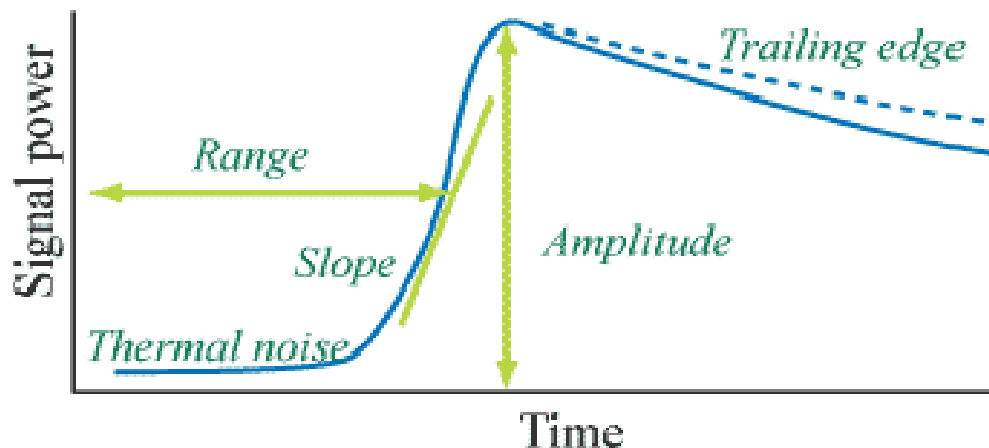
### Tournadre: AGC

Quartly:  $\sigma^0_{adj}$

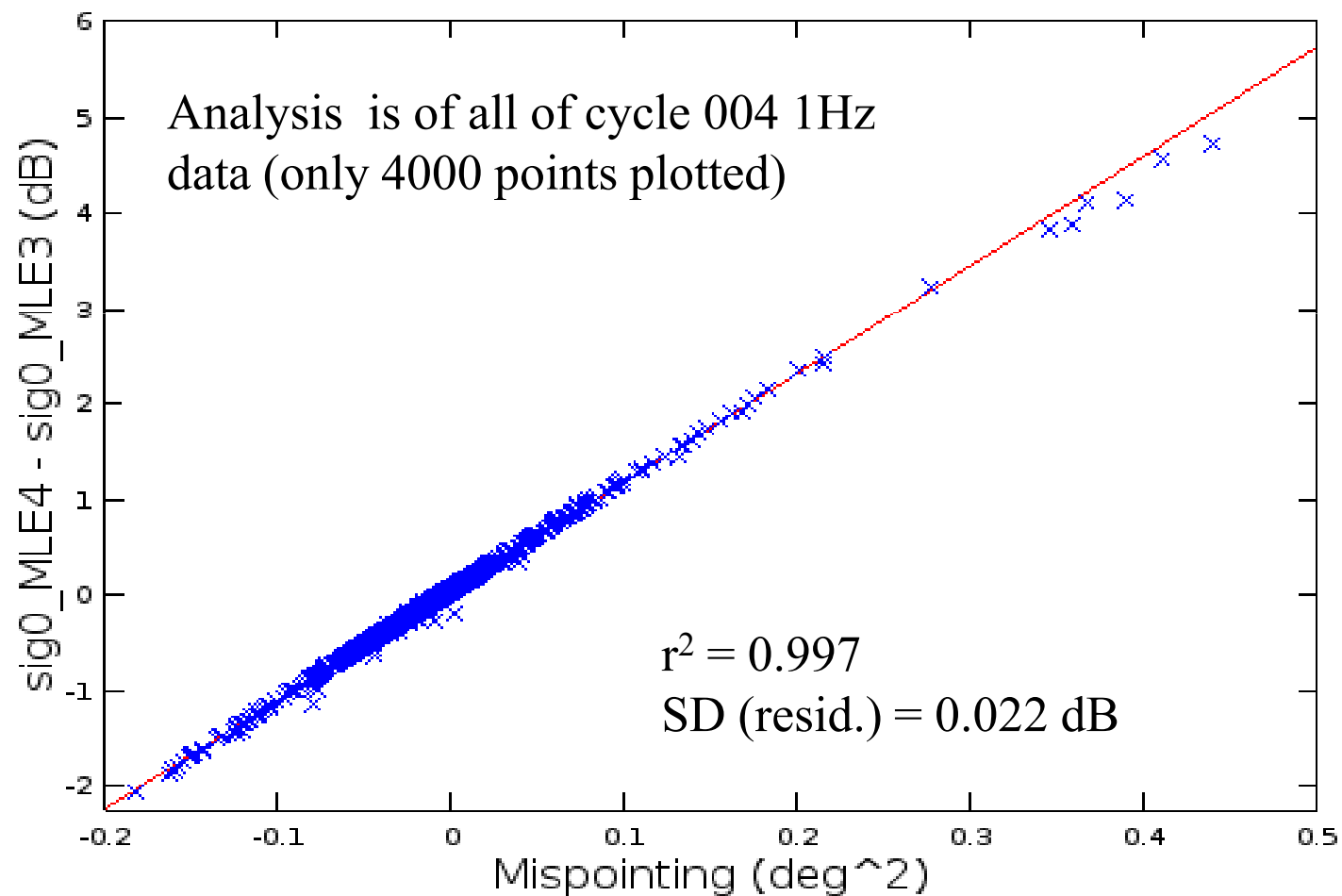
Observed dependency between  $\sigma^0_{MLE4}$  and  $\psi^2$   
 (Quartly, 2009)

Robust definition:

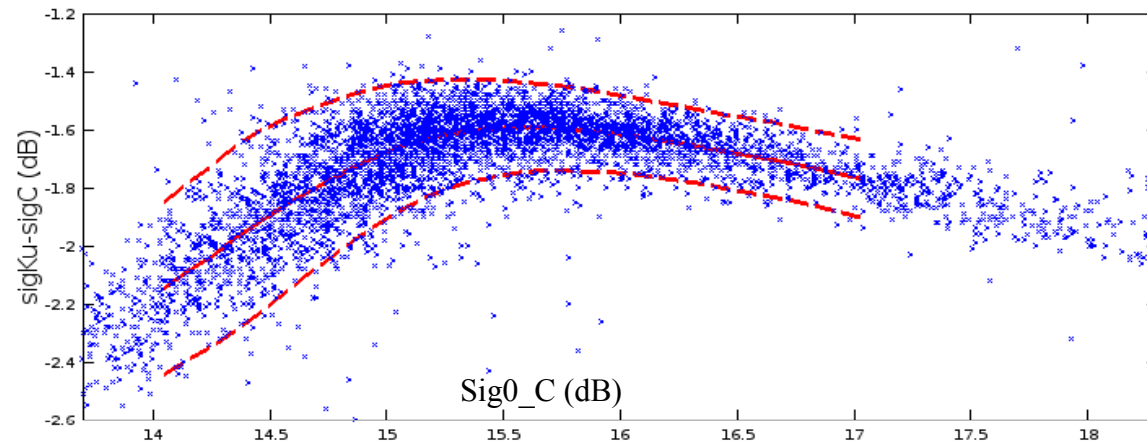
$$\sigma^0_{adj} = \sigma^0_{MLE4} + \alpha \psi^2$$



## Return of MLE-3

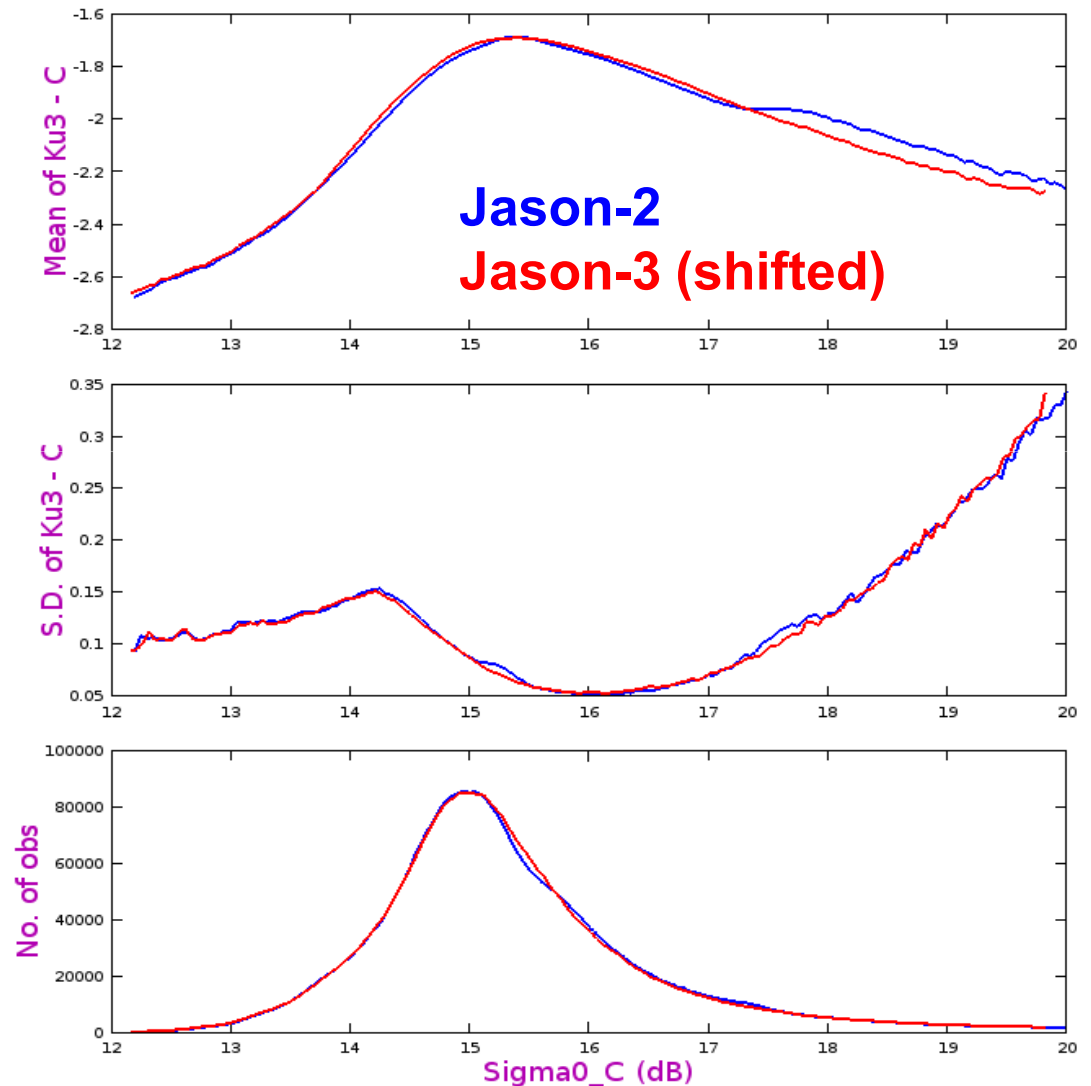


# Ku-, C-band relationship for Jason-3



# Ku-, C-band relationship (II)

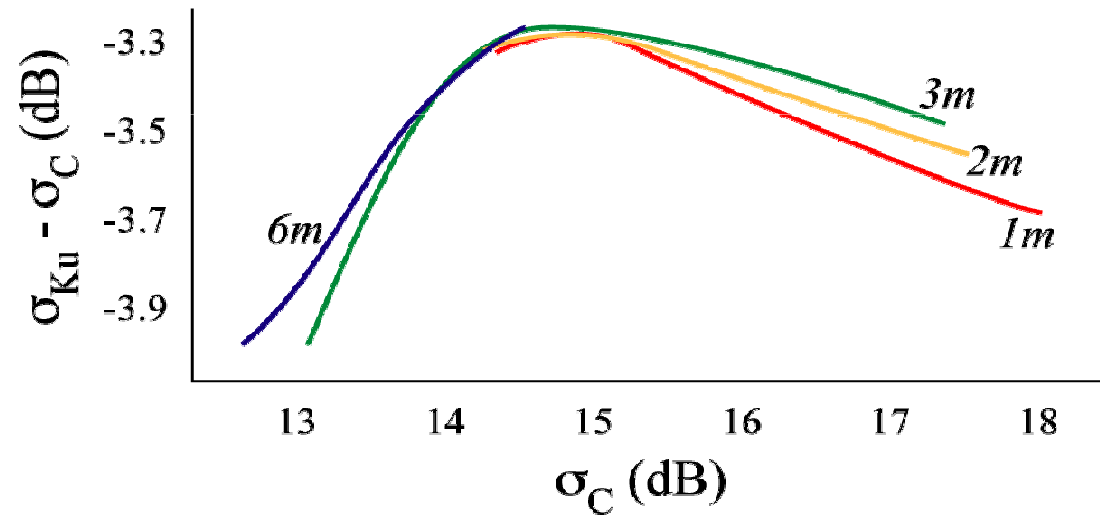
Use  $\sigma^0_{MLE3}$  and  $\sigma^0_C$  in implementation for rain-flagging and  $\sigma^0$  monitoring



# Can we explain more of the variability?

$$\sigma^0_{\text{adj}} = \sigma^0_{\text{MLE4}} + \alpha \psi^2 + f(?)$$

Wave-sheltering: first pointed out by Elfouhaily et al (1998)



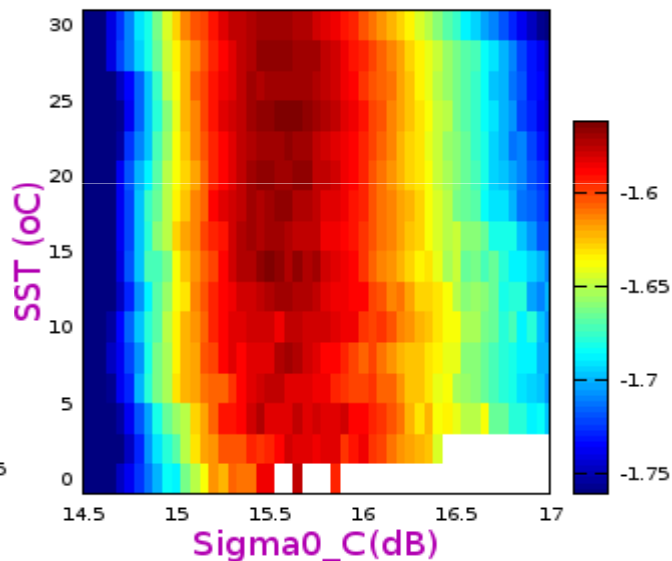
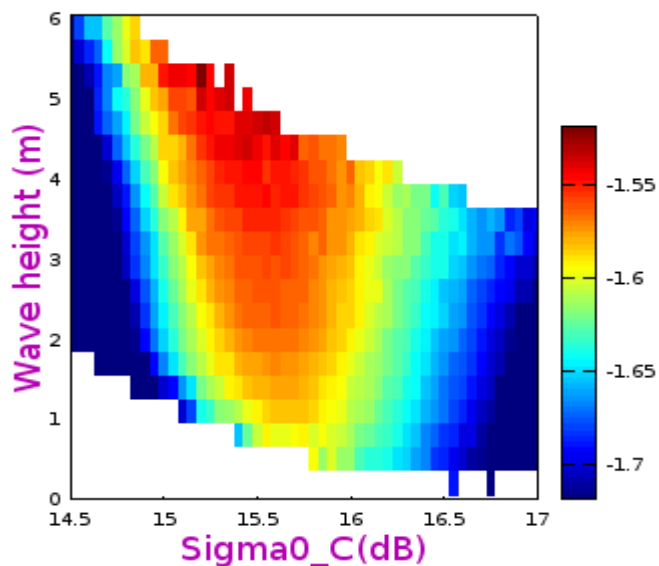


# Effect of SST

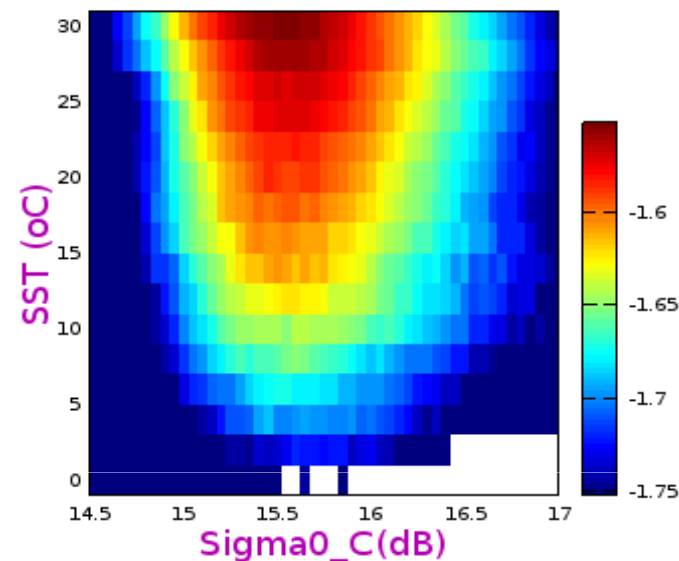
Consider  $\sigma_{Ku} - \sigma_C = f(\sigma_C)$  curves and bin according to SST

[Idea inspired by Vandemark et al. (2016)]

SST correction (see next slide) implemented and retested.

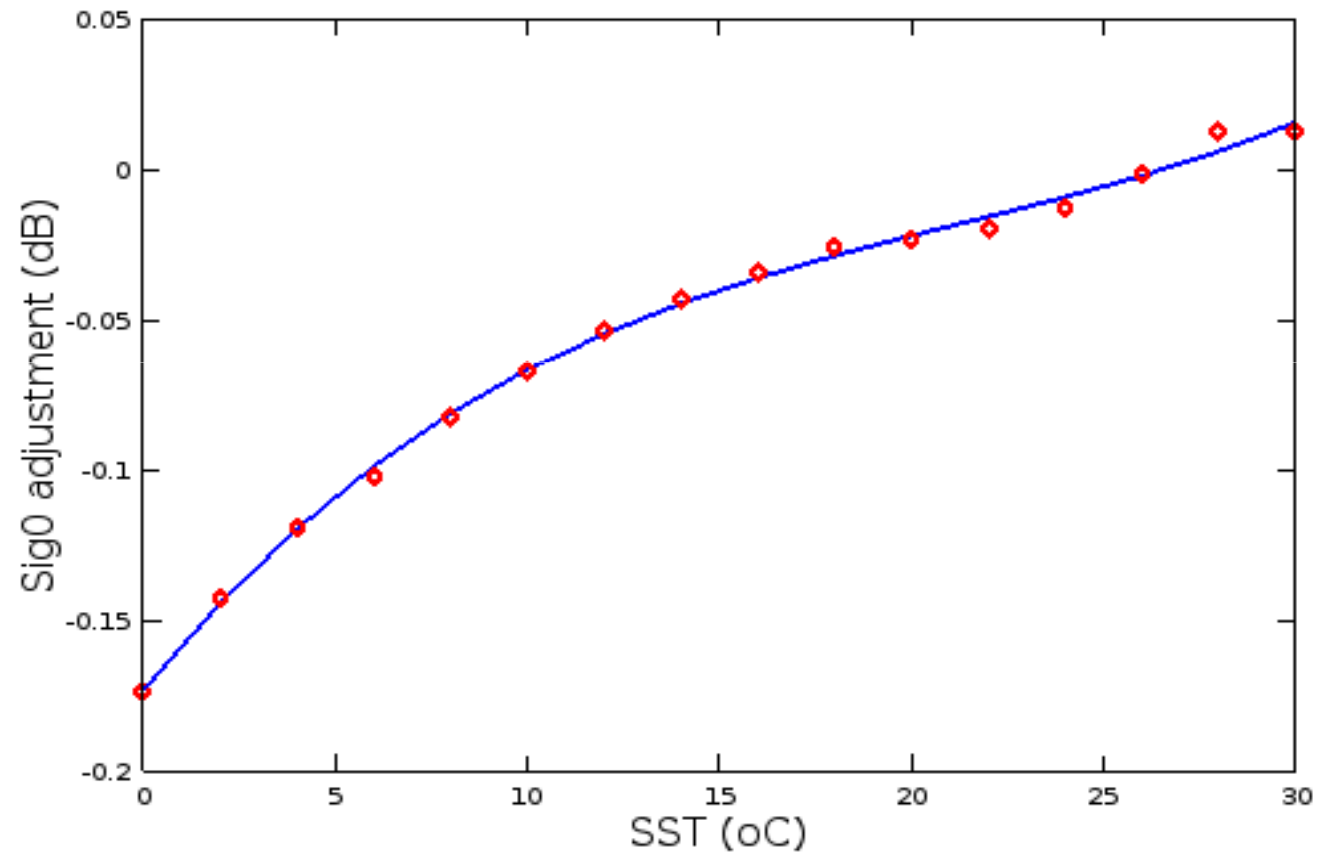


Coloured plot of  $\sigma_{Ku} - \sigma_C$

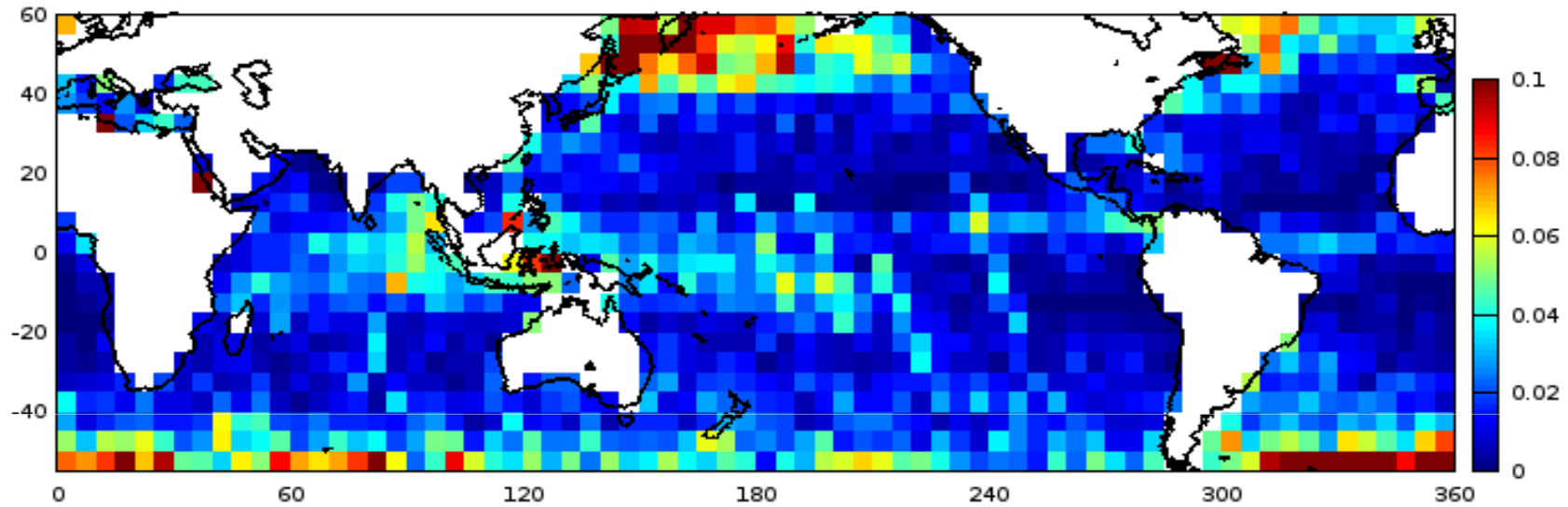


But now there's a more marked residual effect with SWH see e.g. Elfouhaily et al. (1998) & Quartly et al. (1999). Needs care to address, due to geographic correlations.

# SST correction



# Rain-flagging



## Future Work

- Perform analysis with GDR data, binning for Hs and SST.
- Possibly need to deal with time variations

