Better than Averaging:
Empirical Correction for Intra-1 Hz Correlations

Graham Quartly,
Walter Smith & Marcello Passaro

OSTST 2018
\[ \sigma_{\text{adj}}^0 = \sigma_{\text{MLE4}}^0 - \alpha \psi^2 \]

\[ r^2 = 0.976 \]
Sensitivity to fading noise

\[ h, H_s, \sigma^0, \psi^2 \]
Analysis of 1 second of data

— Jason-3 data —

Better than ...
Histograms of regression slopes

$H_s$, $h$
Variation with Conditions

Bigger magnitude at high $H_s$
Better than ...

OSTST 2018
Better than ...
# Altimeter/Tracker

<table>
<thead>
<tr>
<th>Altimeter / Algorithm</th>
<th>Median $\alpha$</th>
<th>% Variance explained</th>
<th>Resultant S.D. of $\sigma_{\alpha,adj}^0$</th>
<th>Median $\beta$</th>
<th>% Variance explained</th>
<th>Resultant $\sigma_{h,adj}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jason-3/MLE-4</td>
<td>11.02</td>
<td>97%</td>
<td>0.060</td>
<td>-0.102</td>
<td>38%</td>
<td>0.068</td>
</tr>
<tr>
<td>Jason-3/MLE-3</td>
<td>-0.48</td>
<td>6.5%</td>
<td>0.059</td>
<td>-0.091</td>
<td>35%</td>
<td>0.065</td>
</tr>
<tr>
<td>Jason-2/MLE-4</td>
<td>11.01</td>
<td>97%</td>
<td>0.060</td>
<td>-0.101</td>
<td>38%</td>
<td>0.067</td>
</tr>
<tr>
<td>Jason-2/MLE-3</td>
<td>-0.48</td>
<td>6.5%</td>
<td>0.060</td>
<td>-0.091</td>
<td>35%</td>
<td>0.064</td>
</tr>
<tr>
<td>Jason-2/ALES</td>
<td></td>
<td></td>
<td></td>
<td>-0.117</td>
<td>50%</td>
<td>0.061</td>
</tr>
<tr>
<td>Jason-2/N-R</td>
<td></td>
<td></td>
<td></td>
<td>-0.102</td>
<td>19%</td>
<td>0.111</td>
</tr>
<tr>
<td>Jason-2/N-M</td>
<td></td>
<td></td>
<td></td>
<td>-0.252</td>
<td>28%</td>
<td>0.101</td>
</tr>
<tr>
<td>S-3A/PLRM</td>
<td>7.84</td>
<td>90%</td>
<td>0.070</td>
<td>-0.095</td>
<td>40%</td>
<td>0.084</td>
</tr>
<tr>
<td>S-3A/SARM</td>
<td></td>
<td></td>
<td></td>
<td>-0.095</td>
<td>13%</td>
<td>0.052</td>
</tr>
<tr>
<td>Jason-3/C-band</td>
<td>-0.02</td>
<td>$\sim$0</td>
<td>0.141</td>
<td>-0.094</td>
<td>44%</td>
<td>0.137</td>
</tr>
<tr>
<td>Jason-2/C-band</td>
<td>-0.02</td>
<td>$\sim$0</td>
<td>0.140</td>
<td>-0.092</td>
<td>44%</td>
<td>0.135</td>
</tr>
<tr>
<td>AltiKa/MLE-4</td>
<td>8.51</td>
<td>4.2%</td>
<td>0.094</td>
<td>-0.116</td>
<td>43%</td>
<td>0.050</td>
</tr>
</tbody>
</table>

*Better than ...*
— SSB & Ice —

SSB = EM bias + Skewness bias + Retracker bias

Hs-correlated noise

Similar empirical corrections in ice studies

Correcting range for changes in LEW
S-3B – S-3A tandem

S-3A (SAR) – S-3B LRM (adj.)

S-3A (SAR) – S-3B LRM

R.m.s. diff in Range (cm)
Summary

Covariant errors between $\sigma^0$ and $\psi^2$ well understood;

similar, but weaker effect for $h$, $H_s$

Derived by looking at highest frequency variability

Zaron & de Carvalho had similar results from RTA

Easier investigation of variation with $H_s$, $\sigma^0$ etc.

Can work with long-repeat or no-repeat missions