

## RETHINKING THE MODELING OF THE MEAN SEA SURFACE IN THE ERA OF CLIMATE CHANGE

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 $f(x+\Delta x) = \sum_{i=0}^{\infty} \frac{(\Delta x)^{i}}{i!} f^{(i)}(x)$ 

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## **DTU21 Mean Sea Surface.**



Update with respect to DTU15 and DTU18 MSS. State of the art and available on (S3A/S3B/S6)

20 Year average (1993-2012) centered on 2003.01 (Similar to previous DTU MSS) Truly global MSS focused on accuracy and completeness between 90S and 90N.

#### Shorter wavelength improved through:

Two-pass altimetry for all geodetic missions (C2+SA+JA1+JA2) Parks McClellan filtered 2Hz Sea surface height data (Limiting spectral hump in LRM)

#### Longer wavelength improved through:

Physical retracking of high latitude regions (C2-SAMOSA+ data using ESA GPOD) New Sea State Bias for high latitude applied to result in min-offset between LRM & SAR (even into Sea Ice)



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## **GMSL** rise





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## MSS or MSS(t)

Available global MSS (DTU/CLS) are averaged over 20 years (1993-2012)
"Center time" will be 2003.01.01

> Due to GMSL trend, ALL MSS becomes increasingly "**outdated**" with time.

➤Good thing is that the "center time" is well-defined



## Transforming the MSS between periods

 $MSS_{P1} = \langle \eta \rangle_{P1} = \langle G + h \rangle_{P1} = G + \langle \overline{h}_{P2} + h'_{P2} \rangle_{P1} = \langle G + h \rangle_{P2} + \langle h'_{P2} \rangle_{P1} = MSS_{P2} + \langle h'_{P2} \rangle_{P1}$ Rio and Andersen, 2004



#### Use of JPL MEASURES or AVISO grid is problematic.

#### Suggest.

MSS is computed along with Linear sea level trend model over averaging period.  $MSS(t) = MSS + SL_{trend} \times (t-t_{center})$ 

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## MSS(2022) = MSS(2003)+linear SL \* (2022-2003)





## Sea level trend (1993-2012) or 2002-2021





## MSS(2023) = MSS(2012)+linear SL \* (t-2012)



2023



# Suggest shifting averaging period to (2002-2021)center time will be 2012.01.01



#### Difference etween DTU23E with DTU21 Shift it 20 years in time -> DTU23EX

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## S6-MF – First year average (2021.06->2022.05)



# Conclusions



Current MSS gets outdated in our era of climate change.

Suggest the consistent determination of MSS and linear SL change.

We suggest changing the MSS averaging period.

1993-2022 (30 years) 2003-2022 (20 years)

#### **Pros:**

Enables more consistent use of C2/S3A/S3B/J3/SA/HY-2/S6-MF in development

#### Cons:

Regional patterns are still visible

30-year sea level trend average through more natural variability than a 20-year trend.

Get best estimate of mean for year 2022 shifting averaging period to 2002-2021 Use linear trend.





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