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Revised SMAP Solar Contamination Flagging

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Salinity Continuity Processing Workshop, Remote Sensing Systesms, Santa Rosa, CA

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Background

- SMAP is an L-band radiometer that is used to retrieve the sea surface salinity (SSS)
- Before salinity retrievals, all surface and atmospheric effects must be removed
  - Surface roughness due to winds
  - Water vapor, oxygen, clouds
  - Faraday rotation
  - Sun, moon, and galaxy

Background

- Solar contamination model is not complete
- SMAP's orbit and scanning geometry yields low sun glint angles when the scanning angle α is left of forward

SMAP salinity residuals

- SMAP L2C netCDF files contain:
  - `sss_smap`: retrieved salinity
  - `sss_ref`: reference salinity (v03.0 data: HYCOM)
  - `winspd`: wind speed
  - `sunglt`: sun glint angle
- QC flags respected *except* the sun glint flag
- 18,231 SMAP L2C files from 2015-04-01 to 2018-11-22

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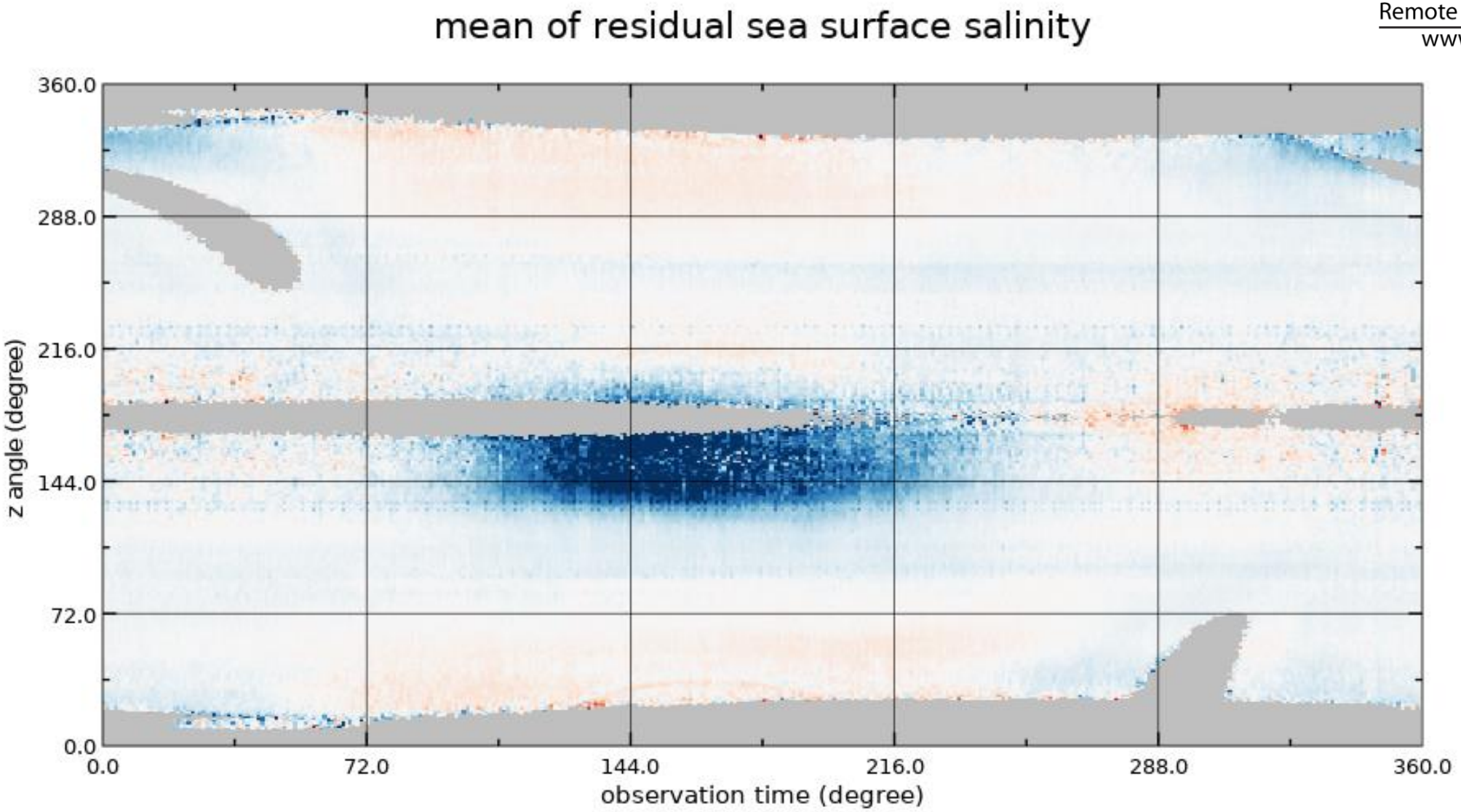
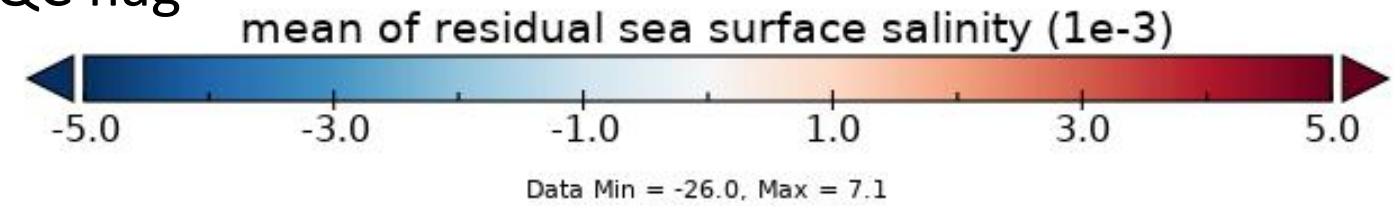


WITHOUT sun glint QC flag

α: 60° to 75°



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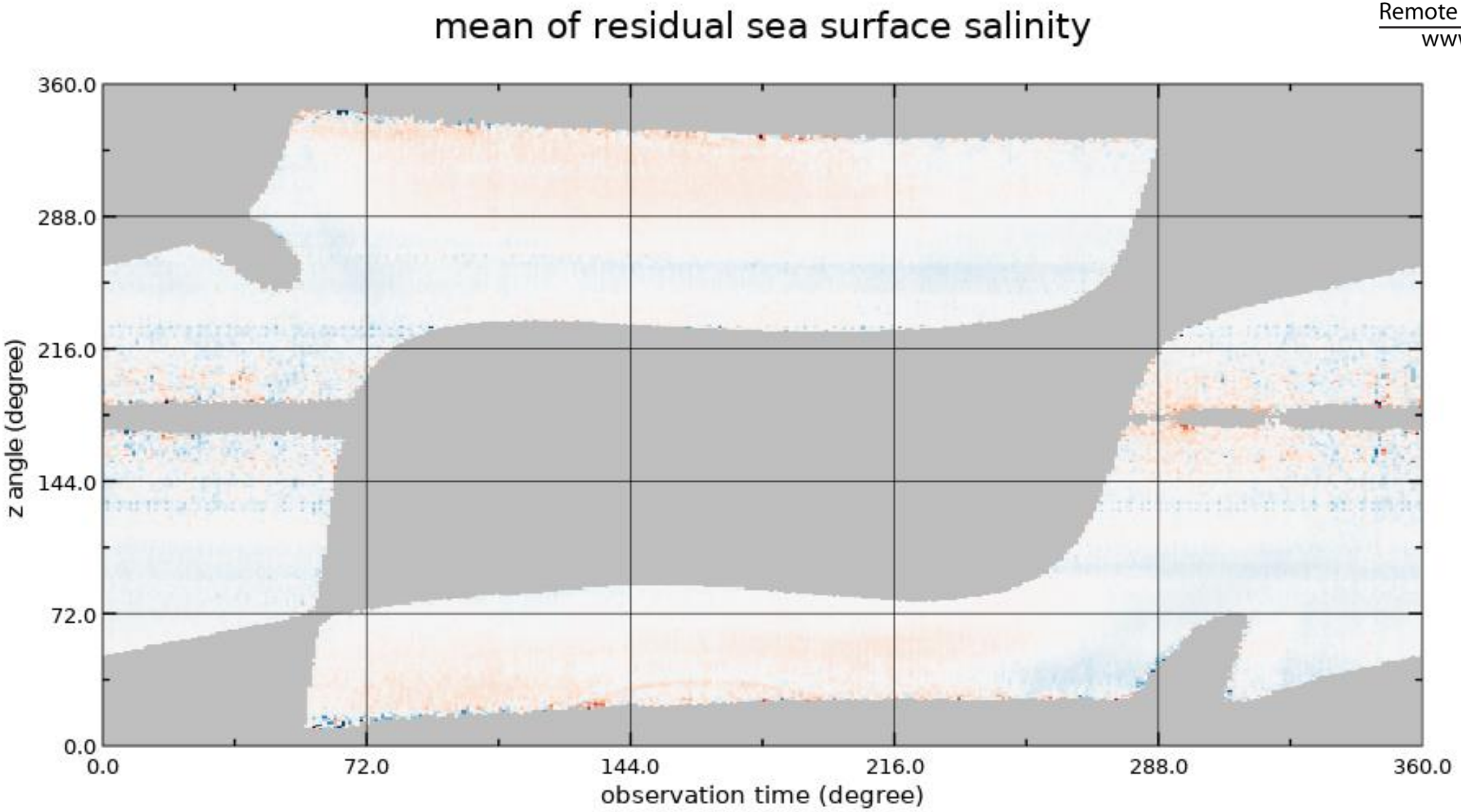

WITH sun glint QC flag

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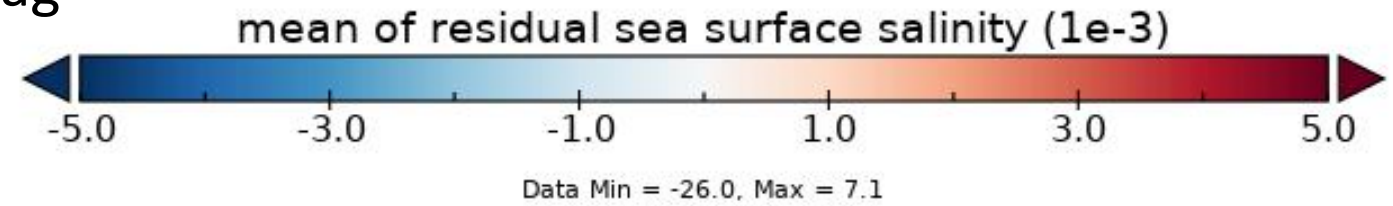

Sun glint QC flag

- Quality control flag is set if both:
  - Sun glint angle ≤ 50°
  - Scan angle between 30° and 150°
- Effective, but could be relaxed somewhat

Solar contamination correction

- Previously attempted a simple correction to SMAP TAs to account for solar contamination
- Correction inadequate – refine the mask instead
- More sophisticated correction to scattered sunlight model may be possible

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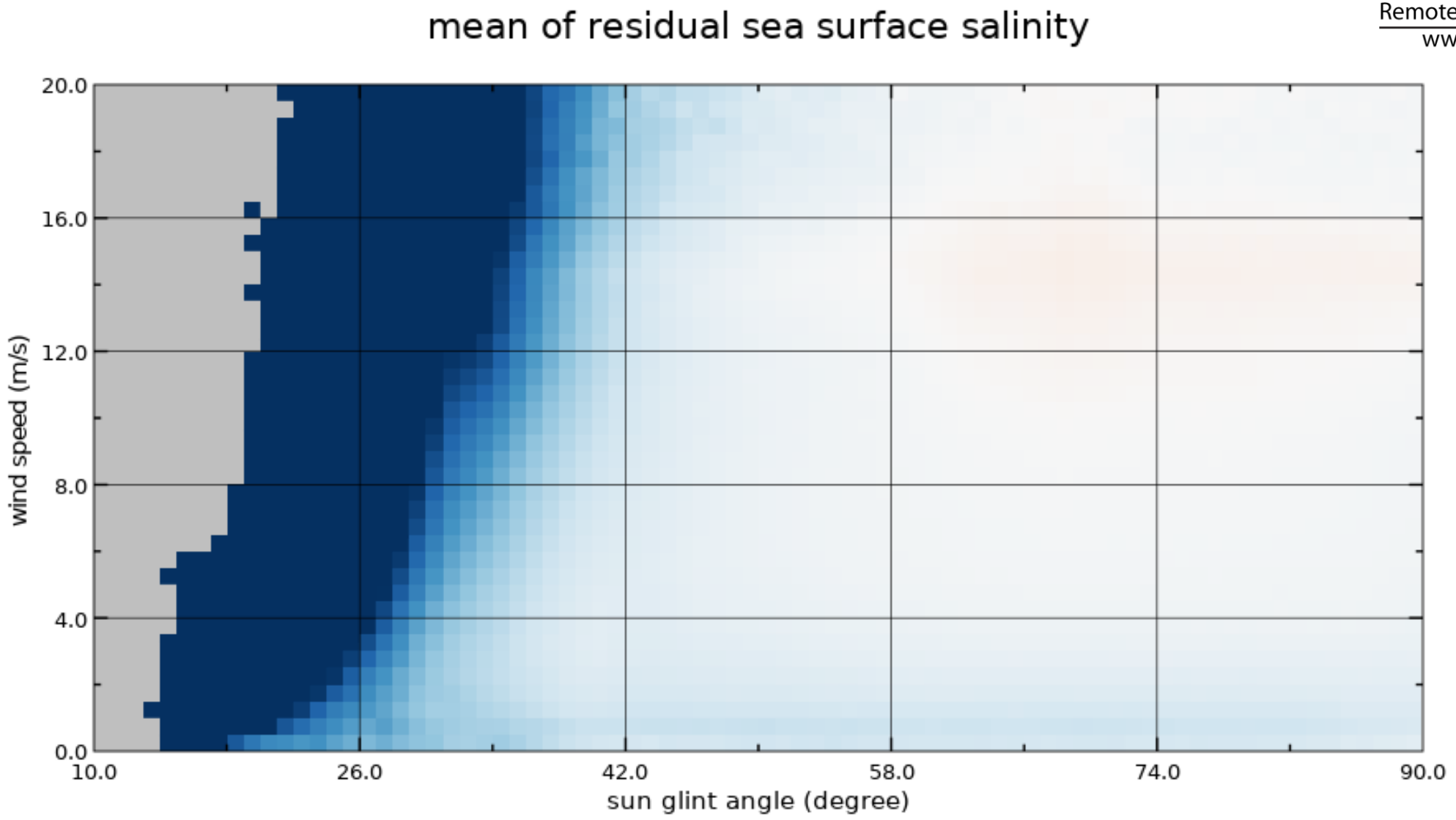
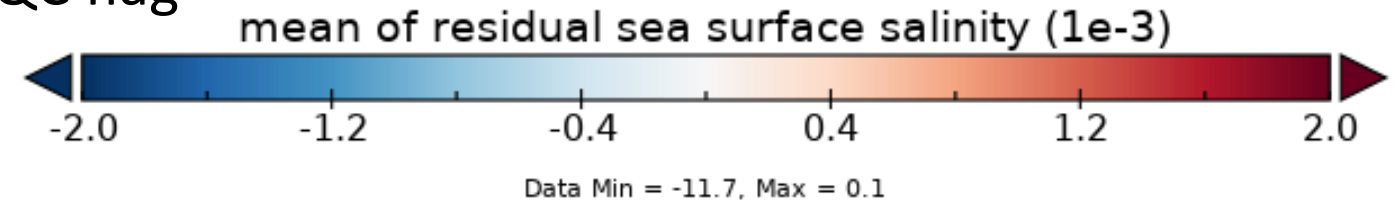


WITHOUT sun glint QC flag



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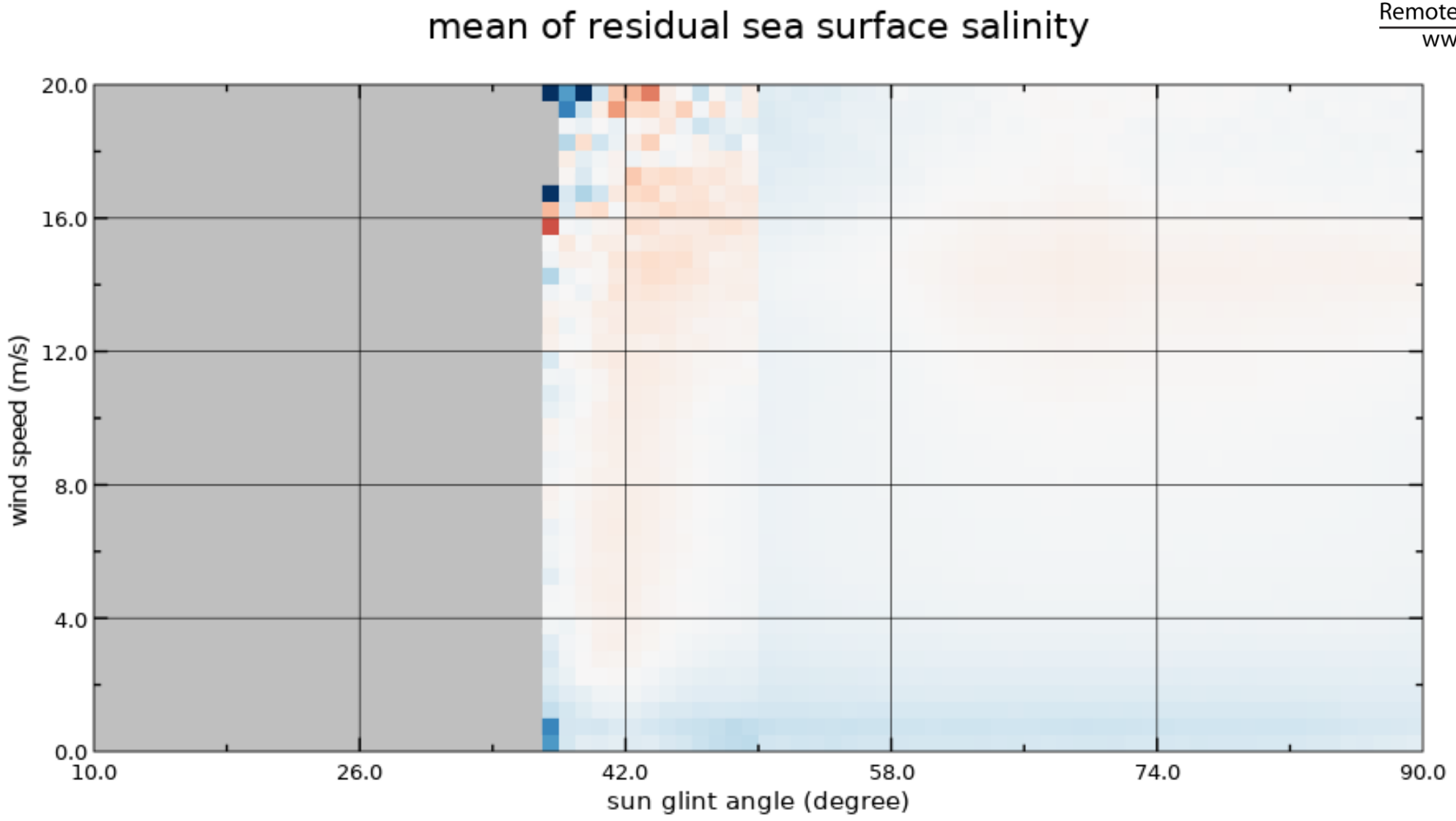
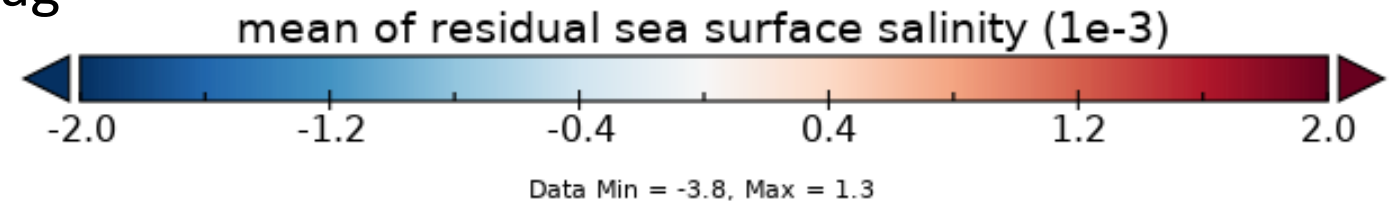


WITH sun glint QC flag



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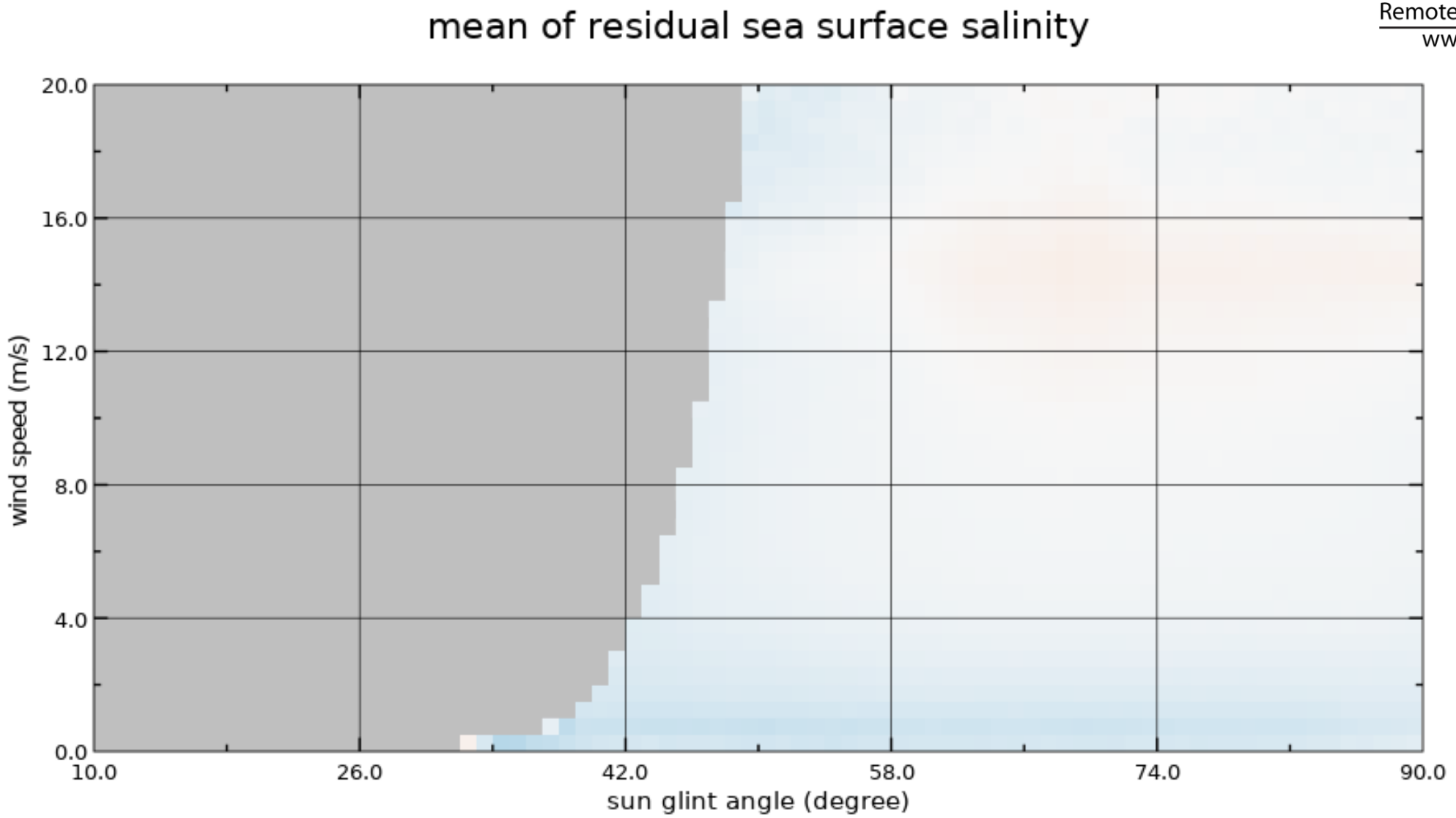
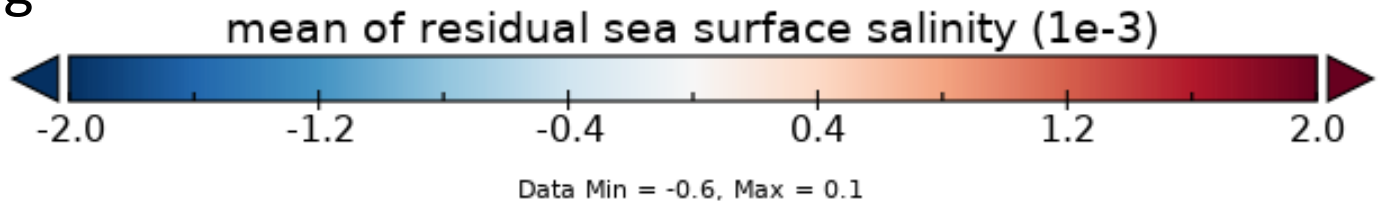
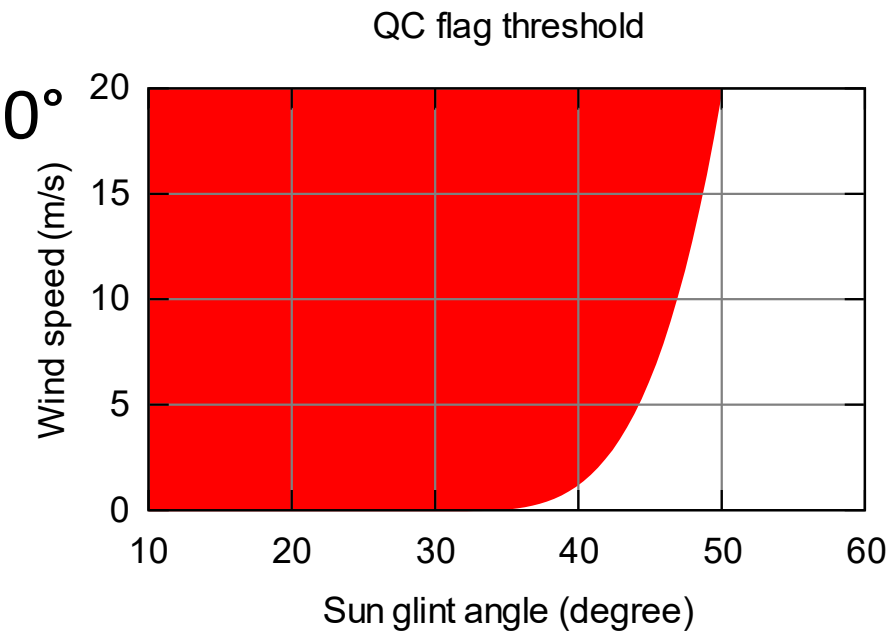


NEW sun glint QC flag



Revised sun glint QC flag

- Quartic polynomial, function of sun glint angle g and wind speed w
- Quality control flag is set if both:
  - Sun glint < 50°
  - $w > \frac{1}{8000}(g - 30°)^4$
- Flag is never set > 50° and always set < 30°



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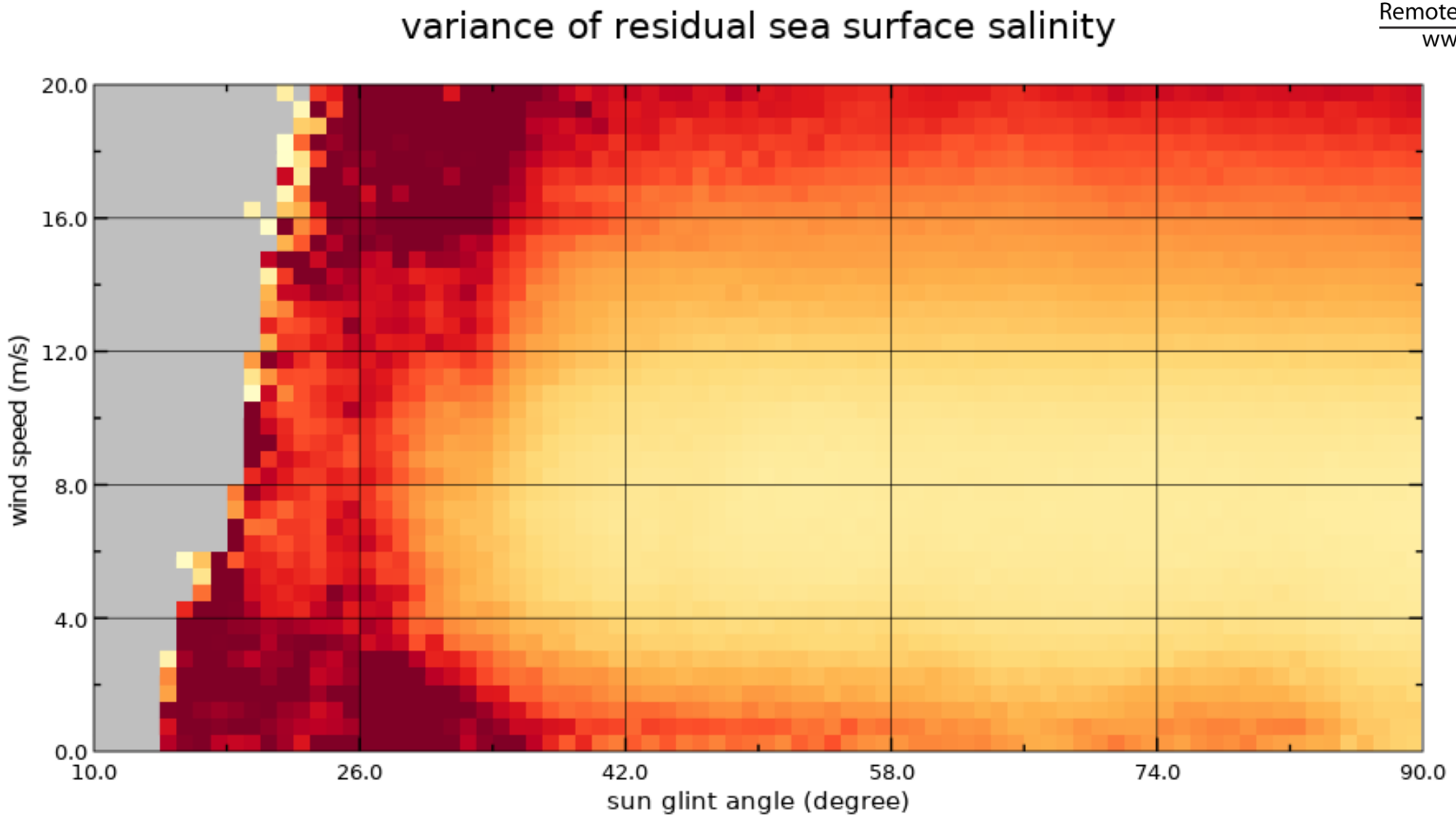
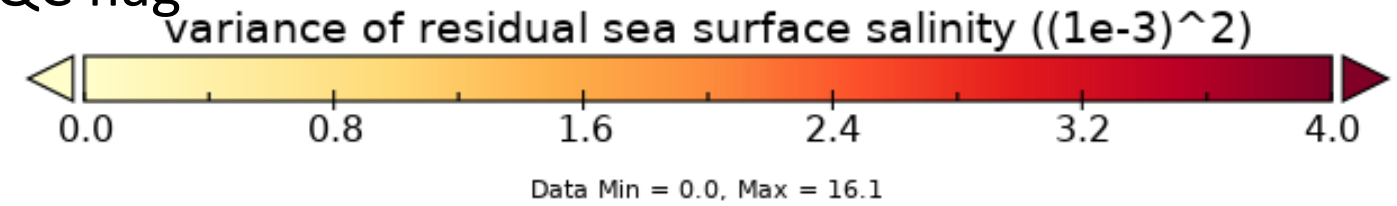


WITHOUT sun glint QC flag



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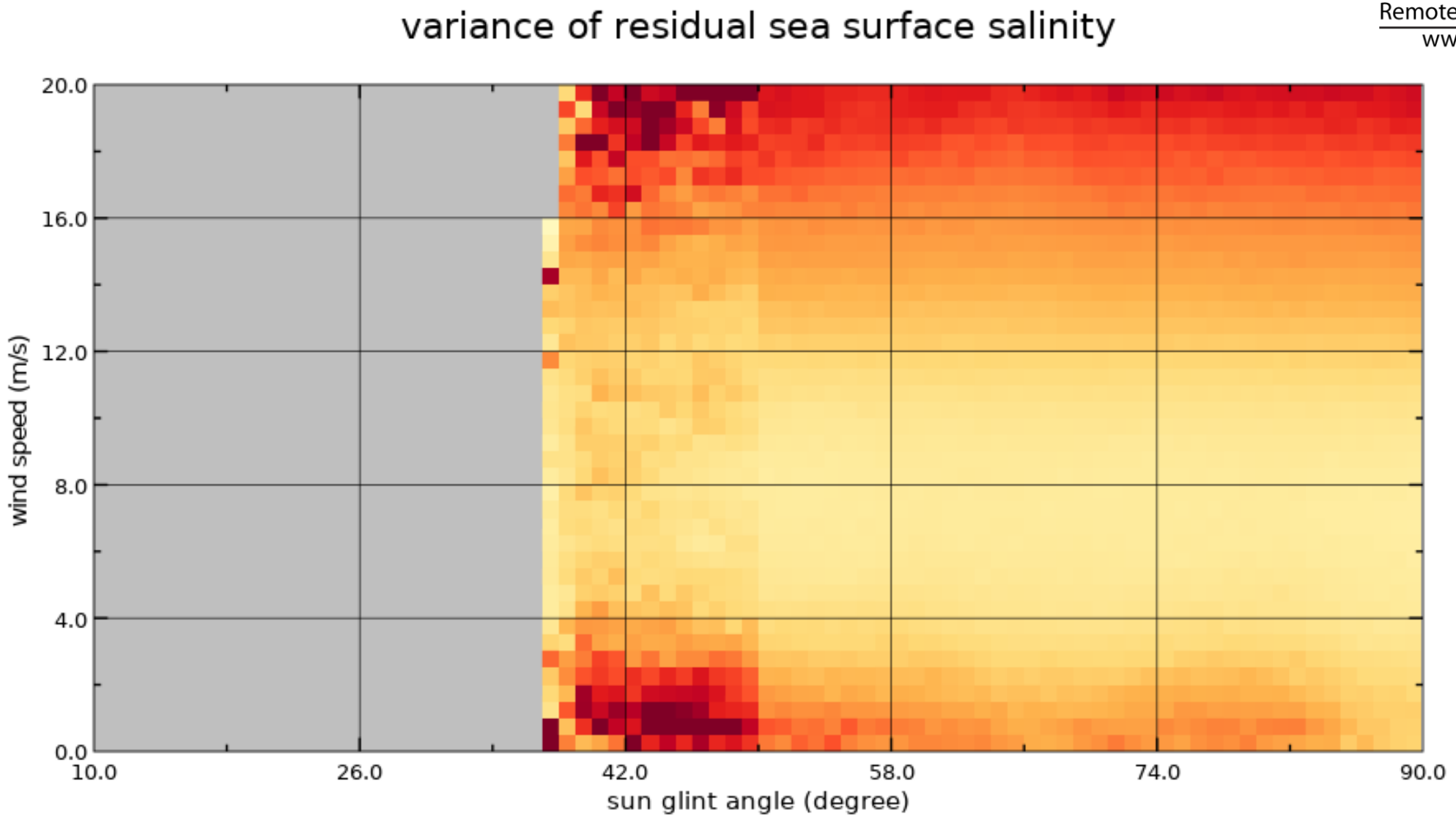
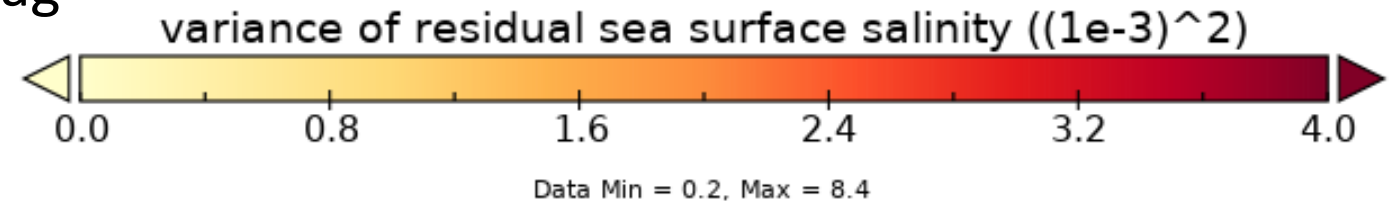


WITH sun glint QC flag



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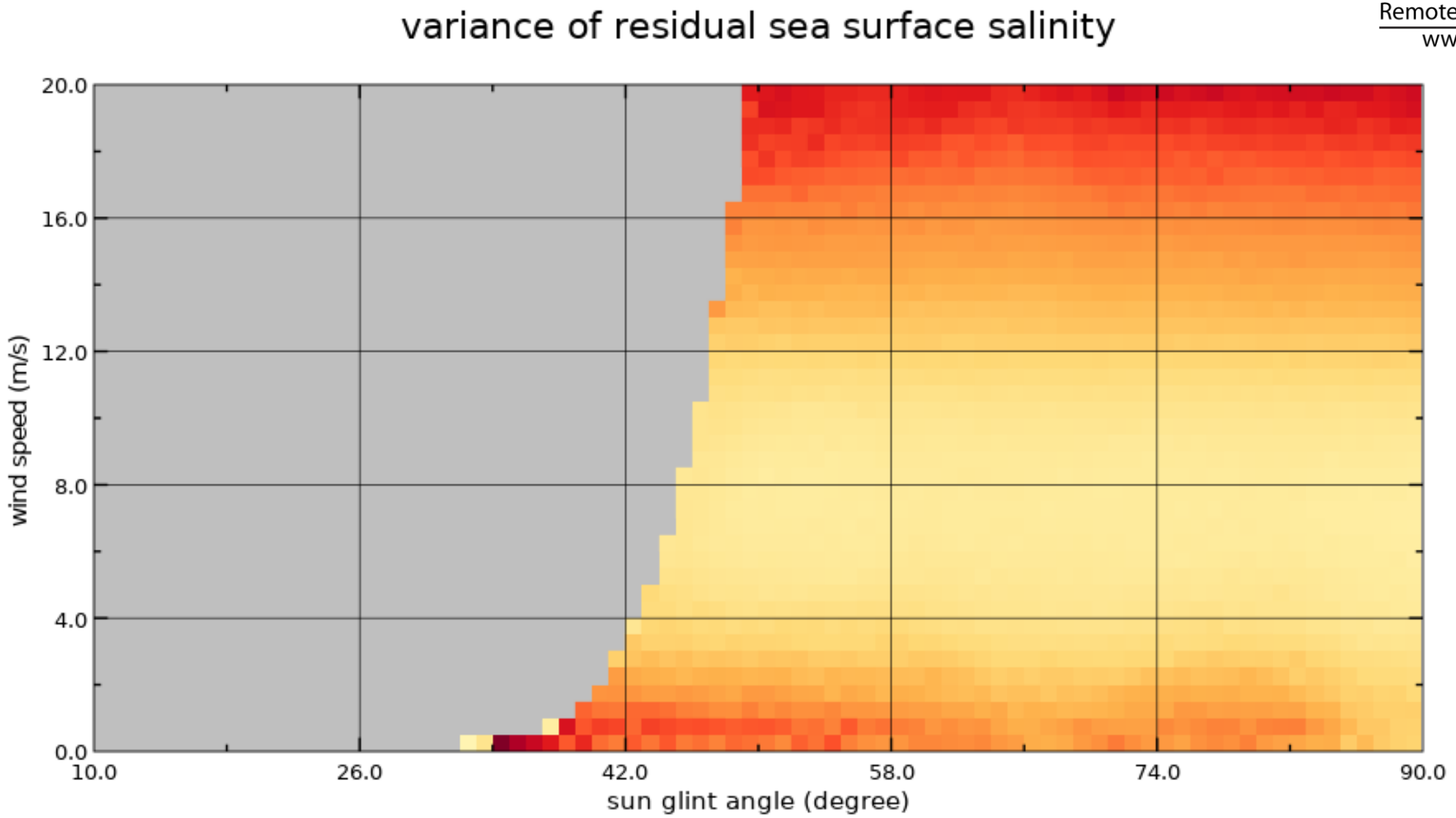
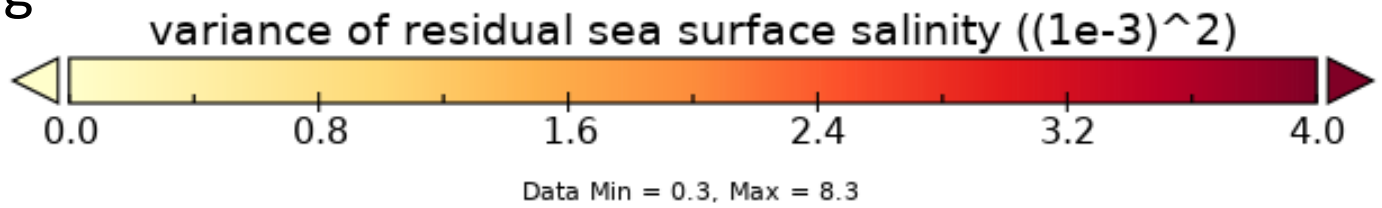


NEW sun glint QC flag



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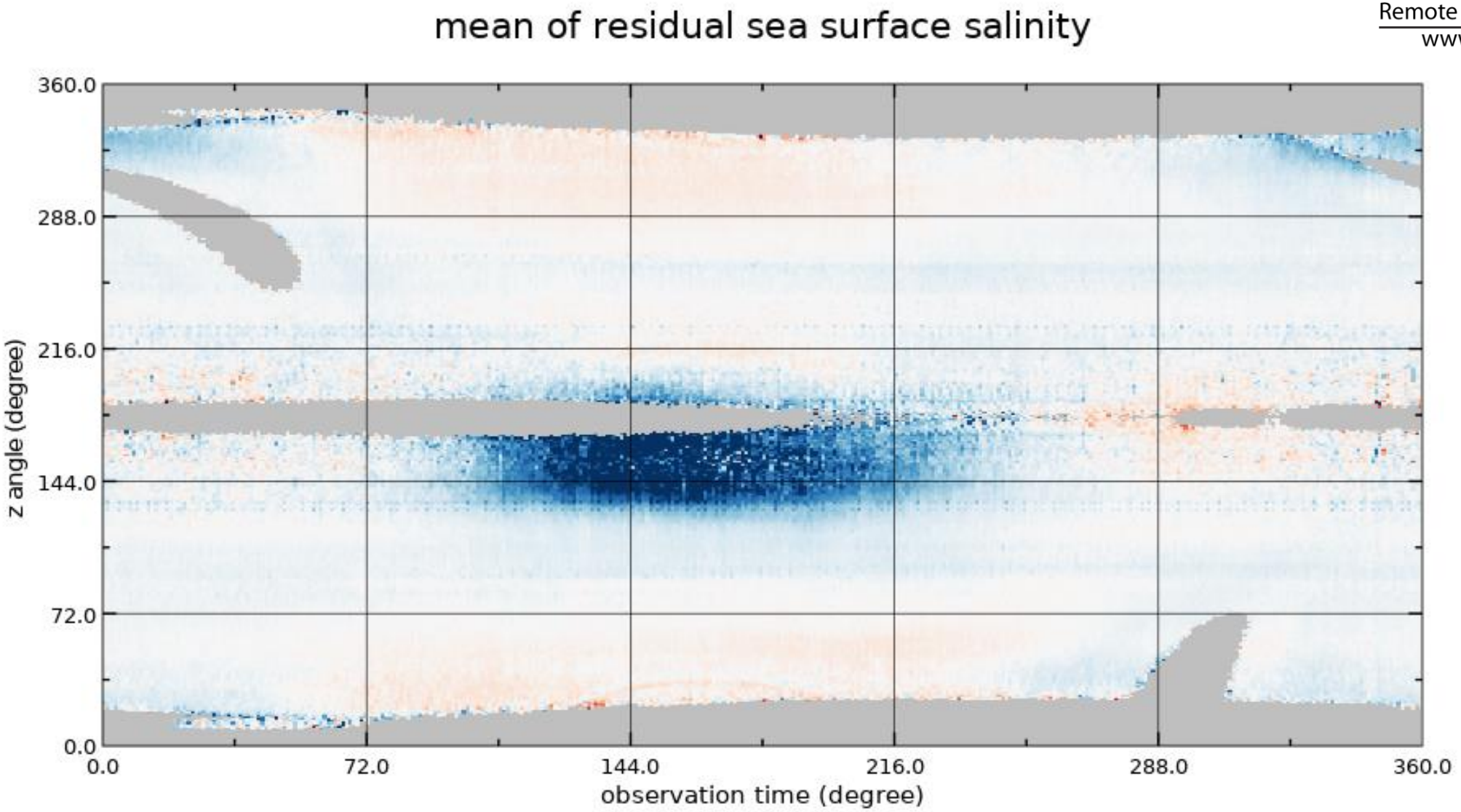
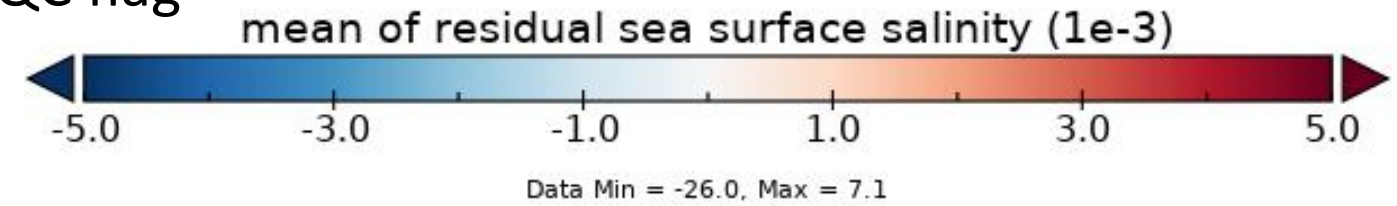


WITHOUT sun glint QC flag

α: 60° to 75°



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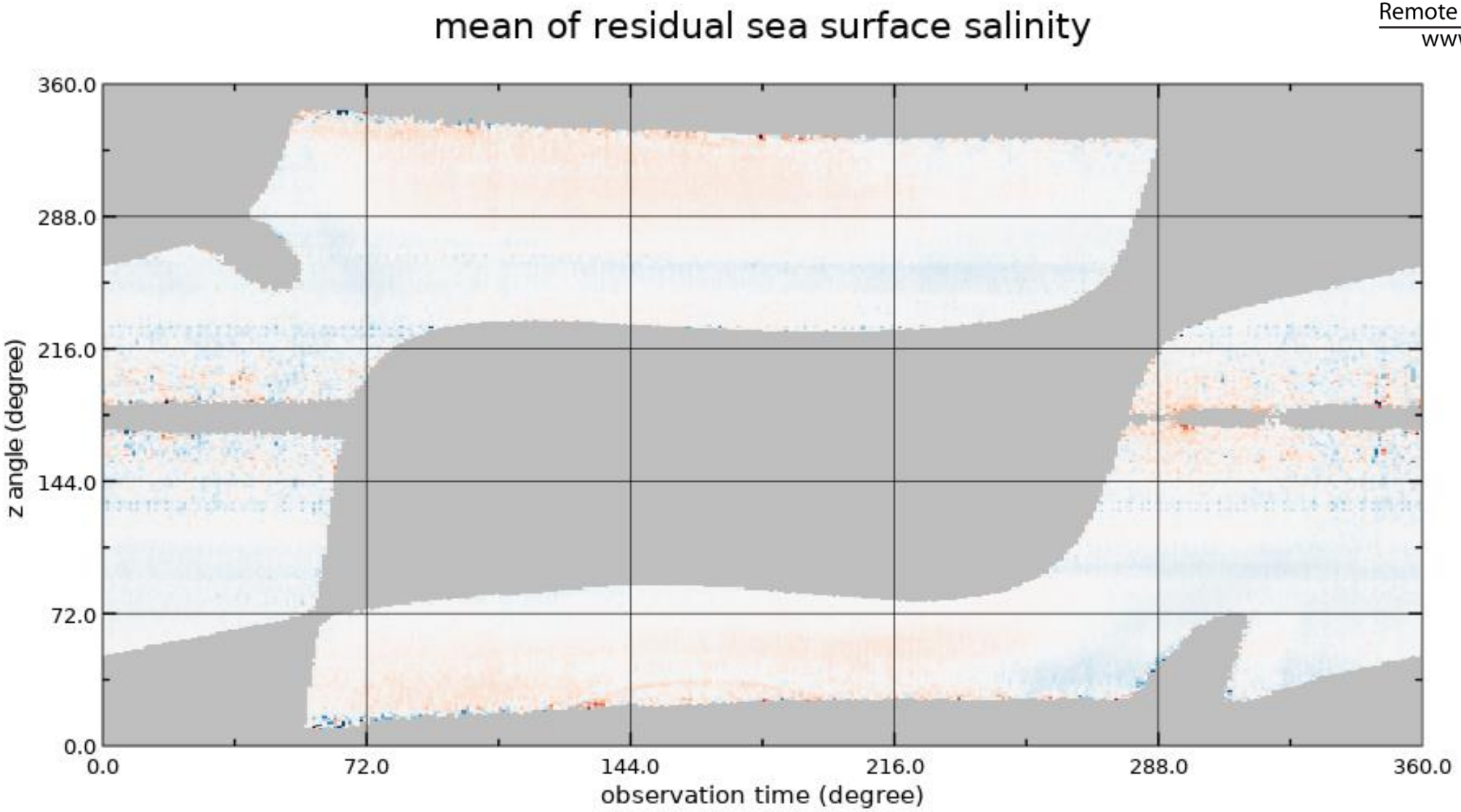

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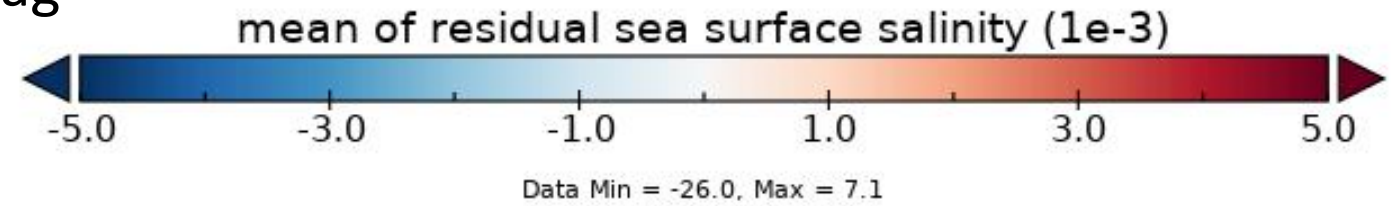

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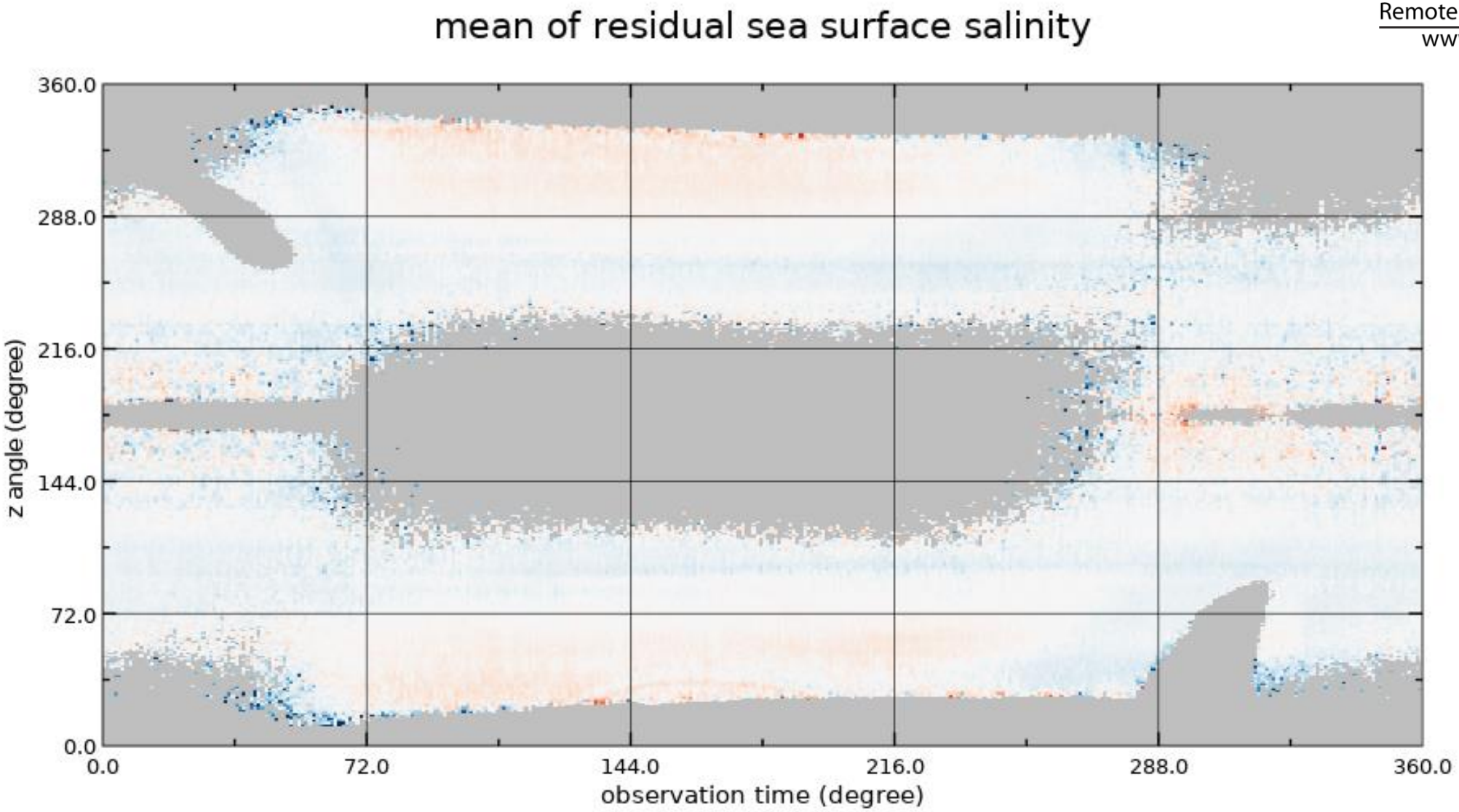

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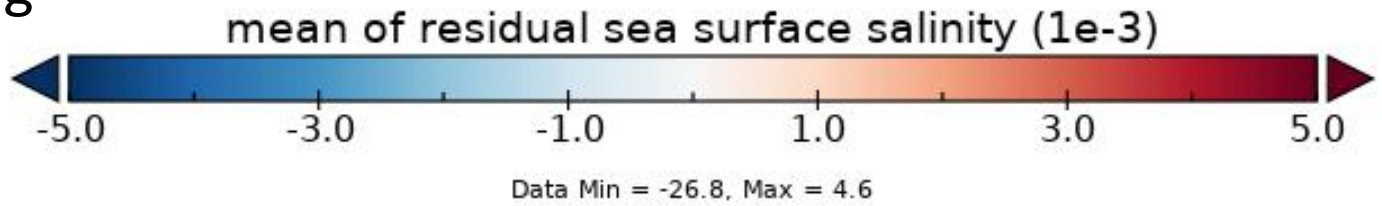

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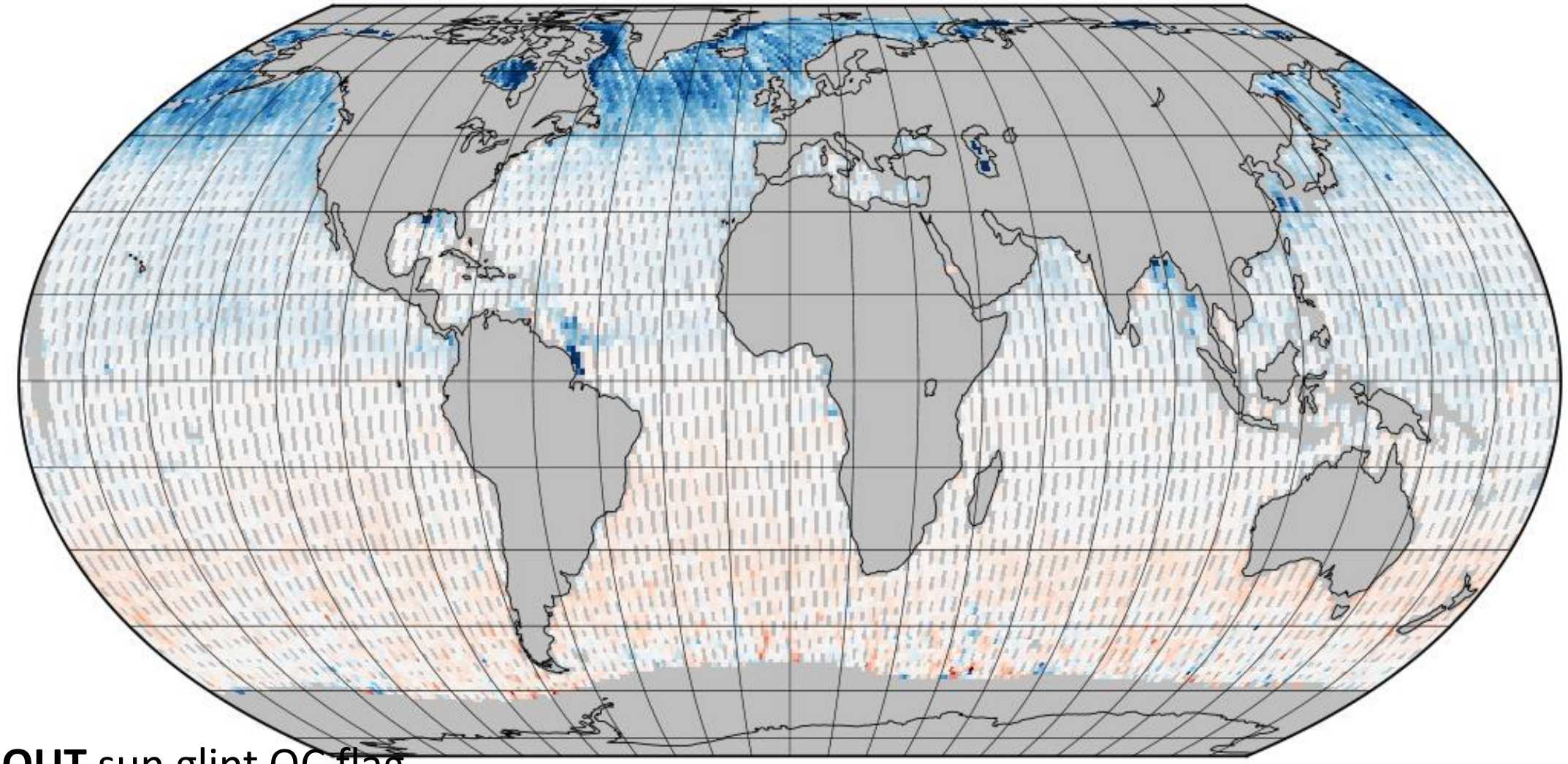
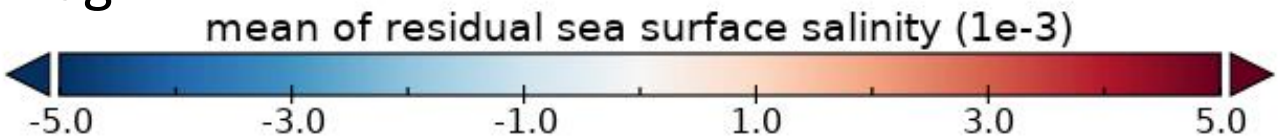
mean of residual sea surface salinity



WITHOUT sun glint QC flag

α: 60° to 90°
Ascending passes
Early August



Data Min = -25.7, Max = 5.0, Mean = -0.4

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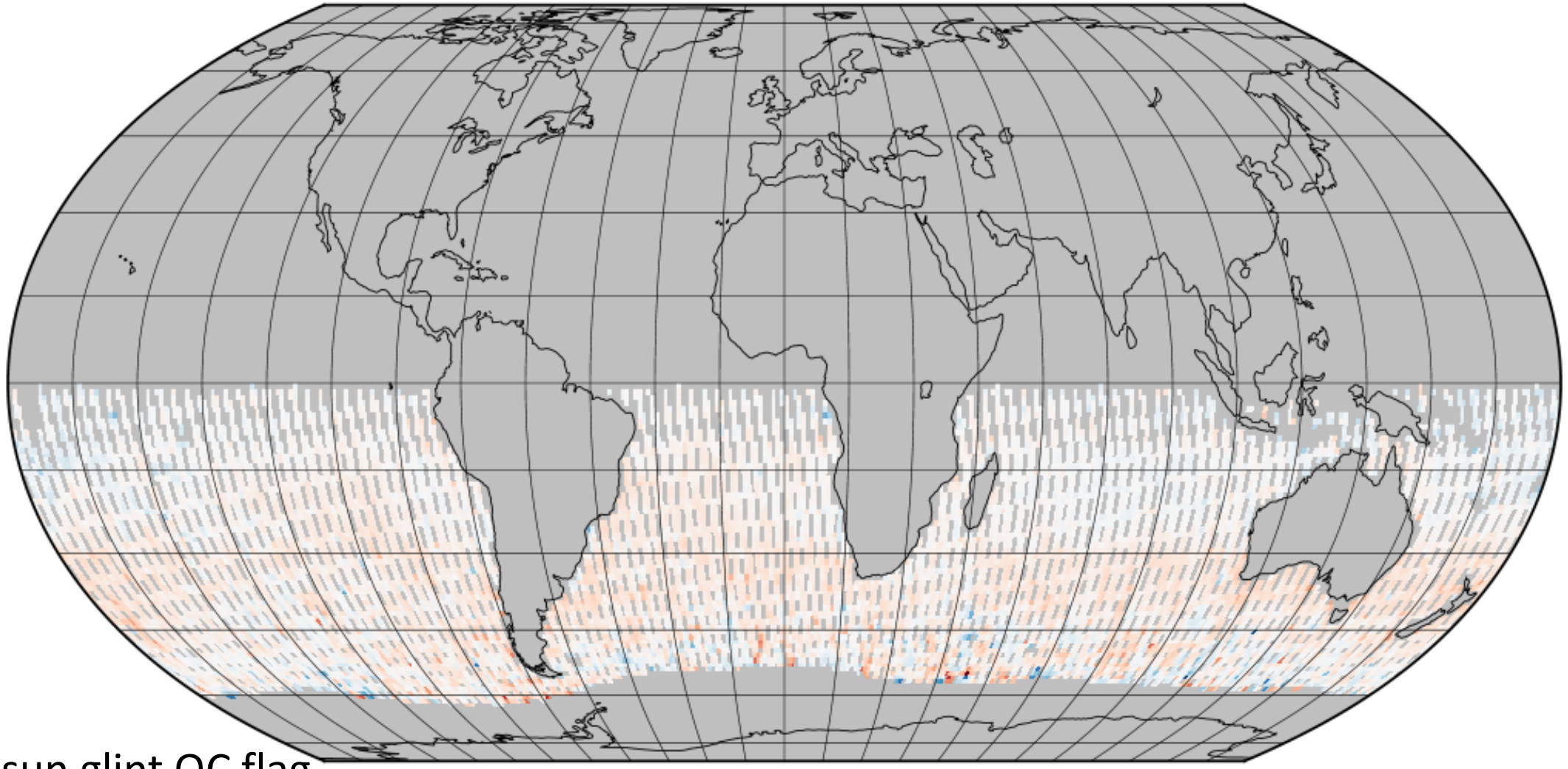
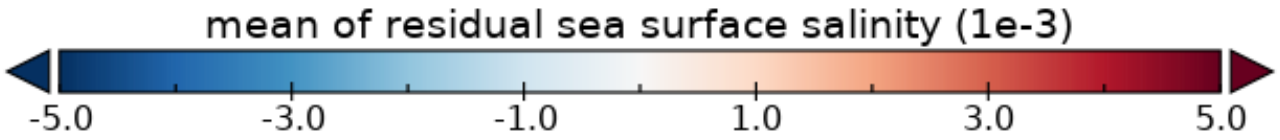
mean of residual sea surface salinity



WITH sun glint QC flag

α: 60° to 90°
Ascending passes
Early August



Data Min = -4.7, Max = 5.0, Mean = 0.2

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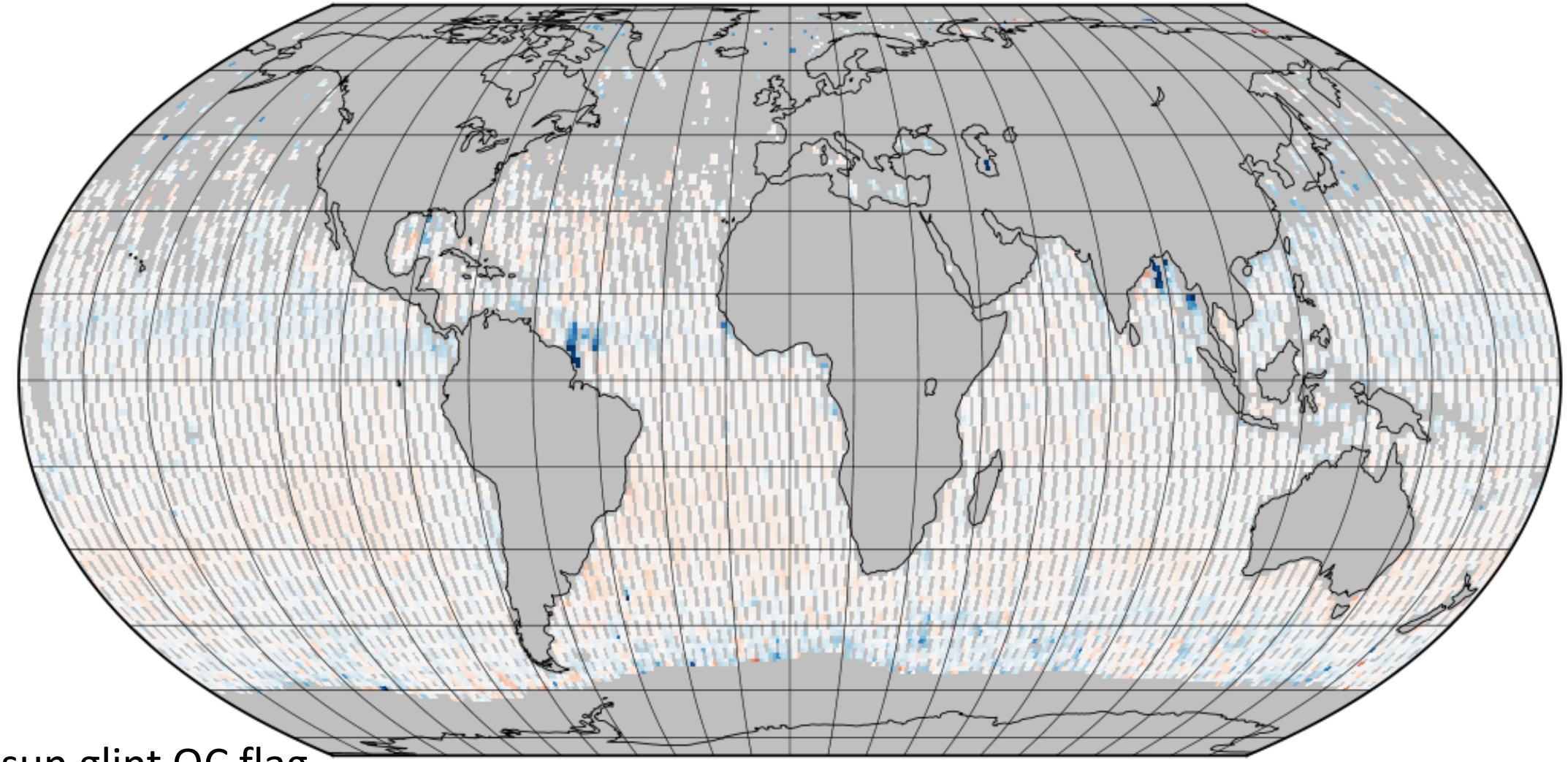
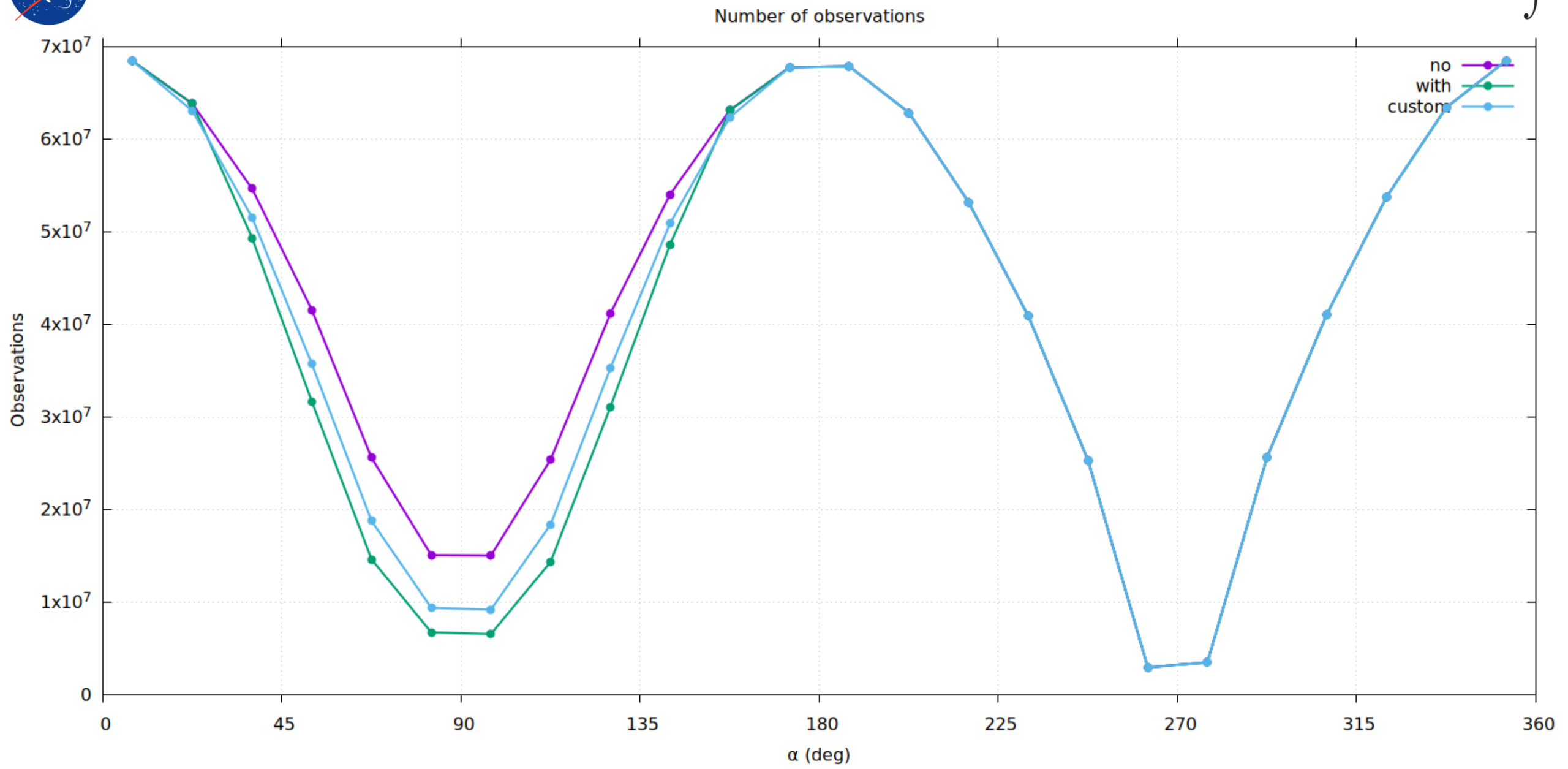
mean of residual sea surface salinity



NEW sun glint QC flag

α: 60° to 90°
Ascending passes
Early August

Data Min = -26.2, Max = 4.6, Mean = -0.1


Number of observations
Observations
7x10^7
6x10^7
5x10^7
4x10^7
3x10^7
2x10^7
1x10^7
0
0
45
90
135
180
225
270
315
360
α (deg)
no
with
custom

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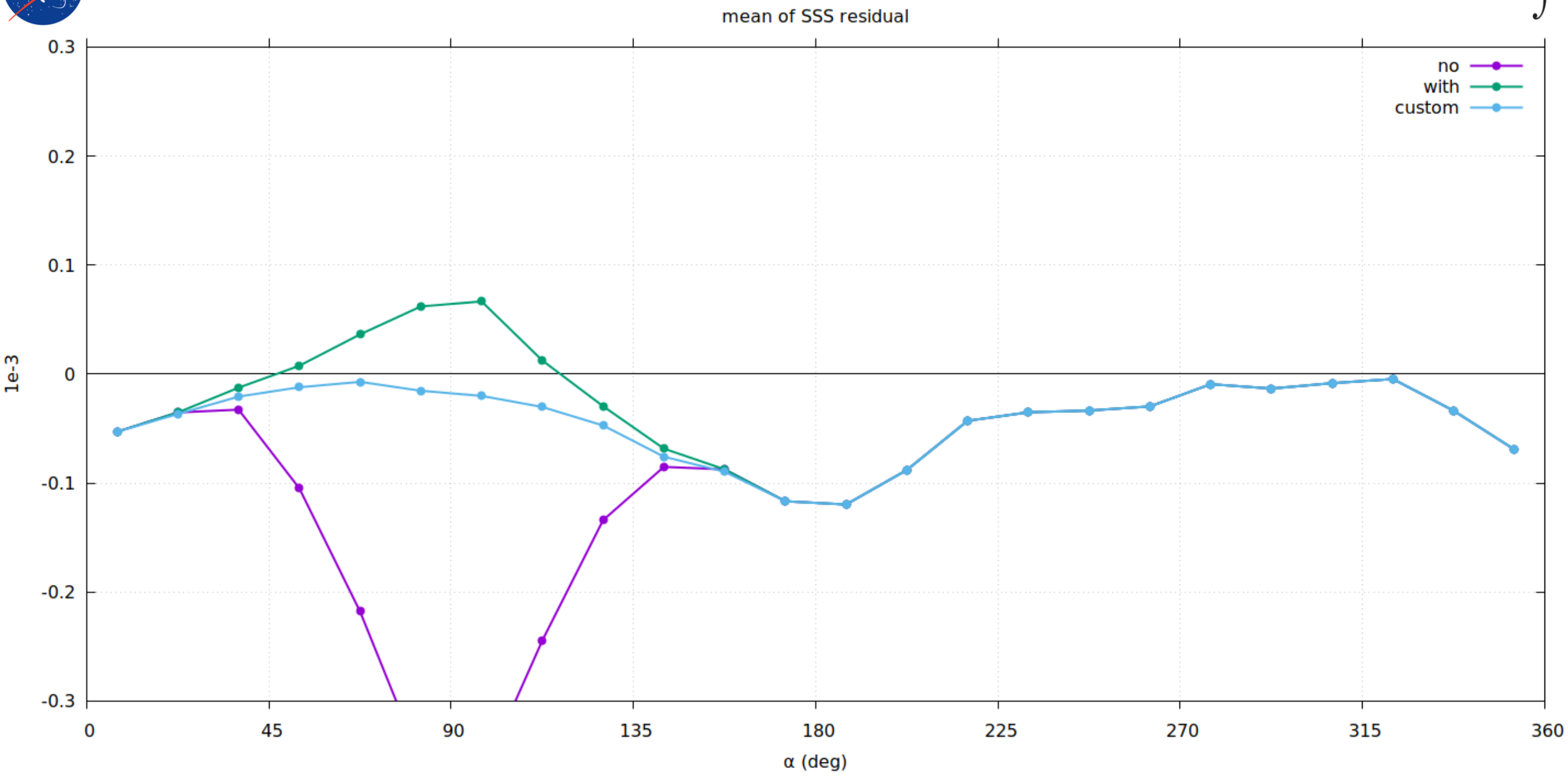

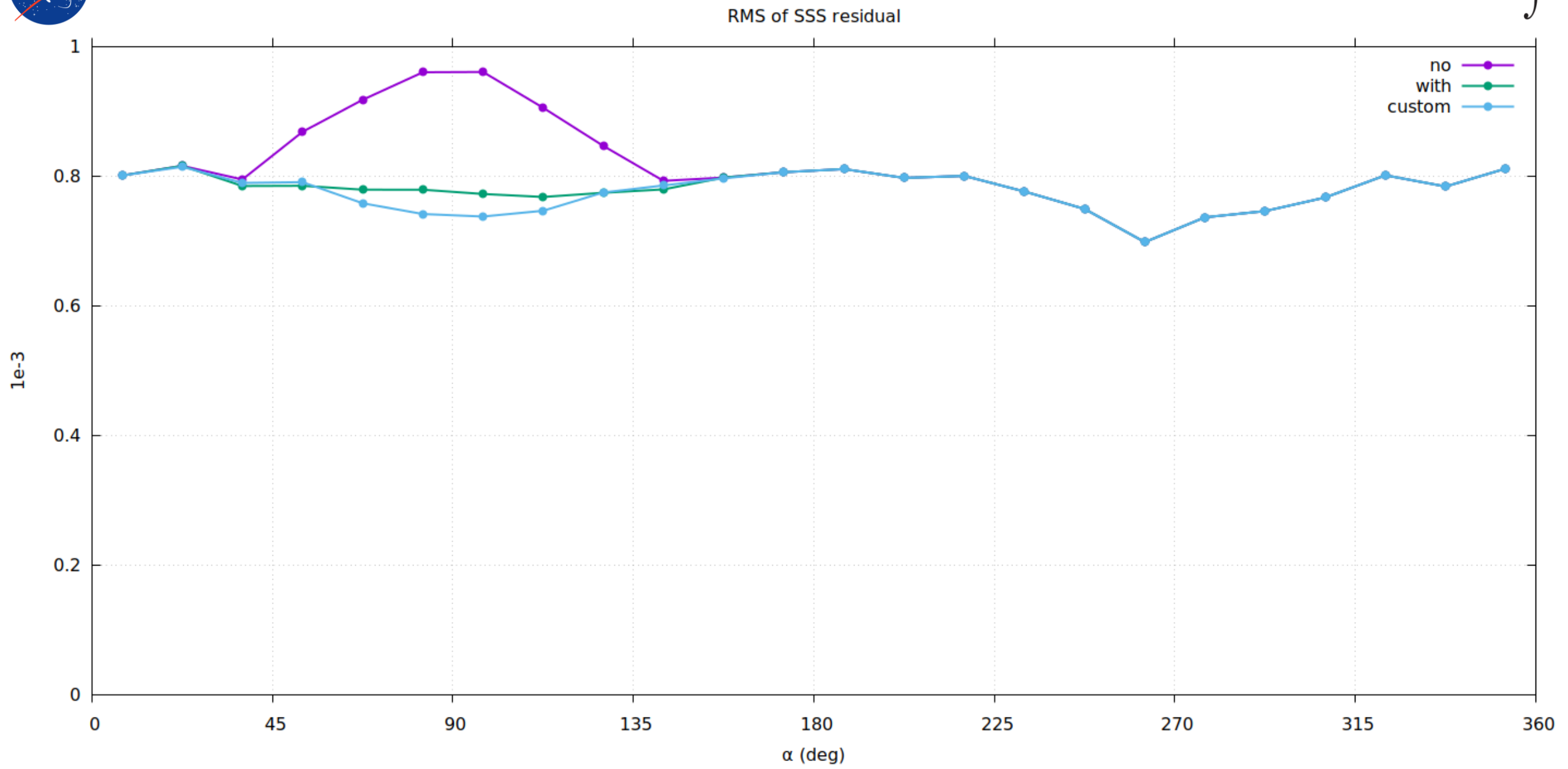
RMS of SSS residual
1
0.8
0.6
0.4
0.2
0
1e-3
0
45
90
135
180
225
270
315
360
α (deg)
no
with
custom

Conclusion

- Revised sun glint QC flag increases coverage while rejecting bad contamination
- Easily implemented in L2C processing
- Also easy to retroactively correct extant L2C files

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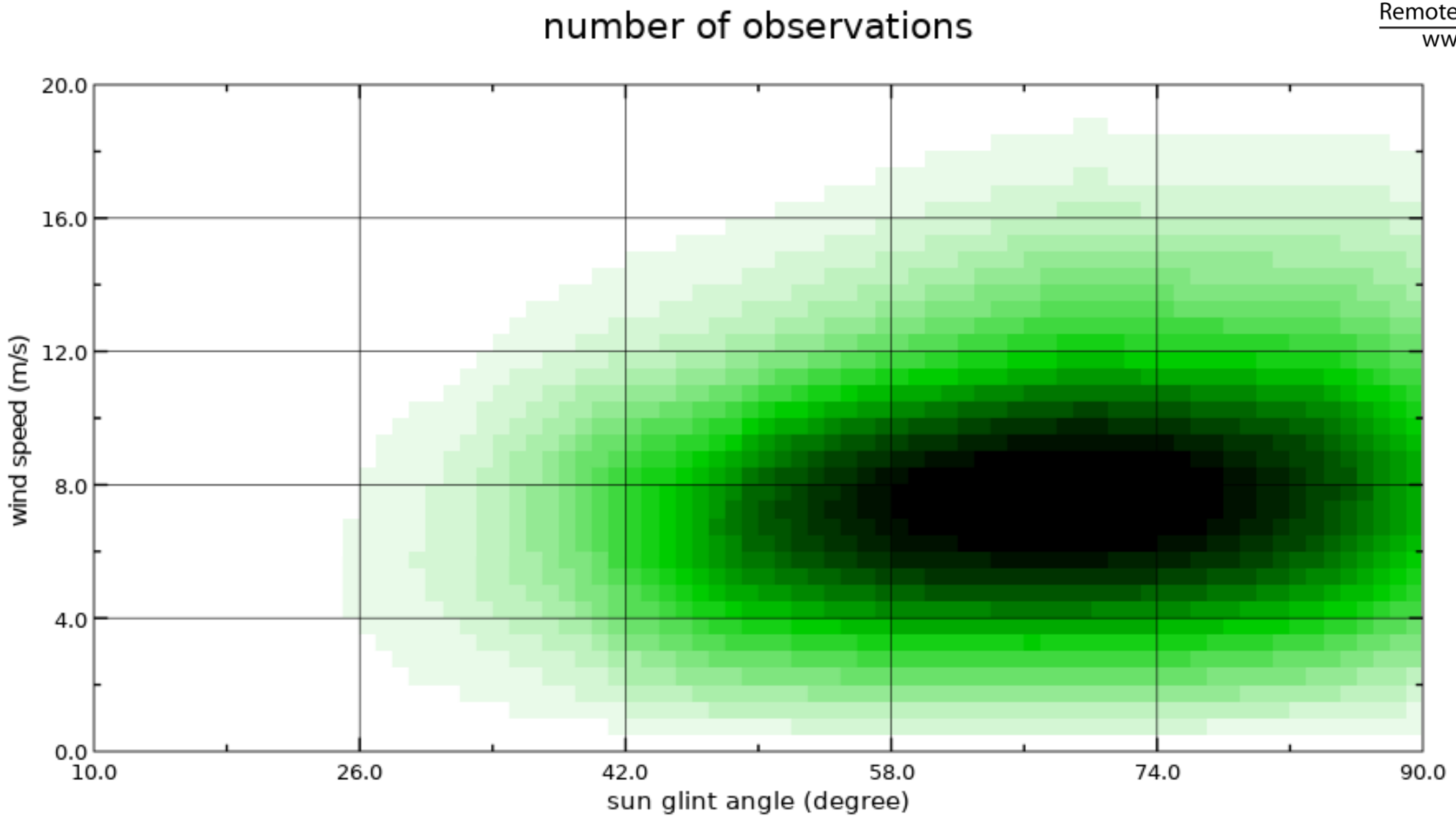
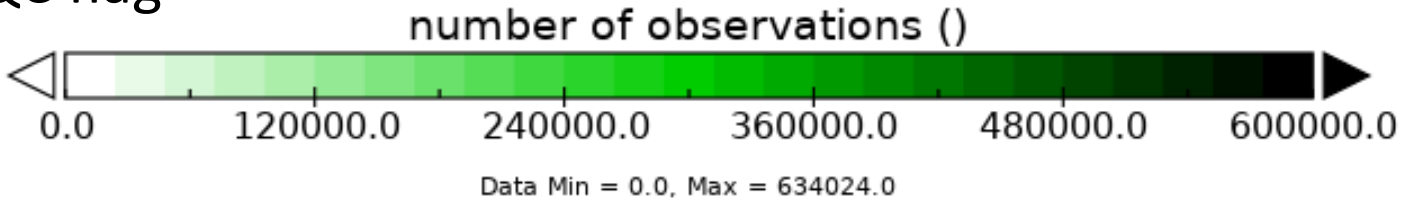


WITHOUT sun glint QC flag



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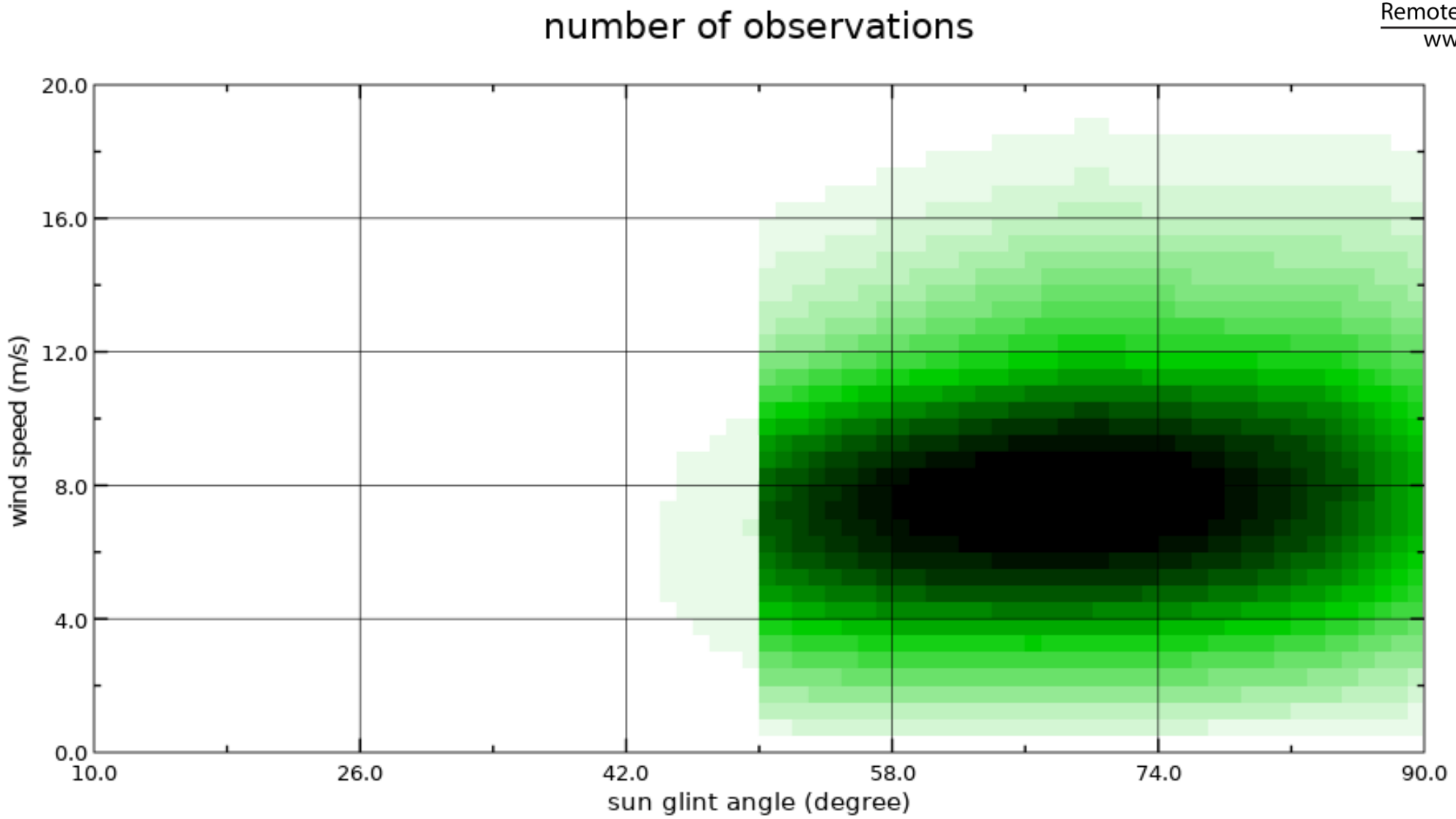

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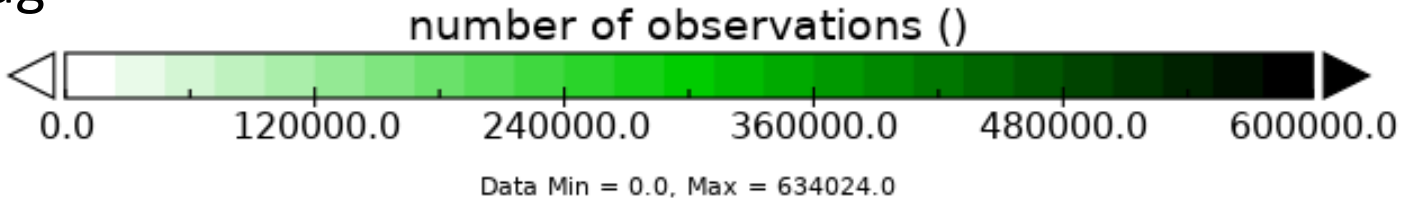

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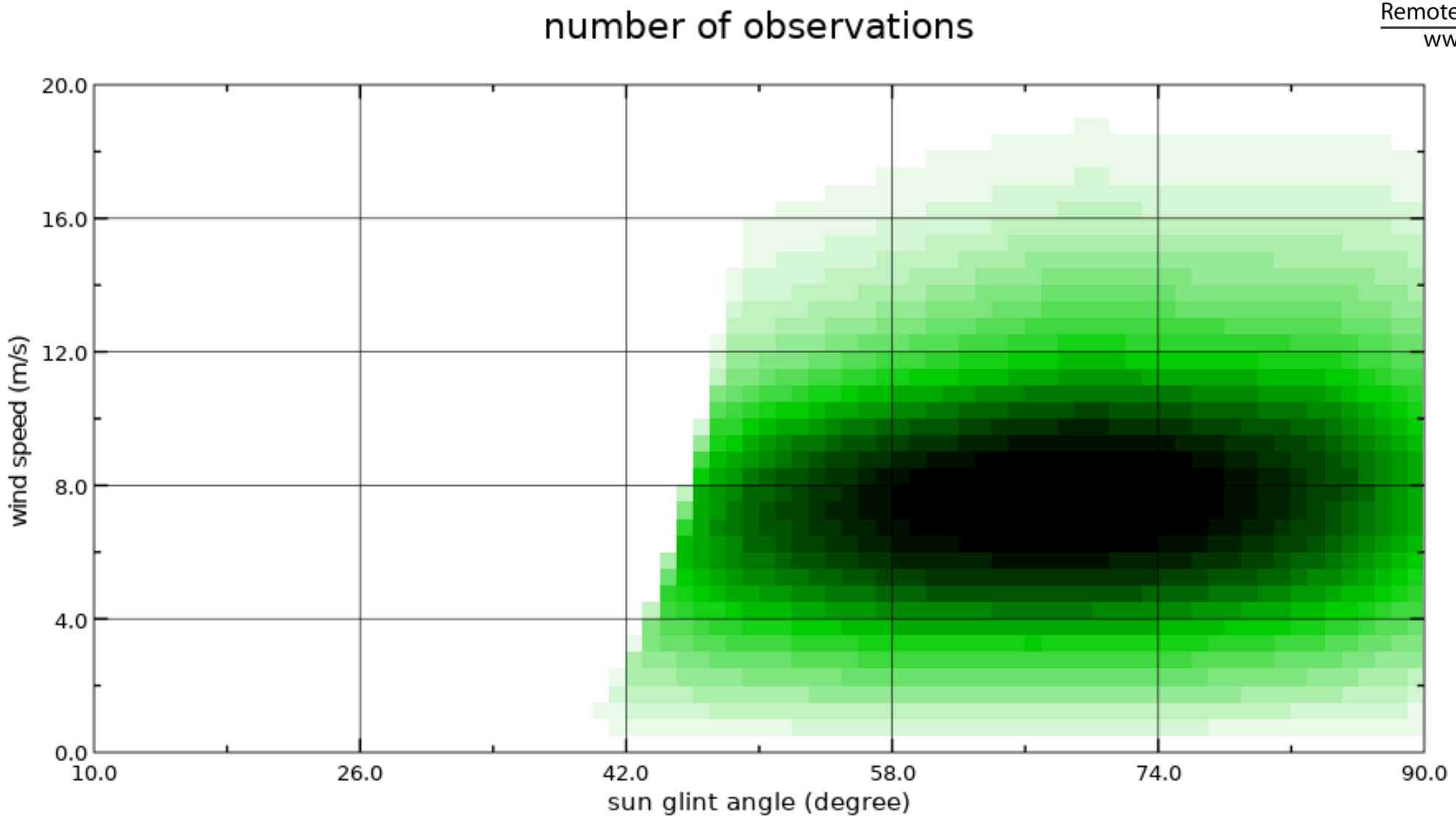

NEW sun glint QC flag