Revised SMAP Solar Contamination Flagging

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

2019-04-29
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 $\alpha$ 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
mean of residual sea surface salinity

WITHOUT sun glint QC flag

$\alpha$: 60° to 75°

mean of residual sea surface salinity (1e-3)

Data Min = -26.0, Max = 7.1
WITH sun glint QC flag

$\alpha: 60^\circ$ to $75^\circ$
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
mean of residual sea surface salinity

WITHOUT sun glint QC flag
WITH sun glint QC flag
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°
variance of residual sea surface salinity

WITHOUT sun glint QC flag

variance of residual sea surface salinity \((1e-3)^2\)

Data Min = 0.0, Max = 16.1
WITH sun glint QC flag

variance of residual sea surface salinity

variance of residual sea surface salinity \((1e-3)^2\)

Data Min = 0.2, Max = 8.4
NEW sun glint QC flag
WITHOUT sun glint QC flag

mean of residual sea surface salinity

\[ \alpha: 60^\circ \text{ to } 75^\circ \]
$\alpha$: 60° to 75°

WITH sun glint QC flag
NEW sun glint QC flag

$\alpha$: 60° to 75°
mean of residual sea surface salinity

WITHOUT sun glint QC flag

$\alpha$: 60° to 90°
Ascending passes
Early August
mean of residual sea surface salinity

**WITH sun glint QC flag**

\[ \alpha: 60^\circ \text{ to } 90^\circ \]

Ascending passes

Early August

Data Min = -4.7, Max = 5.0, Mean = 0.2
NEW sun glint QC flag

α: 60° to 90°
Ascending passes
Early August

mean of residual sea surface salinity

Data Min = -26.2, Max = 4.6, Mean = 0.1
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
WITHOUT sun glint QC flag
WITH sun glint QC flag
NEW sun glint QC flag