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# Harmonized Quality Assessments Using GHR SST SSES

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# Problem ?!

- Our users require gap free, best quality, best accuracy, high resolution, skin, close to the coast, (in bays and inland lakes) SST, based on \*real\* measurements from operational real-time (= within an hour of reception if possible) systems.
- For research we want this from the beginning of time.
- L4 fully or partially interpolated products ?
  - Some are ok with these products
  - Some are not, because of the spatial smoothing and interpolation – high frequency detail is washed out, and there is often a longer delay before availability
  - Some would simply prefer persistence to interpolation



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# Solution ?

- Use all of the data that we can get our hands on.
- GHRSSST "L3S" multi-sensor composites
  - But for best quality we need to know which measurements are "best"
  - Algorithmic
  - Application
  - Seasonal
  - Platform
  - Sensor





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# Best Quality ?

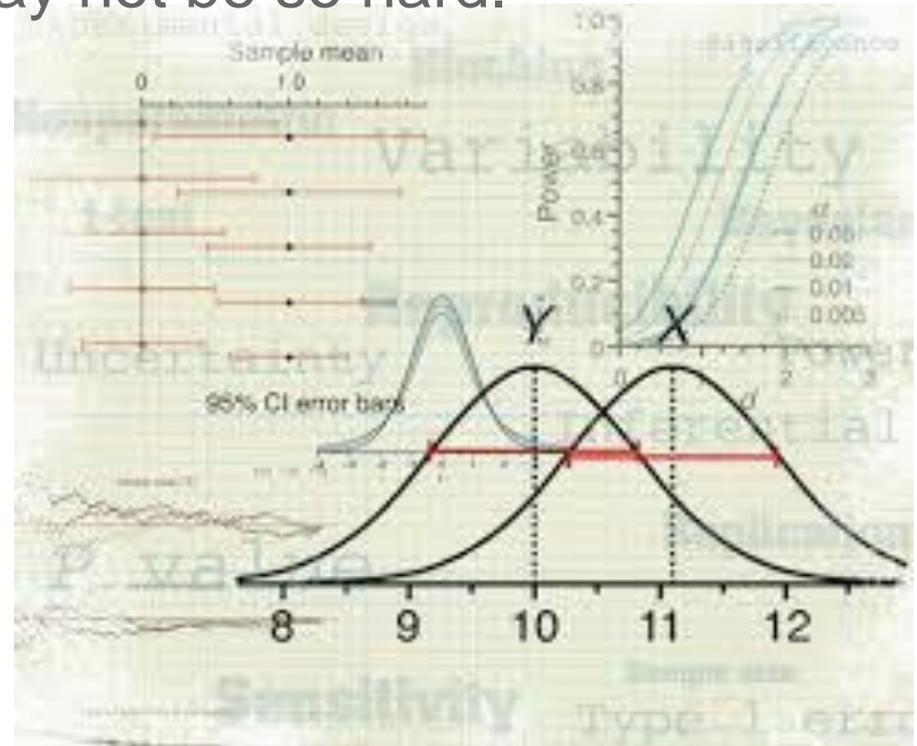
- There should be a solution that is almost statistical
  - GHRSSST products bury the geophysical bits.
  - The first approximation may not be so hard.

`sses_bias`

`sses_standard_deviation`

`quality_level`

ancillary information





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# Comparison ?

Only consider the best `quality_level` ?

- Is it appropriate to blend a pixel flagged quality 5 with one flagged quality 2 ? Even if SSES were stated to be the same ?
- Would it be appropriate to do high school statistics with variances and biases on same `quality_level` ?
  - How does it change over time ?
  - How can high quality from one source be compared to high quality from another source ?
  - Given the information we provide, is this a statistical problem or a geophysical one ?



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# Toy problem !

- ABOM has a long time series HRIT record of NOAA-AVHRR
  - Has been converted to 1km SST over 20+ years
  - Now past end of life
- NPP-VIIRS and MetOp time series are available
  - ACSPO NPP-VIIRS L3U SST is available in real time
  - Better coverage, similar resolution
  - How do we aggregate it with NOAA ?

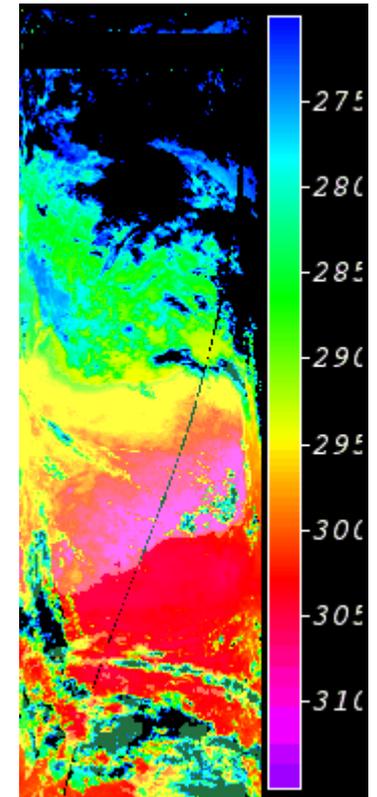
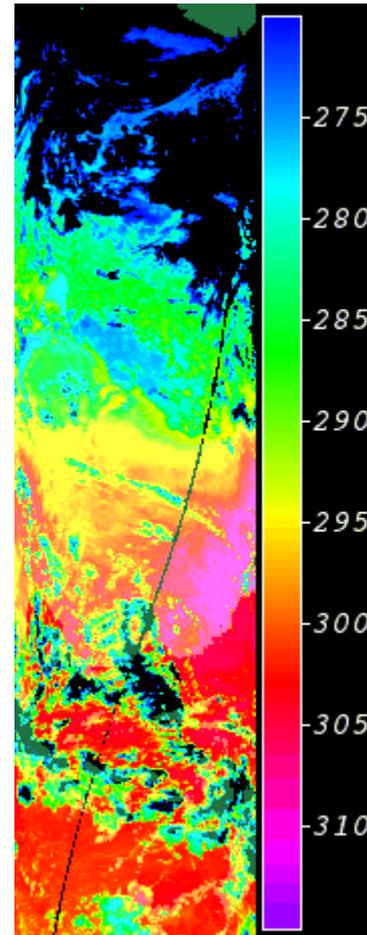
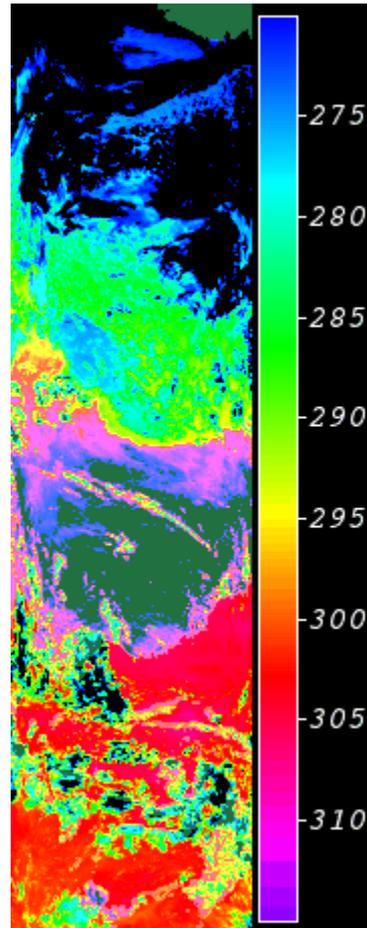




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# Toy problem !



NOAA 19, 18, 15

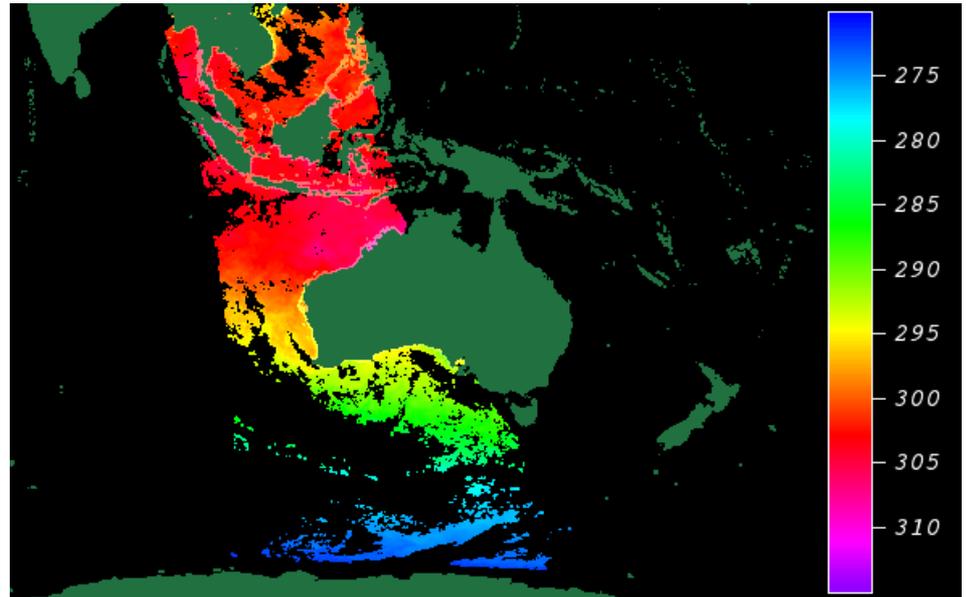
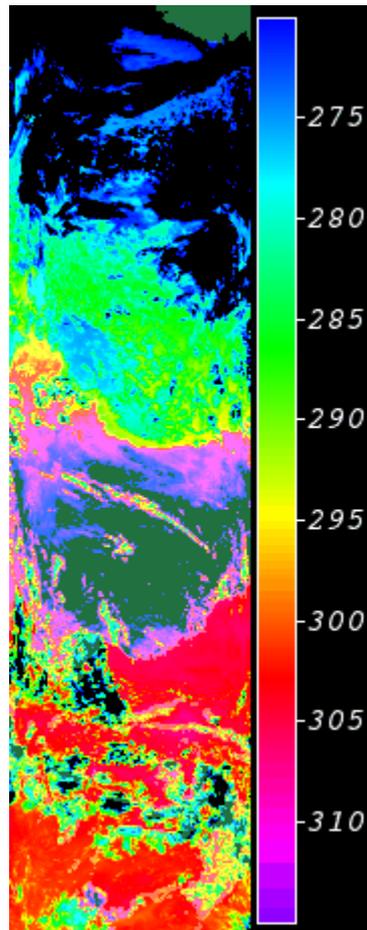


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# Toy problem !

AVHRR L2P ABOM



VIIRS L3U NOAA ACSPO



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# Toy problem !

- Take the best quality measurements from both images
  - best quality NOAA-15 retrieval of the same value as a best quality NOAA-19 retrieval ?
  - the same value as a best quality NPP-VIIRS retrieval ?
- Perhaps quality assessment could be degraded because of time and platform variability of performance.
- Need another definition of "quality" that is good over time and platform, that downgrades the view by view quality,

$$\text{quality\_level} \rightarrow \min(\text{quality\_level}, q_s)$$



# A simple proposal (based on GDS2)

$$q_s = \left[ 5 \exp^{77 q_{sses}} \right]$$

Scale

Bias target is zero

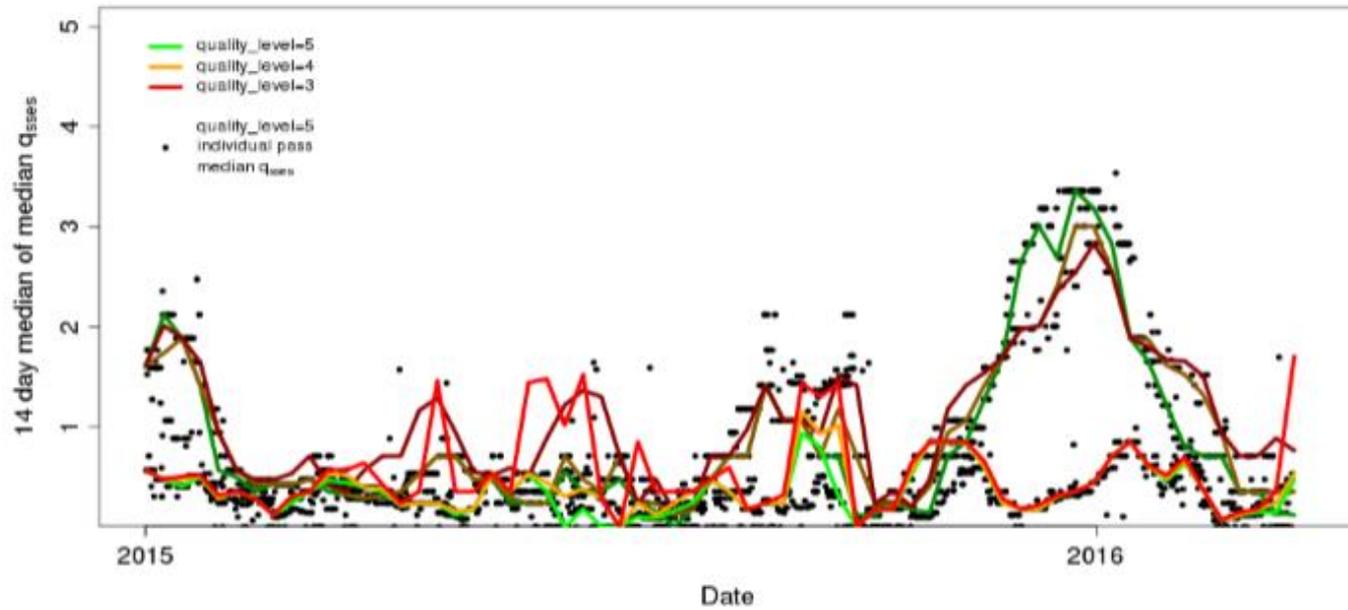
$$q_{sses} = \frac{1}{\sqrt{2}} \sqrt{\max \left( \left( \frac{\sigma_{sses}}{\sigma_0} \right)^2 + \left( \frac{\mu_{sses} - \mu_0}{\sigma_{sses}} \right)^2 - 1, 0 \right)}$$

Lower bound of uncertainty,  
Typically 0.2-0.3K for LEO, more ? for GEO

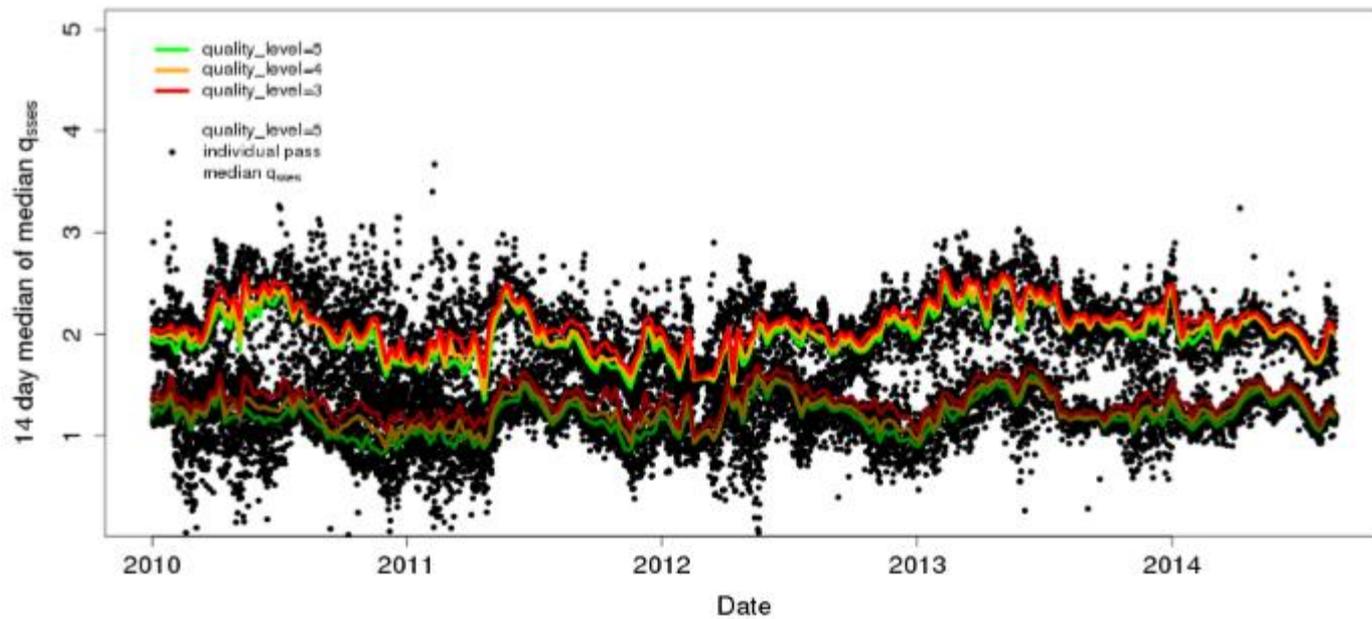


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NOAA-19, L2P fv01, Jan 1 2015 to March 31 2016



NOAA-19, L2P fv02, Jan 1 2010 to Aug 23 2014

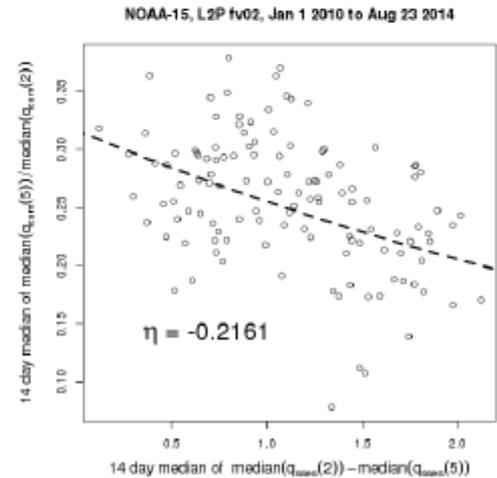
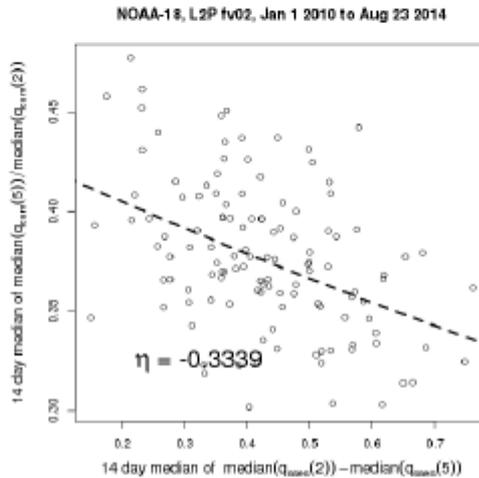
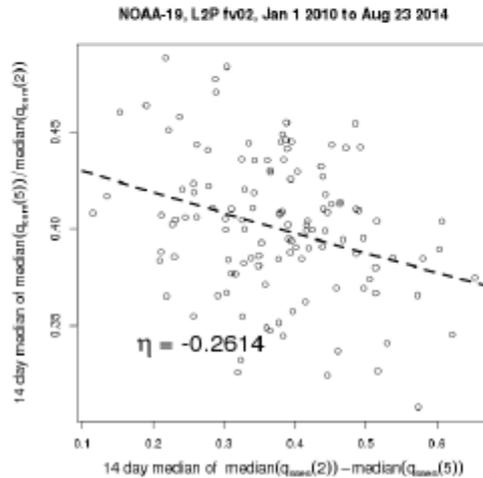
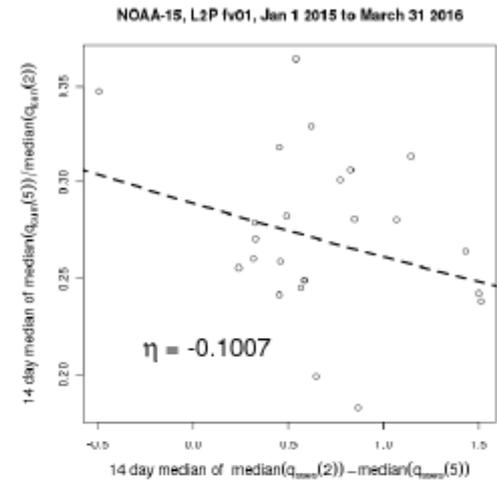
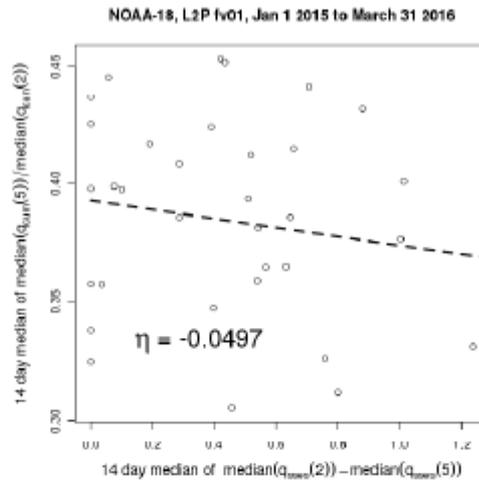
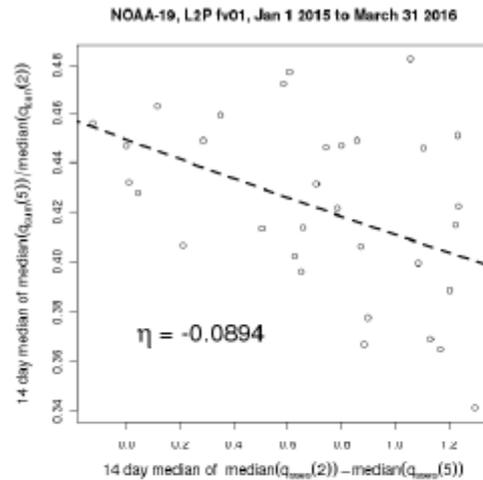




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# Setting scale

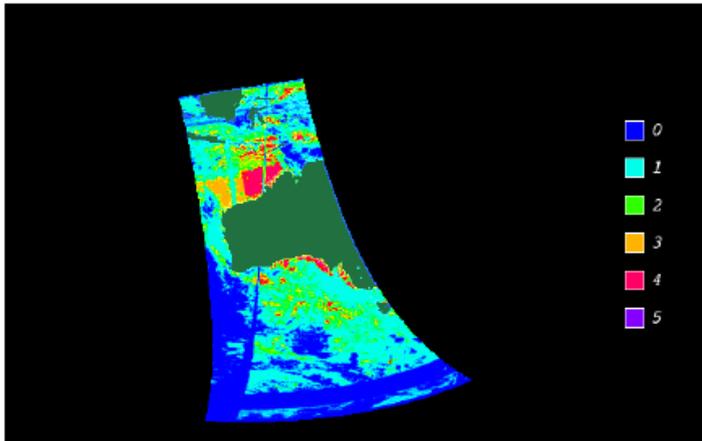




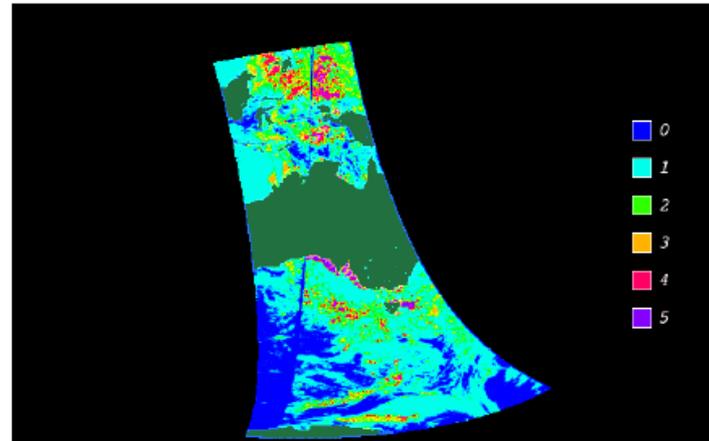
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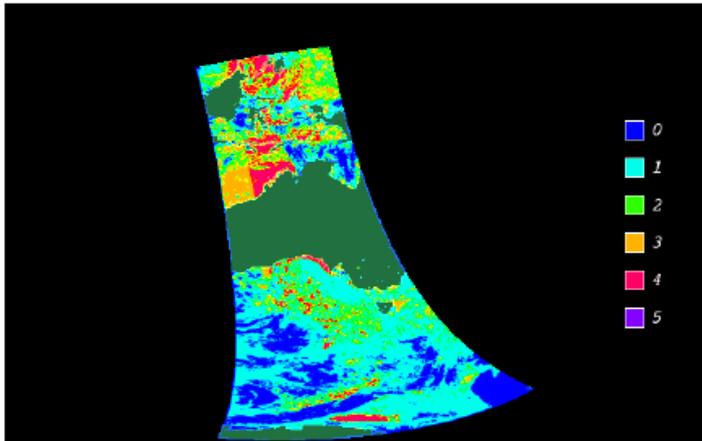
# Does it help ?



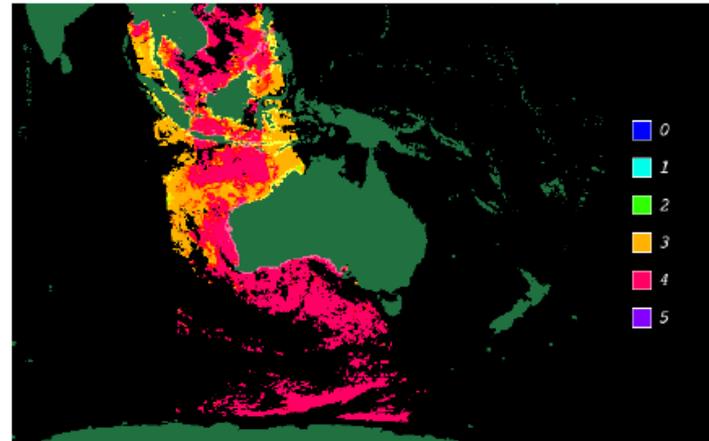
NOAA-15 fv01 L3U



NOAA-18 fv01 L3U



NOAA-19 fv01 L3U



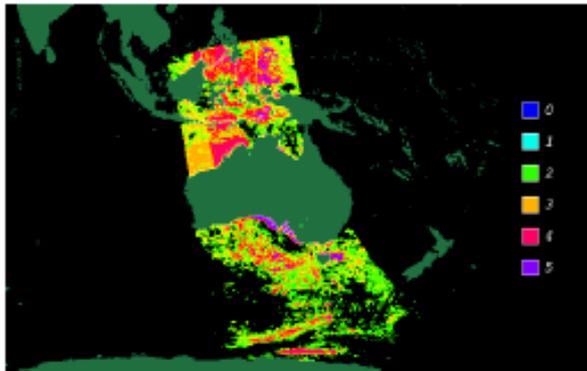
L3U NPP VIIRS



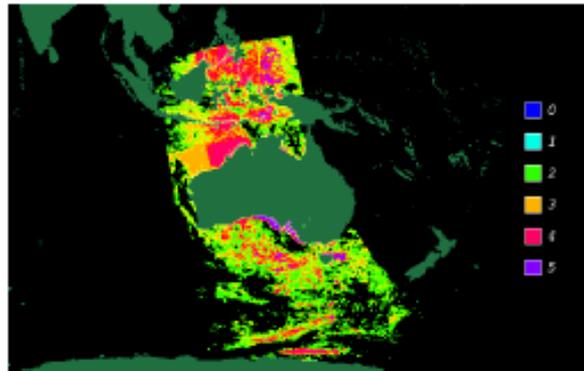
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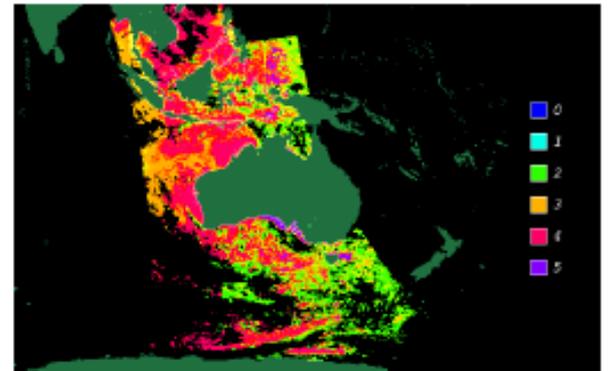
# Does it help ?



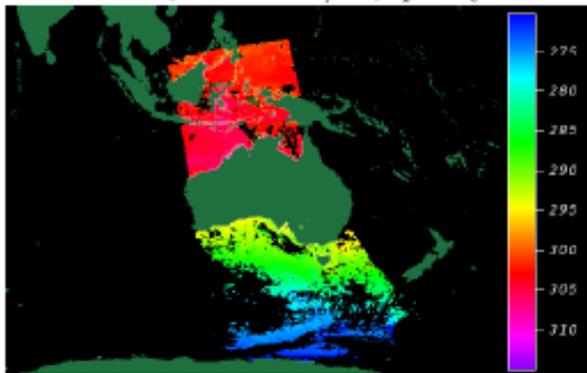
SST, NOAA-18/19, quality



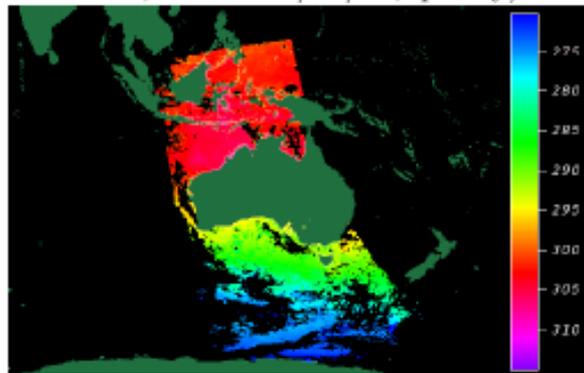
SST, NOAA-15/18/19, quality)



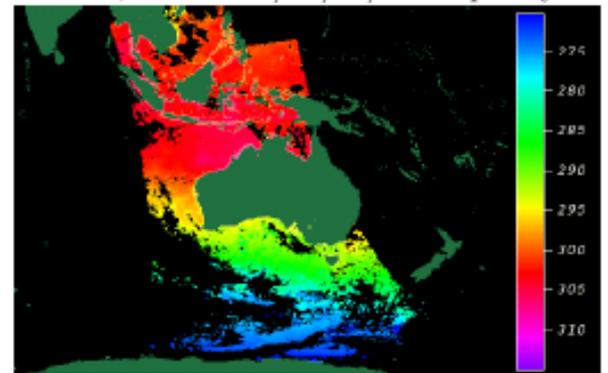
SST, NOAA-15/18/19/NPP quality



SST, NOAA-18/19, SST



SST, NOAA-15/18/19, SST



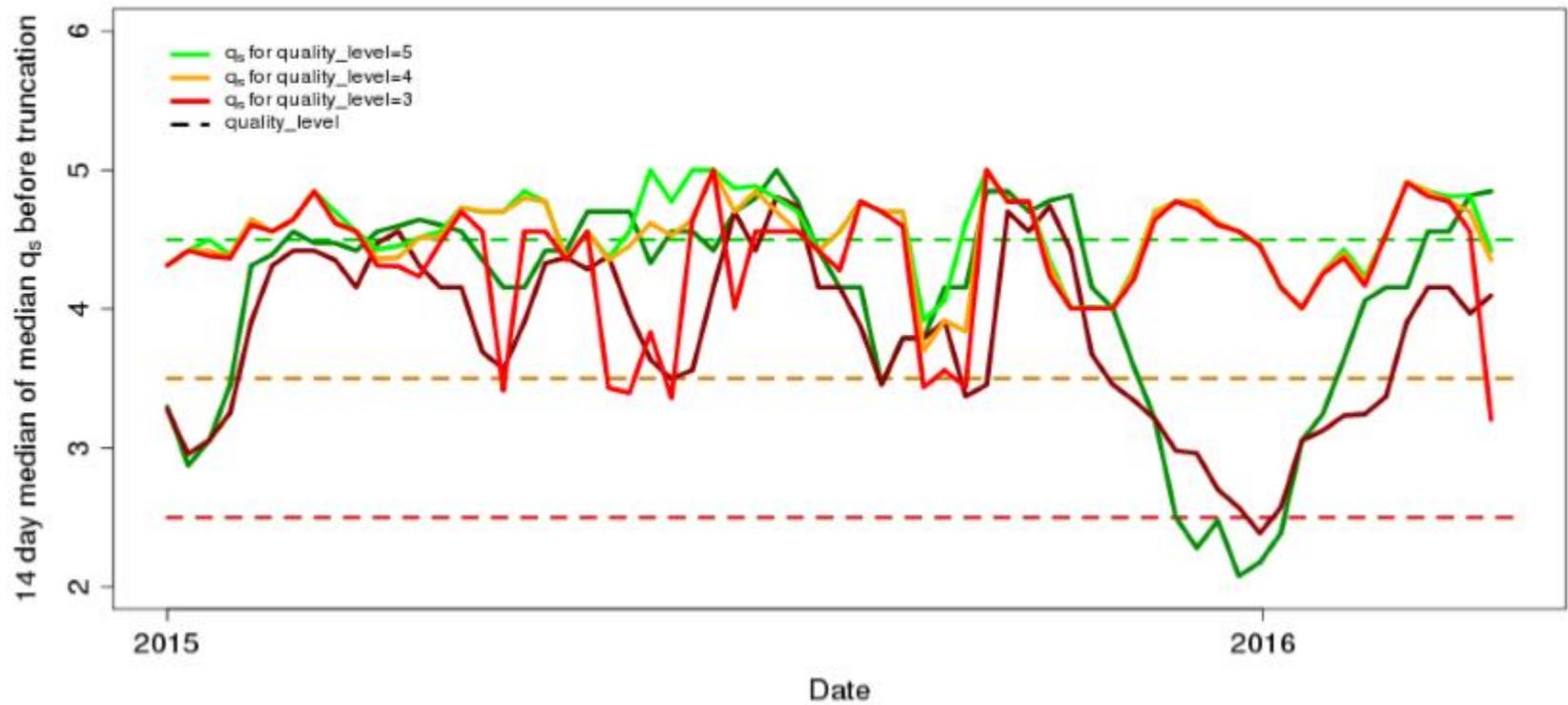
SST, NOAA-15/18/19/NPP SST



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NOAA-19, L2P fv01, Jan 1 2015 to March 31 2016 NOAA-19 fv02 reference.





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# Does it work ?

- Validation per coverage cannot be worse than any one platform
  - We take the best quality measurements from each.
- Coverage is guaranteed to be greater
  - There are more sources.
- A little more work will tell how significant the validation results are.
- Similar approach for merging with Himawari-8 just before sunrise L3S.





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# Questions ?

*Thank  
You*

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# Kullback-Liebler divergence

- If you transmit a number under the assumption that it's of excellent quality

$$x \sim N(\mu_0, \sigma_0)$$

- Then you realize that the you made a mistake and its really

$$x \sim N(\mu_{\text{sSES}}, \sigma_{\text{sSES}})$$

- The information gained in that realization is

$$d_{\text{KL}} = \frac{1}{2} \left( \left( \frac{\sigma_{\text{sSES}}}{\sigma_0} \right)^2 + \left( \frac{\mu_{\text{sSES}} - \mu_0}{\sigma_0} \right)^2 - 1 + 2 \log \left( \frac{\sigma_0}{\sigma_{\text{sSES}}} \right) \right)$$



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