4/30/15 4:22 PM from Emmanuel

Otto,

Thank you very much for your presentation. Well organized talk and a very impressive sensing capabilities.

I wonder if you thought about vicarious calibration once the sensor is in space.

Optical sensors drift in time, and maintaining accuracy is a big issue for the ocean color community.

All the best and thanks again,

  Emmanuel

4/30/15 5:16 PM from Bryan Franz

Greetings Otto,

Very nice presentation (even after seeing it several times!).  I have a few questions if you don't mind.  In the SPEX specifications, I think you show SNR of 300 @ 850nm for LER=0.03.

1) do you know the SNR in the blue (e.g., 440nm)?
2) how do you define LER (surface or TOA)?

Also, on the question of swath width, have similar uncertainty analyses been done at varying cross-track view angles.  I'm wondering, for example, if the 5-angle conclusion holds at the 30-deg cross-track angle, or if it has been clearly demonstrated that the value of multi-angle measurements diminishes significantly beyond 30-deg.  I think this is a critical point that we need to document.

Thanks,
bryan

5/1/15 2:29 PM from Otto

Emanuell, (I include 2 SPEX instrument scientists Jeroen and Willem in the cc so they can correct/add if necessary) Since we measure two modulated spectra with opposite phase, and we know the sum of the 2 should contain no modulation, we can correct the polarization measurement for in-flight changes in instrument transmission, making the polarization measurement concept virtually insensitive to in flight transmission changes. A potenitial critical aspect is polarization changes induced by the telescope as that comes before the polarization optics. It has urgent attention in the design to make this component as stable as possible. For vicarious calibration/monitoring of this aspect we plan to use scenes for which we know DoLP = 0 to high accuracy. For intensity, we would rely more heavily on vicarious calibration. Here, we would like to use the OCI instrument itself to monitor stability. Also, I understood from the PACE spacecraft team that moon pointings will be possible. Otto

5/1/15 2:45 PM From Otto

Dear Bryan, 1) 850 nm is the most critical wavelength to achieve SNR. At other wavelengths the SNR will be similar or better. I can inform on more accurate estimates if you like. 2) LER is here defined at TOA. Actually, the SNR is defined per ground pixel (2X2 km2) here and not per spatial resolution element (4X4 km2). For the latter it would be a factor 2 better. Concerning the swath: The ± 30 degrees is not the result of a quantative trade-off as was done for the number of viewing angles. It is to large extend driven by the fact that instrument performance becomes worse the wider the swath is (i.e. one would achieve coverage at cost of accuracy) and the instrument size grows rapidly by further extending the swath. The swath of the original design was ± 15 degrees and the extension to the ± 30 was considered feasible but already challenging by the design team. This, combined with the fact that scattering angle range becomes narrower at the swath edges made us decide not to push the swath further. Hope this answers your questions. Feel free to ask more information. Best regards, Otto

5/6/15 2:33 PM from Robert

Ahoy Otto:

A few more questions about the SPEX instrument concept:

1) How radiometric calibration would be achieved?

2) Is the angular range ±55 deg with respect to the spacecraft or the ground (i.e., is 55 deg the largest viewing zenith angle along the ground trace)?

3) Would accuracy be improved (aerosol parameters) if larger viewing zenith angles were used?

4) For observing over the ocean (focus of the PACE mission), and for aerosol remote sensing, would it be appropriate, using polarization, to measure at more than 5 angles, but only in the UV, VIS, and NIR (no SWIR)?

5) Would there be an advantage in having an equatorial crossing time at 10:30am instead of 12:00pm, e.g., to cover a wider range of scattering angles?

6) Is it necessary to measure at 100 angles to describe properly the rainbow region?

Thank you, Cheers, Robert.

5/8/15 2:59 AM from Otto

Dear Robert, 1) How radiometric calibration would be achieved? We plan to use vicarious calibration with OCI and stability checks with natural targets. 2) Is the angular range ±55 deg with respect to the spacecraft or the ground (i.e., is 55 deg the largest viewing zenith angle along the ground trace)? These numbers have been under discussion last week within our team. For the SWIR we changed it to ± 50 deg at spacecraft which is ~+/- 57 deg at the ground, because for this instrument concept pixel size inceases a lot between 50 and 55 deg (at spacecraft). Still, there will be measurements at higher angles but these will not meet the spatial resolution requirement. For the VNIR we are more flexible as we can modify the pixel size per viewing module. Here, the current baseline is ± 60 deg. at the ground. 3) Would accuracy be improved (aerosol parameters) if larger viewing zenith angles were used? In theory yes because it increases the scattering angle range. In practice no because the retrieval will be hampered by 3D effects, Earth curvature, etc. That is why we choose ± 60 deg at the ground for the VNIR even though we are flexible in choosing a larger anglular range. 4) For observing over the ocean (focus of the PACE mission), and for aerosol remote sensing, would it be appropriate, using polarization, to measure at more than 5 angles, but only in the UV, VIS, and NIR (no SWIR)? Our sensitivity studies indicate that adding more viewing angles do not provide significant gain for aerosol remote sensing, and hence also not for atmospheric correction. If you would do this at cost of the SWIR it will worsen the capability of the instrument for aerosol remote sensing and atmospheric correction. For cloud remote sensing there would be a slight advantage when observing the rainbow at 865 nm, but also not if this would go at cost of removing the SWIR. 5) Would there be an advantage in having an equatorial crossing time at 10:30am instead of 12:00pm, e.g., to cover a wider range of scattering angles? Yes, but I'm afraid we would have to live with a 12:00 orbit as the primary focus is on ocean. 6) Is it necessary to measure at 100 angles to describe properly the rainbow region? 100 angles is a bitt overkill. 50 would be sufficient. Best regards, Otto

5/8/15 5:48 PM from Robert

Ahoy Otto:

Thank you for your clear and useful answers. Looks like, using polarization, wide scattering angle range and observations in the SWIR are important. Perhaps we should discuss the ECT issue during one of the PACE telecons.

Regards, Robert.

Robert Frouin, Scripps Institution of Oceanography, (858) 534-6243