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Comment on bg-2020-454

Anonymous Referee #2

Referee comment on "Reviews and syntheses: Ongoing and emerging opportunities to improve environmental science using observations from the Advanced Baseline Imager on the Geostationary Operational Environmental Satellites" by Anam M. Khan et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2020-454-RC2, 2021

General comments:

This is a well written and valuable synthesis of the emerging and potential uses of new geostationary sensors. I think it will be a useful reference for a broad audience of ecologists and environmental scientists, especially those who perhaps already use remote sensing but haven't yet added geostationary sensors to their toolbox. It certainly spurred new ideas for me.

I really only have one general comment (though see below for some more specific and technical comments): is this a review specifically of ABI, or of the new generation of geostationary sensors more broadly? The title states ABI, but there are many places throughout the article that seem much more general than the title implies, even places (especially in sections 3 and 4) that don't seem tied to geostationary sensors at all but are more general overviews of broadly applicable issues in remote sensing (e.g., descriptions of atmospheric correction, vegetation indices, and derivation of incident PAR that could use more specifics on how these would be applied to and/or benefit from geostationary observations and what the challenges would be in their derivation/use). My main suggestion would just be to tighten up this focus a bit throughout. (I have a couple of additional specific suggestions below on a few specific places where this would be helpful.)

Specific comments:

-Line 112: I might choose a different heading here. This section seems less about working with ABI data (which I had initially interpreted as being from the perspective of a typical environmental science user) than about some of the issues and uncertainties in ABI data that need to be corrected before you can even start working with it.

-Section 3.3.2: This section is kind of general and could be more specifically focused on LST from ABI (or others of the newer generation of geostationary sensors).

-Lines 231-232: It might also be worth noting that EVI has a soil background correction factor built in that may also make it more suitable for open canopy systems (Huete et al., 2002).

-Lines 356-358: There's a really good article from Zhang et al. (2009) on the impact of temporal resolution on vegetation phenology retrieval (as well as the impacts of missing data around vegetation transitions) that might be useful here. It might be worth expanding a bit on where and how much geostationary data could improve on the composite data (typically 8- to 16-day) that are often currently used for vegetation phenology retrieval. The authors specifically mention how it could be useful where cloudy conditions occur around seasonal transitions, but another thing to highlight might be the utility of geostationary observations in some dryland systems, where phenological transitions can occur very rapidly and unpredictably in response to rainfall pulses (Smith et al., 2019), which might be either missed by polar orbiting sensors or washed out in the composite. Monitoring phenology in these regions has definitely been a long-standing problem (e.g., the White et al. 2009 and Ganguly et al. 2010 articles that are already cited by the authors). Of course, there are other challenges aside from temporal resolution that make dryland phenology difficult to model/detect (Smith et al., 2019), but any potential improvement from geostationary observations in these regions could be worth noting.

-Line 416: I think this should say "linear relationship between absorbed PAR (APAR) and _gross_ primary production," right? The MODIS algorithm first models GPP at an 8-day frequency then estimates annual NPP as the annual integral of GPP minus the annual integral of autotrophic respiration (modeled from allometric relationships and air temperature).

-Lines 417-420: There are a couple (admittedly nitpicky) details of the MODIS algorithm that I think are incorrect here and should be double-checked. First, in the operational MODIS GPP/NPP product, NDVI is not the primary way that APAR is estimated (though in principle, it certainly could be). APAR is estimated from the MODIS FPAR product (MOD15), which is itself based primarily on an inversion of a radiative transfer model, with the NDVI~FPAR relationship only being used as a backup algorithm in case the full inversion fails (Knyazhikin et al. 1999; Myneni et al. 2002). Second, and this is merely a technicality, there are five (not three) biome-specific parameters in the model since Tscale and Wscale require two parameters each: a lower Tmin/VPD threshold and an upper Tmin/VPD threshold. (If you also include the allometry and Q10 parameters needed for the NPP estimates, then there are even more than five.)

-Lines 429-432: Maybe here, or maybe elsewhere, it might be worth noting possible synergies with other satellite-based sensors. Here, for example, I'm thinking of possible synergies with soil moisture estimates from microwave sensors (e.g., SMAP or AMSR-E/AMSR-2) given the widespread importance of soil moisture for primary production and the known deficiencies in existing LUE models' ability to represent soil moisture stress (Stocker et al. 2018, 2019).

-Lines 434-435: This is very true, and worth noting that there is at least one relatively new LUE model that does indeed include effects of diffuse irradiance (Zhang et al., 2016).

-Lines 439-441: Could the authors expand on this a bit?

-Section 6.2: Since recovery from disturbance is a relatively slow process (occurring mostly on the time scale of weeks to years, I imagine?), it's unclear to me what geostationary brings to the table that we're not already getting from polar-orbiting sensors like MODIS, especially given the challenges raised by the authors in lines 451-454. Could the authors expand more on why geostationary observations would be useful in this regard and how they would complement or expand on the capabilities already available from polar-orbiting sensors?

-Section 6.3: This is a really interesting section, and something that I hadn't really considered before. I think it could be more specifically tied to the article's focus on geostationary observations, though. Is this not something that can be done with existing polar-orbiting satellites (e.g., the morning/afternoon/nighttime overpasses of Terra/Aqua)? How specifically could you envision geostationary observations contributing to this?

Editorial suggestions/corrections:

-Line 113: I would suggest changing "certain" to "given" and deleting "on the Earth".

-Line 131: This should be section 3.2, not 3.1.

References:

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