CRTM Aerosol LUTs compared to NASA LUTs

CRTM Monthly Meeting Protocol

Core Topic of the Meeting: CRTM Aerosol LUTs compared to NASA LUTs

Date: 2021-08-26 **Time**: 15:00 EST

Location: Google hangout

Invited Speakers: Andy Tangborn

Meeting Chair: Benjamin Johnson (JCSDA)

Keeper of the Minutes: Patrick Stegmann (JCSDA)

Attendees: Patrick Stegmann, Cheng Dang, Hongli Wang, Igor Polonsky, Isaac Moradi, Andy Tangborn, Jim Jung, Ming Chen, Yingtao Ma, Sarah Lu, Benjamin Johnson, Shih-wei Wei, Andrew Collard, Bryan Karpowicz, Cory Martin, yanqiu (?), Quanhua Liu

Ben: Anybody know if Mark Liu is going to join today? – No.

Agenda Item 1:	Introduction by Ben
Discussion:	Ben: What we'll do is just give a brief update on release 2.4.1 and Andrew Collard is joining us today because he is a Fed now. Congratulations Andrew! Andrew: Thank you. Yingtao: Congratulations, what will you do? Andrew: Mostly JEDI stuff. Ben: He'll be working with us on GDAS with us on the OBS team. I was hoping to get the GOES-17 coefficients into v2.4.1. Yingtao, do you have an update? Yingtao: GOES-17 or 18? Ben: Whichever GOES-R is. Yingtao: Yes, I have generated coefficients. Ben: My last update was that they are being evaluated? Yingtao: Yes, they are being evaluated now. Ben: I think we don't have any code changes left, Patrick and Cheng?

	Patrick: There's still 1 PR pending for the TauCoeff netCDF I/O. Ben: The biggest challenge for people to upgrade to v2.4 from 2.3 is the requirement for netCDF support. It can be tricky on laptops. v2.4.1 doesn't change that, but there are some changes to the way aerosols are handled. For v3.0 I had some email contact with Mark Liu to merge it as soon as possible. My goal is to have v2.4.1 as the last standard scalar release. For v3.0 you can just run it in scalar mode. There are going to be some minor and major releases out of v3.0. The good news is that we'll be a lot ahead of RTTOV. One of our main focuses over the next 2 years is UV radiance assimilation. Any questions about v3.0? Jim: I have a question. I don't know where NOAA-21 is, but it might be good to have some placeholder for CrIS and IASI. Ben: Good point, what's the launch date? Jim: I don't know exact dates, I heard 2022, maybe 2023. Ben: That's the other part I have been working on as the acting OBS team lead, to request Jim: You should probably be talking to NESDIS, because they are the ones launching them. NCEP might be knowing better about using foreign instruments. Ben: Who should I coordinate with, Kevin? Jim: I don't know, for GOES stuff probably Jaime, but I'm not sure. Ben: Ok, I just work that through Kevin. So, with this new approach for coefficient generation we can distribute the workload for the coefficient generation. But my ultimate goal is to have a clear pipeline of priority for instruments. That prioritization is critical for operations. There's no automated way of doing this. Along those lines I have been coordinating with the folks that are developing the OSCAR coordination interface. By the end of the month they can export xml files with instrument data. It's not real-time monitoring but it's going to help us. Any other questions? Otherwise we'll move to Andy Tangborn's presentation on aerosols.
Result:	N/A
Tasks:	- Deliver GOES-R transmittance coefficients - Contact NESDIS for NOAA-20 details
Responsible People:	- Yingtao Ma - Benjamin Johnson
Deadline:	Before v2.4.1 release

Agenda Item 2:	Andy Tangborn's talk about CRTM Aerosol LUTs
Discussion:	 Andy: Well, I'm Andy Tangborn, I have been at NASA for 23 years, I have been moving to NOAA for IMSG and I have been working with Cory Martin on cycling experiments with JEDI and CRTM. This is a workflow that Cory has first developed. I have been learning how to use it and today I will talk about the forward modelling and the differences from the CRTM. All we want to look at is the forward modelling. It doesn't really matter what kind of obs we have and I have been putting in MODIS Terra Obs. It really needs to be analyzed over a short period of time, less than a month. We are not in a position to say which one is more accurate. We have a good idea what the optical depth is, but also the individual species. There is a source that is AERONET, but also ATom for the species. And so, this really doesn't tell us much about which one is more accurate, but rather what' s the reason why they're so different. The first thing is the experiment I did some time ago. This is three weeks of Mean O-F. The NASA LUTs are generally closer to the Obs, but not all the time. The important thing is that they are different. But it's not changing the forecast accuracy, but the changes to the actual fields … Sarah: Are you using an older version? The CRTM LUTs are also coming from NASA. Andy: I don't know, Mariusz is knowing more. Mariusz: This is the most recent table. Sarah: Ok, so I guess we are talking about an older CRTM version.

Andrew: Ok, the important thing is that they are different. The first thing is to create an HofX difference scatter plot. It gives you an idea of the difference in AOD magnitude. You can see that in some places the CRTM is larger. In some values the NASA values are larger. This includes the influence of all 16 species, so It's kind of hard to analyze, so I was just looking into one 16-hour window and a limited region and separated the species. So, for a model output I zeroed out all species but one. The location is the Indian ocean. It has land and ocean, and a pollution source over India. The top plot is just a scatter plot of the differences and you can see distinct lines which are probably different species. The second column is over the ocean and the third is over the land. This here has the biggest difference. Over the ocean the correlation between the two schemes is the most different. The individual species are here. Black carbon is a good fit. The difference between ocean and land is negligible. A very different one is the hydrophilic black carbon. The differences are not entirely random, but the difference is not getting with smaller amplitude. If you look at hydrophobic black carbon, it's similar, probably a little bit better. Hydrophilic organic carbon shows no systematic difference and there is no trend. The differences are so small that everything's random. The dust values show large systematic differences. There's no difference over the ocean or over land. You can't even see the random difference because there's a systematic bias. For dust-2, the radius is a bit larger, but the situation is the same. The last one is the sulfate. It's somewhere in between with a big random and systematic component, with the ocean being a bit more random. The only thing I don't have are the sea salts. They don't contribute much to the AOD. There's some uncertainty in my mind on how the CRTM handles them. My understanding is that sea salt bin 1 and 2 are put into bin 1 in the CRTM, but checking that didn't work out. This is my initial conclusion from this part of the study. There are some differences, the black carbons have a little bit larger systematic differences, but it's not as large as dust. Again, we can't make a statement which one is better. The thing that we need to do is to make comparison with in-situ data. That's what I have, questions?

Ben: Thanks, Andy. For the validation we can't tell which one is correct. Do you think the AERONET data would be beneficial here?

Andy: Yes, I think Mariusz has already integrated AERONET into JEDI.

Ming Chen - NOAA Affiliate

3:31 PM

Ben, I need to leave for about 20min. I need to pick up my son.

Jim Jung - NOAA Affiliate

3:32 PM

JPSS-2 current launch date is 30 September 2022

Andy: I should also ask if this is the analysis form that might be useful for you?

Mariusz: I have an opinion I can express. Rather than comparing the output with the species, the previous step would be to look at the tables themselves. Just by looking at the differences for the hydrophilic species, there are some significant differences on how those models approach aerosol growth and possibly refractive indices.

Cheng: Hi Andrew, I have already done the comparison of the SSP and refractive index between those two models. We can have a separate meeting on that. And I also agree with Mariusz on first looking into the SSP.

Andy: Ok, Mariusz would probably also be interested in that.

Sarah: I must also say this table is probably GOES-4. If we verify the tables we need to look into making sure that we go in the right direction.

Mariusz: The NASA process of tuning the aerosol model has been going on for some time. I don't know how objective the tuning process is, but in my mind the current NASA LUTs correspond better to observations.

Sarah: That's a good point. A lot of tuning is done at NASA. [unintelligible].

Cheng: In CRTM v2.4.1 those NASA tables will also be available and you can call either table.

Ben: We just want to verify that when we say NASA table, we are referring to the same tables. We also need to make sure that we have proper versioning.

	Mariusz: NASA tables come with tags. It's not difficult to keep track of their changes. Ben: Right, there will be a NASA version and a CRTM version. Sarah: Ben, when you talk about version, is that for aerosol tables? Cheng: I just want to say that for the NASA tables I combined all tables in one common item. Quanhua: I think the NASA and JCSDA tables are formally the same, just the format is different. But at the same time, we can call default and NASA table. Once people accept it, we can use it. So, we can make it simple. Ben: Any other questions for Andy? Thanks, very nice comparison. Quanhua: In the past we do not use aerosols [for data assimilation]. There are some people doing aerosol assimilation but it's based on retrieval products. At STAR we complete a relatively simple UV radiance assimilation, just to check whether the model can do it. I think NCAR expressed interest into UV assimilation. Ben: We are quickly getting to the point where UV radiance assimilation is becoming of operational importance, especially for regional air quality. Other comments? Igor: I have one comment. Are there any plans to compare the product with CALIPSO data? Ben: Yes, Isaac Moradi was working on a Forward operator for space-based radar. Once that's done we are moving forward with that. So that's definitely on our radar. Whether that is going to be easy to do, that's another issue. Igor: CALIPSO is not trivial. They specifically developed that to make a better retrieval. Mariusz: CALIPSO is also not available in real-time, just 2 or 3 days. If there is something for real-time, that would be useful. Ben: Does anybody know what the status of the CALIPSO laser is? Igor: Still operational. Ben: Patrick, do you want to give an update on the coefficient generation roundtable?
Result:	Significant differences between NASA and CRTM aerosol radiances, especially for dust.

Tasks:	- Set up a meeting to discuss GOCART single-scattering properties
Responsible People:	Andy Tangborn Cheng Dang
Deadline:	N/A

Agenda Item 3:	CRTM Transmittance coefficient generation roundtable summary
Discussion:	Patrick: So, recently we had our first transmittance coefficient generation roundtable meeting and I would like to thank everybody that attended. I would also like to thank Dr. Liu, Igor and Isaac for their contributions. We plan to extend this into a series of meetings with tutorials on how to generate coefficients, starting with the MW case. That's all. Does anyone have a question on this? Quanhua: Do you plan to make the repository public? Patrick: Currently it is part of the JCSDA-internal organization. You should already have access. We don't have plans to make it public yet. We have also discussed the warnings from the RTTOV team. They have made their coefficient generation code public at some point and users were not handling it correctly and blaming the RTTOV model. Ben: We were planning to keep it as an expert release. Igor: One comment, university students might provide some fresh ideas for the coefficient generation, so this might be an argument for making it public. -
Result:	Successful first transmittance coefficient roundtable meeting.
Tasks:	- Organize the second roundtable with a tutorial.
Responsible People:	Patrick Stegmann
Deadline:	September 2021

Agenda Item 4:	Open discussions
Discussion:	Quanhua: For the v2.4.1 release, is everything already clear? Quanhua: I have to leave to another meeting. Ben: Anybody from UPP? There's a plan to update the UPP to the latest version. That specific task shouldn't be too challenging. Then as soon as 2.4.1 is released we can work on the transition plan with UPP folks. We also need to think how the JEDI team can transition to v.2.4.1. So, I'll be working with the OBS team and the rest of the JEDI folks. It's not going to be so easy because the JEDI structure is based on v2.3. Sarah: This EMC work wants to check whether the CRTM aerosol tables are consistent with NASA. Ben: That's a key element of the proposal that was written. Any other questions? Yingtao: Is Isaac here, I have a question for him? If no, I will ask Patrick. I have heard that Isaac made some changes to the CRTM scattering coefficient format. Is there any information on it, because I am trying to include the new Texas A&M cloud tables as well? Patrick: Yes, Isaac has made a branch for this and there is also a Zenhub issue, #156. Ben: Isaac also has made some experimental changes. It's not clear yet what will be included. Alright, this concludes the meeting.
Result:	N/A
Tasks:	N/A
Responsible People:	N/A
Deadline:	N/A

16:10 EST End of meeting.