2021-03-25

CRTM Monthly Meeting Protocol

Core Topic of the Meeting: Monthly meeting (AOP2020 in Hindsight, and etc.)

Date: 2021-03-25 **Time**: 15:00 EST

Location: Google hangout

Invited Speakers: None

Meeting Chair: Patrick Stegmann (JCSDA)

Keeper of the Minutes: Cheng Dang (JCSDA)

Attendees: Patrick Stegmann, Andrew Tangborn, Bryan Karpowicz, Haidao Lin, Jianjun Jin,

Jim Jung, Ming Chen, Nick Nalli, Quanhua Liu, Sarah Lu, Scott Sieron, Shih-Wei Wei, Tom Greenwald, XingMing Liang, Yingtao Ma,

Agenda Item 1:	AOP2020 in Hindsight: CRTM Achievements CRTM v2.4.1 Updates
Discussion:	Talk: Patrick Stegmann Last CRTM meeting for AOP 2020: - New aerosol interface/LUTs - New instrument coefficients - OpenMP parallelization of the CRTM - CRTM v3, CSEM - pyCRTM - Transmittance coefficient generation - CRTM 2.4 release CRTM v2.4.1 updates CRTM v3.0 release plans 

Questions:

Mark Liu: I saw some comments in the code regarding openmp, did Jim provide any document on the code modifications? – will follow up on this with Ben

Yingtao Ma: What's the progress of openMP. implementation over channels?

Patrick: we recently merged an updated PR into the developing branch.

Mark: has it been tested? Is it consistent?

Patrick: the default test past and are consistent, we probably need to do more tests.

Ming: in the current GSI system, there is openMP already, so how can we apply the CRTM parallelization within a GSI environment? We should collaborate with the GSI team to figure out how to prioritize parallelizations.

Ming/Mark: for the CRTM v3.0 release, what is the schedule or plan for CSEM?

Patrick: currently Ben is working on the v3.0 merge, so I would recommend contact Ben to this regard.

Mark: Here is my suggestion, for the last 2.4 release, we were in a hurry (because we have not released any CRTM code for a long time), while this time, we can probably take more time and do more tastings before we release version 3.

Yingtao: do we have a plan for the testing? I saw some tests on the GitHub repo.

Patrick: we have some tests available, similar to the previous regression test and unit test.

Yingtao: we probably need more specific tests on model physics.

Ming: we also need to collaborate with the data assimilation side to design the tests.

Patrick: I guess the beta release will be a starting point for all these developments.

Ming: with the CRTM 3.0, we need to tell the users what is the improvement of science.

Mark: yes, we will document these changes and improvements after tests.

Mark: with CRTM 3.0, the users can pick if they want to use the vectorized version. If they don't want to use the vectorized version, they will get the same results.

Yingtao to Mark: for the vectorization, you also need to have updated coefficient tables, has these tables been updated?

Mark: currently, the LUTs for the IR is very similar to the scaler model. For specific cloud categories, we need to discuss which versions we need.

Patrick: if there is anyone interested in help developing vectorized LUTs, please let us know.

Yingtao: perhaps Ping Yang and the Penn State teams are interested.

Tasks:	
Responsible People:	
Deadline:	

Agenda Item 2:	Vector SOI development Status

Discussion:	Tom Greenwald - Background (SOI; VSOI; current SOI solvers is valid for scalar IR and MW only; code is slower than it should be) - Accomplishments (Code based on v3.0 alpha, 2019; tests VSOI FWD/TL/AD codes, adjoint is in development) - Path forward (complete adjoint model; merge with CRTM 3.0 beta later; develop a method to optimize the doubling initial layer OP; debating on if I want to do an initial release)  Questions: Yingtao: what's the major advantages of each CRTM solvers? Tom: Initially we had two solvers due to the speed differences, while Mark has improved the speed a lot. Mark: 1) It's important to have SOI and ADA because the two modules can be checked against each other. 2) there are still some people using SOI (aka SOS). 3) SOI has some advantage because it can category different scattering types. Yingtao: is it still plane-parallel geometry? Tom: yes. Yingtao: perhaps we can think about the spherical geometry? Tom: this is a good point. Ming: years ago, I remember you implemented some functions to optimize the number of streams? Tom: The scattering indicators? Yes, it's still alive, as well as the Eddington model, but not sure if we will add this in CRTM 3.0.
Result:	
Tasks:	

Responsible People:	
Deadline:	

Agenda Item 3:	Open Discussion about Shortwave Radiative Transfer Solvers (VIS/UV) and Challenges
Discussion:	Patrick: there are some challenges for the VIS/UV simulations, for example, the peak in the phase function, molecular scattering in the atmosphere. Does anyone have any suggestion on this topic? No Reponses.
Result:	
Tasks:	
Responsible People:	
Deadline:	

Agenda Item 4:	Aerosol Development & Coordination
Discussion:	Cheng Dang - GOCART-GEOS5 tables - NAAPS tables - Hongli's recent updates on GSI/CMAQ AOD assimilation. Questions: Sarah: is it possible for CRTM to take aerosol properties from an observational system or instrument? Cheng: yes, as long as they provide us with their assumptions on aerosol optical properties, we can implement that in CRTM. Yingtao: perhaps it is good to document the steps and provide an instruction to the users on how to implement their tables. Cheng: yes that's definitely possible. Depending their tables, the users might also need to modify CRTM code, which could be a tricky part.
Result:	
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Responsible People:	
Deadline:	

Agenda Item 4:	**Open discussion**
Discussion:	Patrick: any additional questions or topics you would like to discuss? Perhaps the application of AI for CRTM? Mark Liu: we see some advantages of adopting AI for CRTM simulations, especially the speed and the stream selection. AI tends to be 1000 times faster, which would a good improvement to CRTM. AI predicted values are probably better because we use more streams for the approximation. In STAR, we have several people working on the AI model, so we are probably leading the CRTM AI work, in the future AOP, it's better to define this. Sarah: are we just apply AI to a specific component of CRTM? Mark: doing AI-based flux is challenging because CRTM is sensor specific, but we have demonstrated that AI based model has a good accuracy. In the future, we can probably provide much better results. Patrick: for the scattering part, it is probably challenging to get the representative training data. Mark: yes. That part is challenging. In the future, the AI model is also involving, so there will be changes in our results in the future too (1-3 years). Yingtao: Given the uncertainties of the current AI surrogate model, perhaps we can use the AI model for QC first to gain some confidence, step by step. Mark: Yes, AI is like a black box that the results are largely depending on the a prior assumptions and set up. Yingtao: perhaps we can only apply AI to the time consuming and less well understood components. Mark: sure. This is one way to implement AI, can we use the black box for physics? This would be the fundamental questions. Tom: is there a way to compute the Jacobians with a 4D var system? Mark: yes. We cannot train the forward/jacobines using separate AI models. What we want to do is to have physics there in the AI system so that the forward model and Jacobians are consistent, which would probably take 1-3 years.
Result:	
Tasks:	
Responsible People:	
Deadline:	

16:10 EST End of meeting.