SPECIAL PROJECT PROGRESS REPORT

All the following mandatory information needs to be provided. The length should *reflect the complexity and duration* of the project.

Reporting year	2019
Project Title:	EC-EARTH: developing a European Earth System model based on ECMWF modelling systems
Computer Project Account:	SPNLTUNE
Principal Investigator(s):	Dr. Ralf Döscher
Affiliation:	Rossby Centre, SMHI
Name of ECMWF scientist(s) collaborating to the project (if applicable)	Dr. Glenn Carver
Start date of the project:	2018
Expected end date:	2020

Computer resources allocated/used for the current year and the previous one
(if applicable)
Please answer for all project resources

		Previous year		Current year	
		Allocated	Used	Allocated	Used
High Performance Computing Facility	(units)	50000000	30923451	60000000	26927095
Data storage capacity	(Gbytes)	70000	?	70000	?

Summary of project objectives (10 lines max)

The objective is to prepare the EC-Earth3-AerChem climate model for CMIP6 experiments. The model includes interactive aerosols and atmospheric chemistry, which affect the radiative properties of the atmosphere. Therefore it differs from the standard EC-Earth3 GCM model, where aerosols and greenhouse gases are prescribed, and it requires a dedicated tuning and spinup. The goal is to tune the IFS component to produce a global temperature for the pre-industrial period on par with observations. Long integration of more than 100 years are needed for robust tests of the various sets of tuning parameters.

Summary of problems encountered (10 lines max)

The AerChem version of EC-Earth is slower and more expensive than its GCM counterpart. This is due to the coupling with TM5, a Chemistry and Transport Model (CTM). After a bit more than 100 years the model crashed, because the air mass in TM5 has been slowly deviating from its IFS value to become unrealistic after 100 years. This mass conservation (or spatial distribution to be more accurate) issue has been resolved but costs us more than 200 simulated years.

Summary of plans for the continuation of the project (10 lines max)

By early July we will make a final decision and choose the tuning parameters. We will switch on CMIP6 output and start a CMIP6 piControl run (250 years).

List of publications/reports from the project with complete references

Two reports are available:

About the mass conservation issue: "CFL violation in EC-Earth3-AerChem after 100 years integration", https://dev.ec-earth.org/issues/658 (PDF attached)

About the tuning of EC-Earth3-AerChem: "Monitoring EC-Earth3-AerChem piControl-spinup", https://dev.ec-earth.org/issues/614 (PDF attached)

Summary of results

If submitted **during the first project year**, please summarise the results achieved during the period from the project start to June of the current year. A few paragraphs might be sufficient. If submitted **during the second project year**, this summary should be more detailed and cover the period from the project start. The length, at most 8 pages, should reflect the complexity of the project. Alternatively, it could be replaced by a short summary plus an existing scientific report on the project attached to this document. If submitted **during the third project year**, please summarise the results achieved during the period from July of the previous year to June of the current year. A few paragraphs might be sufficient.

Here we chose to submit 2 short reports from the EC-Earth development portal.
At this stage we have narrowed down on two strong candidates for the tuning of the EC-Earth AerChem configuration. Both tuning sets are currently under testing.
The first report (#614) describes the tuning and development of the PI control simulations. The second report (#658) describes the issue of a CFL violation after a long integration.

EC-Earth 3 - Bug report #658

CFL violation in EC-Earth3-AerChem after 100 years integration

27 May 2019 12:23 - Philippe Le Sager

Status:	Resolved	**Start date:**	13 May 2019
Priority:	High	**Due date:**	
Assignee:		**% Done:**	100%
Category:		**Estimated time:**	0.00 hour
Target version:	EC-Earth 3.3.2		

Description

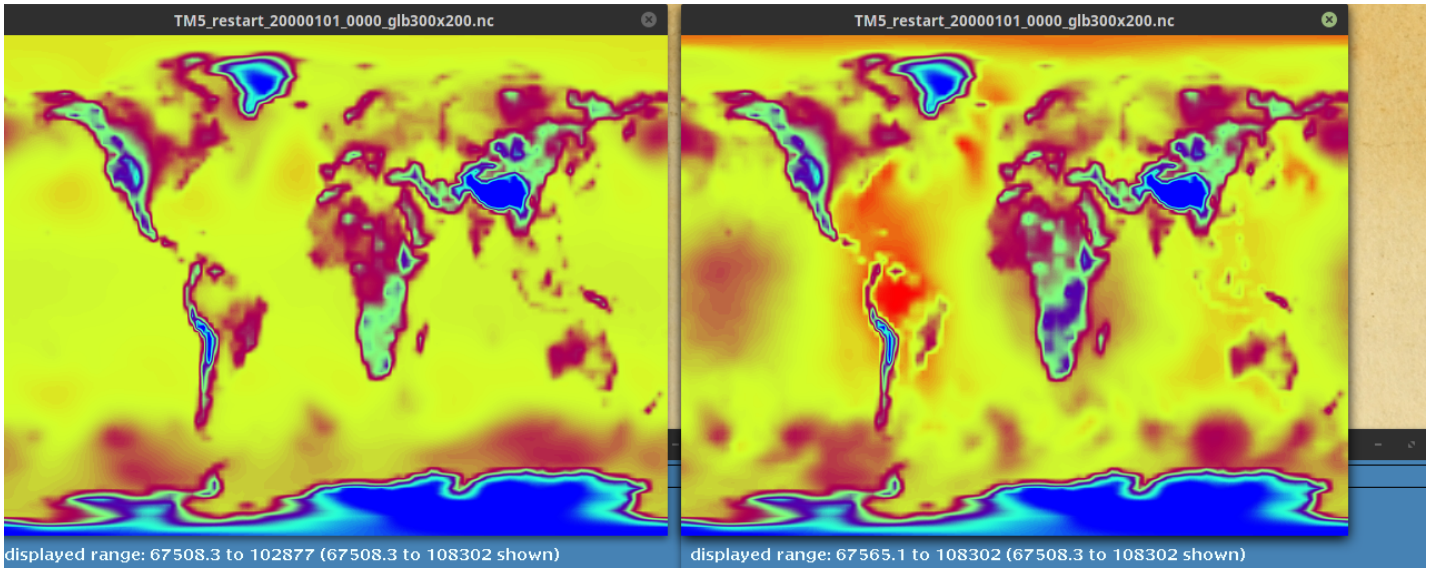
CFL violations **in TM5** occured with the EC-Earth3-AerChem spinup/tunings runs after about 100 years. After close examination, we found out that the air mass in the grid box where a CFL violation happened was too small. So that even a totally fine wind from IFS would empty the grid box in one second. That low air mass corresponds to a very low surface pressure, which is adjusted in TM5 in the advection scheme.

It turns out that, when TM5 restarts, it reads not only the tracers mass but also air mass and surface pressure from its restart file. That means the advected pressure overwrites the pressure received from IFS. This is a small difference that build up over the years.

It is possible to read only mixing ratio of the trace gases from the restart files. This is done by setting the option istart to 32 (partial restart) instead of 33 (full restart). Thus, when we restart, we can reset the air mass to its IFS value instead of the slowly deviating TM5 value. The code has been updated to use istart=32 (r6840 and r6841). That option was also buggy since it did not read any M7 related variable. That has been fixed in r6853.

To illustrate the problem, I made a couple of 10-year runs with TM5 (CO2, 10 Levels) driven by IFS (no feedback). The following plots show the difference after 10 years. On the left panels the IFS pressure is not overwritten (option 32, new code), on the right panel it is (option 33, old code).

You see that the pressure get too high in some region (like the red spot in South America):



Related issues:

Related to EC-Earth 3 - Information request #614: Monitoring EC-Earth3-AerChe...	**Investigation**	**07 Feb 2019**

History

#1 - 27 May 2019 12:26 - Philippe Le Sager

- Description updated

updated description.

#2 - 27 May 2019 12:31 - Etienne Tourigny

Hi Philippe, how does this impact the co2-only version of tm5 ? It uses istart=9 to read the co2 state as I recall. Thanks!

#3 - 27 May 2019 12:38 - Philippe Le Sager

- File diff-32s-33-CO2-L4-tm5co2-10years.png added

- File diff-32s-33-airmass-L5-tm5co2-10years.png added

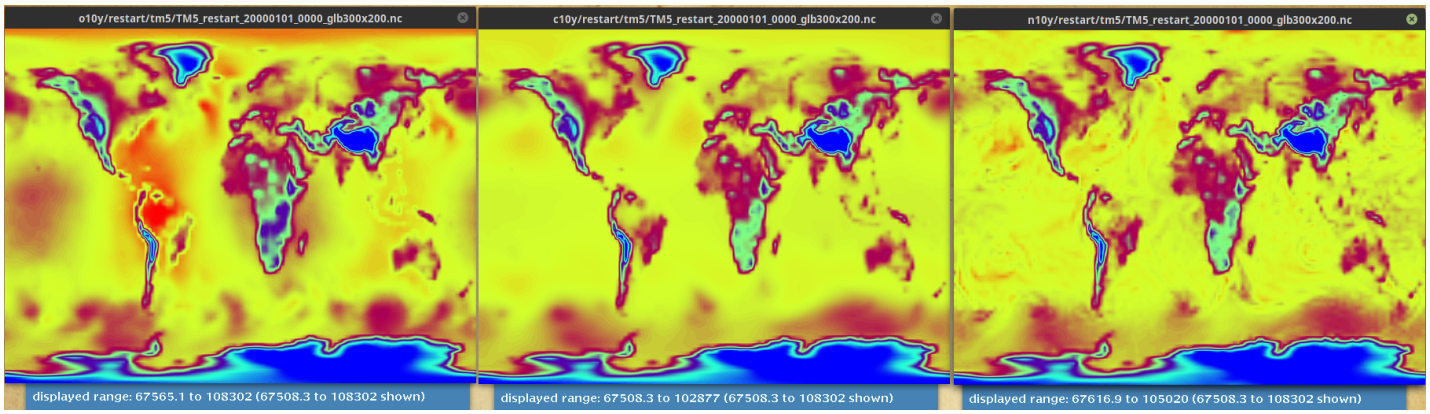
- File diff-32s-33-SP-tm5co2-10years.png added

With r6859, we went further: we now reset the airmass/surface pressure to its IFS value after every coupling step.

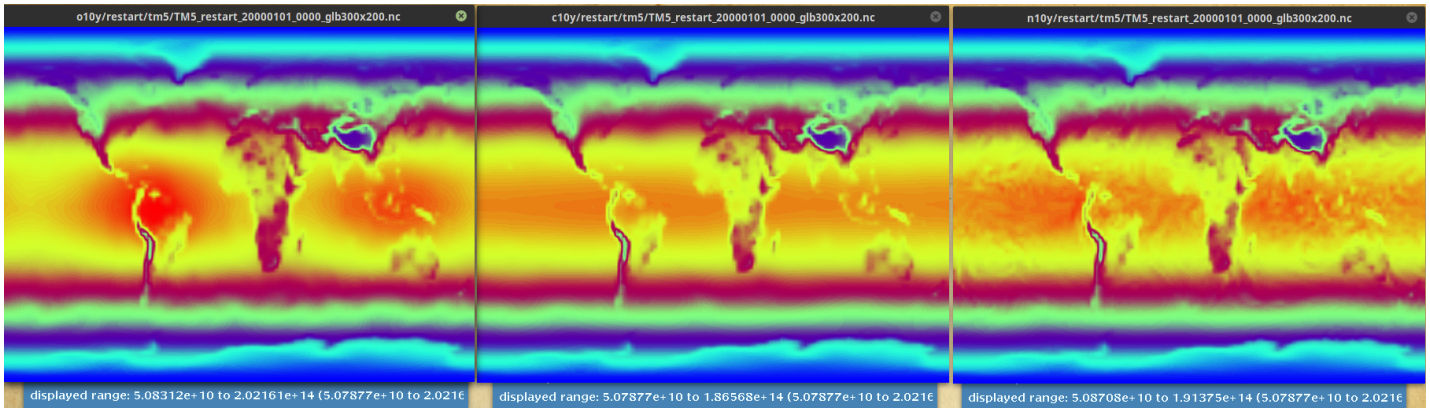
I made few 10-year runs with TM5-CO2-only driven by IFS (no feedback), using only 10 levels in TM5 for expediency. They all start from a uniform CO2 concentration of 354 ppm (istart=9). The following plots show the difference built up after 10 years for different versions of the code. Going from left to right, the plots correspond to:

- SP from IFS at the start of the run only, which lead to CFL violation after 100 years (istart=33)
- SP from IFS at every restart (every year here; istart=32)
- SP from IFS at every coupling time step (currently every 6 hrs)

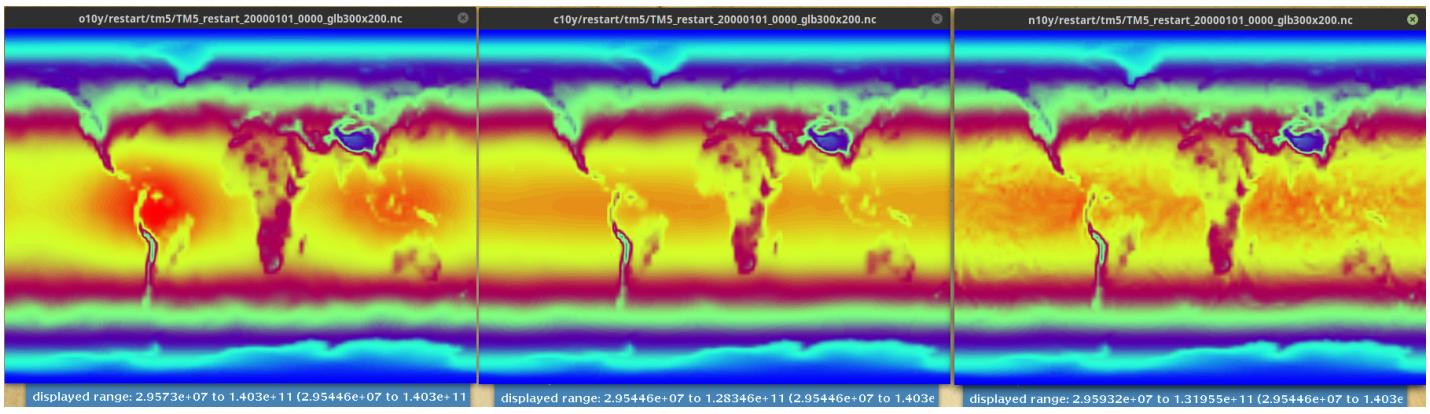
As already mentioned in the issue description, the pressure was getting too high in some region with istart=33 (left panel):



which lead to some mass accumulating in some regions, here at level 5:



and a different distribution of CO2 mass, here at level 4:



Updating SP from IFS is obviouly needed, and doing it at every coupling step provides finer structures (right panel).

#4 - 27 May 2019 12:59 - Philippe Le Sager

- Status changed from Investigation to Implementation

- % Done changed from 20 to 40

Etienne Tourigny wrote:

> how does this impact the co2-only version of tm5 ? It uses istart=9 to read the co2 state as I recall.

Starting from istart=9 is not a problem, but during integration istart is setup automatically by the run script. Used to be 33, now it is 32. Although the mass unit is kg, the plots right above give you an idea of the differences. The overall structure is not changed (particularly in short runs), but finer details are now present. Not accounting for IFS pressure for a year or more had the effect of smoothing everything.

I have looked at the total masses (air and CO2) at the end of every year in the three 10-year runs. The air mass is equally conserved in all runs (the bug is an issue of mass distribution rather than mass conservation). CO2 increases due to emissions. The difference between the runs in the total CO2 after 10 years is of the order of 0.001%:

First run, SP from IFS at first start only (old way, istart=33):

date	toatl airmass [kg]	total CO2 [kg]
1990-01-01	5.123191964953793e+18	2758012559266704.0
1991-01-01	5.123191964953793e+18	2780656693967051.5
1992-01-01	5.123191964953793e+18	2803313893082153.5
1993-01-01	5.123191964953791e+18	2825811466953673.0
1994-01-01	5.123191964953793e+18	2848487842875934.0
1995-01-01	5.123191964953793e+18	2871337421751638.0
1996-01-01	5.123191964953793e+18	2894691505886255.0
1997-01-01	5.123191964953794e+18	2918537138092914.5
1998-01-01	5.123191964953793e+18	2942615749839730.0
1999-01-01	5.123191964953793e+18	2966753021527145.0
2000-01-01	5.123191964953791e+18	2991150503656307.5

Second run, SP from IFS at every restart (once year, istart=32):

date	toatl airmass [kg]	total CO2 [kg]
1990-01-01	5.123191964953793e+18	2758012559266704.0
1991-01-01	5.123191964953793e+18	2780656693967051.5
1992-01-01	5.123191964953790e+18	2803313506974301.0
1993-01-01	5.123191964953797e+18	2825810205087448.5
1994-01-01	5.123191964953793e+18	2848484583628879.0
1995-01-01	5.123191964953795e+18	2871332558360142.5
1996-01-01	5.123191964953789e+18	2894685552656340.5
1997-01-01	5.123191964953795e+18	2918530470606370.5
1998-01-01	5.123191964953793e+18	2942607937636951.0
1999-01-01	5.123191964953791e+18	2966743367587730.0
2000-01-01	5.123191964953788e+18	2991140006954366.5

Third run, SP from IFS at every coupling step (every 6h, istart=32):

date	toatl airmass [kg]	total CO2 [kg]
1990-01-01	5.123191964953793e+18	2758012559266704.0
1991-01-01	5.123191964953795e+18	2780656693967053.5
1992-01-01	5.123191964953793e+18	2803314110364900.0
1993-01-01	5.123191964953790e+18	2825813189676288.5
1994-01-01	5.123191964953790e+18	2848489885660493.5
1995-01-01	5.123191964953790e+18	2871339859667555.5
1996-01-01	5.123191964953795e+18	2894693211014163.0
1997-01-01	5.123191964953793e+18	2918538546884560.0
1998-01-01	5.123191964953795e+18	2942617452327231.5
1999-01-01	5.123191964953793e+18	2966756961058334.5
2000-01-01	5.123191964953790e+18	2991154690722914.0

#5 - 27 May 2019 13:07 - Etienne Tourigny

Philippe Le Sager wrote:

> Starting from istart=9 is not a problem, but during integration istart is setup automatically by the run script. Used to be 33, now it is 32.

Thanks a lot! I had overlooked that. Many thanks for your great work Philippe!

#6 - 27 May 2019 13:28 - Philippe Le Sager

- Related to Information request #614: Monitoring EC-Earth3-AerChem piControl-spinup added

#7 - 27 May 2019 13:34 - Tommi Bergman

To me it seems this could be the reason for problems with the nudging runs as well? What do you think Philippe?

#8 - 27 May 2019 14:29 - Twan van Noije

I have a question about this: once we do update the surface pressure correctly at every time step, this means that the air mass in TM5 and IFS are in sync, right? By implication, this means that the restart files produced by the model during a simulation are correct. Wouldn't it then be possible to revert to istart=33 for all restarts during a simulation, and only apply istart=32 for those cases when the TM5 and IFS restart conditions don't match. If I understand the issue correctly, such an inconsistency can only occur at the start of a new simulation, when we don't have the TM5 restart file consistent with the IFS initial state, e.g. at the start of piControl-spinup in our case.

#9 - 27 May 2019 15:33 - Philippe Le Sager

Tommi Bergman wrote:

> To me it seems this could be the reason for problems with the nudging runs as well?

Yes, generally speaking. The problem is exacerbated with nudging, because the advected pressure (i.e. the corrected one in TM5) and the one in IFS are likely to diverge more. So the CFL violation will happen in less than 100 years.

#10 - 28 May 2019 07:43 - Philippe Le Sager

Twan van Noije wrote:

> once we do update the surface pressure correctly at every time step, this means that the air mass in TM5 and IFS are in sync, right?

They are in sync right after receiving the met fields (or reading the oasis restart), but start to very slowly diverge for the next 6 hours (or whatever the coupling frequency is). Then, the air mass written in the TM5 restart (AM_TM) is different to what will be computed from the surface pressure in the oasis restart (AM_IFS). AM_TM should not be read at restart, but it is with istart=33.

> By implication, this means that the restart files produced by the model during a simulation are correct. Wouldn't it then be possible to revert to istart=33 for all restarts during a simulation, and only apply istart=32 for those cases when the TM5 and IFS restart conditions don't match. If I understand the issue correctly, such an inconsistency can only occur at the start of a new simulation, when we don't have the TM5 restart file consistent with the IFS initial state, e.g. at the start of piControl-spinup in our case.

Good point, and correct as far as tracers mass is concerned. In EC-Earth, unlike in the standalone TM5 where it is done for reason of numerical precision, istart=33 should read only the tracer mass, and not the air mass and surface pressure. This is something that still need to be coded, because it makes the model restartable by doing the exact same computations with or without a restart in a middle of a run. Using istart=32 is very close to that but the conversion from tracer mass to mixing ratio (using AM_TM) and back (using AM_IFS) brings small difference.

I will fix istart=33 for EC-Earth.

#11 - 31 May 2019 08:59 - Philippe Le Sager

- File diff-32new-33new-airmass-L4-tm5co2-10years.png added

- Status changed from Implementation to Testing

- % Done changed from 40 to 60

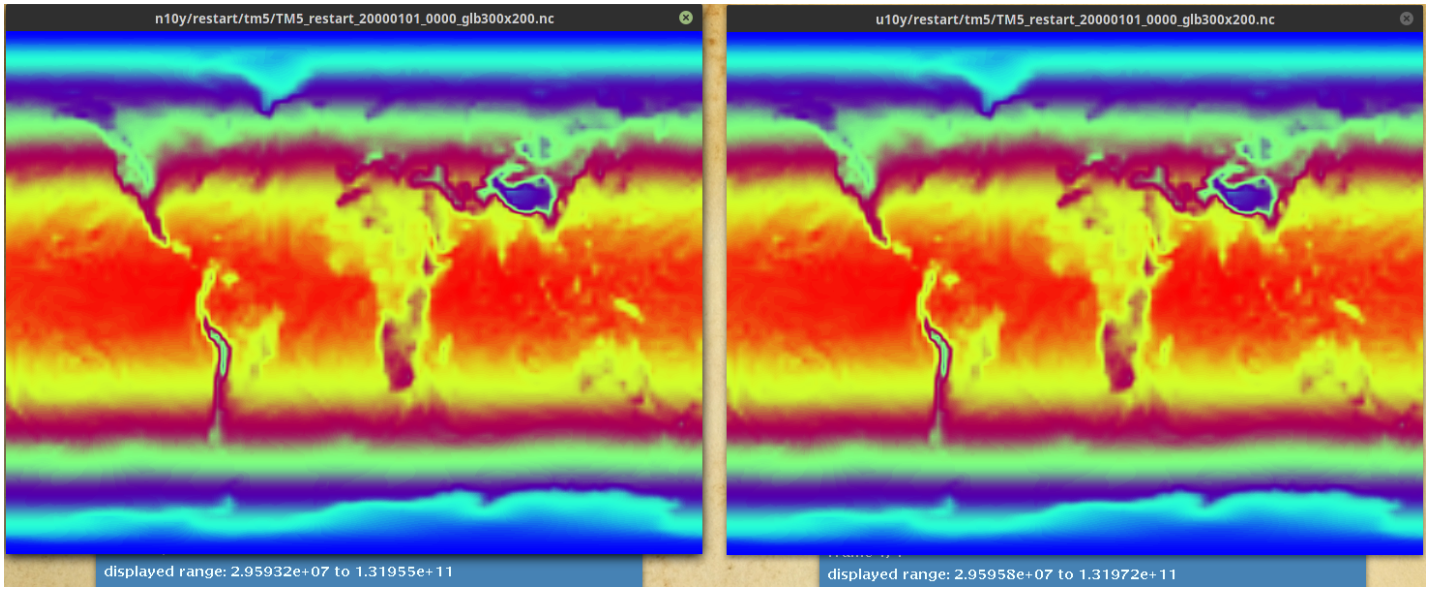
Philippe Le Sager wrote:

> I will fix istart=33 for EC-Earth.

Done in r6874. The code has been fixed to read tracer mass only (+ slope) with option 33 in case of coupling to EC-Earth. It makes the code restartable (same operations with and without a restart). Thus, at this stage we have:

- surface pressure (and derived air mass) reset to IFS value at every coupling time step (including restart step)
- istart=32 conserves mixing ratio of tracers
- istart=33 conserves mass of tracers

The results coming out of TM5 after 10 years with options 32 and 33 are identical for air mass. For the CO2 tracer, no difference is visible in plots. Here is the mass at level 4:



although a very small difference (less than 0.001%) in the total mass of CO2 is found:

date	total airmass [kg]	total CO2 [kg] istart=32	total CO2 [kg] istart=33
1990-01-01	5.123191964953793e+18	2758012559266704.0	2758012559266704.0
2000-01-01	5.123191964953790e+18	2991150503656321.5	2991154690722914.0

#12 - 31 May 2019 15:20 - Philippe Le Sager

- Status changed from Testing to Resolved

- % Done changed from 60 to 100

Files

diff-32-33-SP-tm5co2-10years.png	361 KB	27 May 2019	Philippe Le Sager
diff-32s-33-CO2-L4-tm5co2-10years.png	315 KB	27 May 2019	Philippe Le Sager
diff-32s-33-SP-tm5co2-10years.png	529 KB	27 May 2019	Philippe Le Sager
diff-32s-33-airmass-L5-tm5co2-10years.png	296 KB	27 May 2019	Philippe Le Sager
diff-32new-33new-airmass-L4-tm5co2-10years.png	222 KB	31 May 2019	Philippe Le Sager

Information request #614

Monitoring EC-Earth3-AerChem piControl-spinup

Added by **Twan van Noije** 5 months ago. Updated 10 days ago.

Status:	**INVESTIGATION**	Start date:	07 Feb 2019
Priority:	High	Due date:	
Assignee:	Philippe Le Sager	% Done:	20%
Category:	Multiple components	Estimated time:	
Target version:	[x] CMIP6 Production		

Description

We are about to start the piControl-spinup with EC-Earth3-AerChem, the configuration with interactive aerosols and atmospheric chemistry. This issue can be used to monitor the progress of the simulation, and discuss the desirability of and options for a re-tuning of this configuration.

gregory-aerchem-spin.png (77.7 KB)	Philippe Le Sager, 06 Mar 2019 13:12
t2m-aerchem-spin.png (248 KB)	Philippe Le Sager, 06 Mar 2019 13:12
aerchem-spin-timeseries.pdf (200 KB)	Philippe Le Sager, 06 Mar 2019 13:12
aerchem-spin-timeseries.pdf (316 KB)	Philippe Le Sager, 26 Mar 2019 13:27
t2m-aerchem-spin.png (381 KB)	Philippe Le Sager, 26 Mar 2019 13:27
ece3-control-zonal-t2m-biases.png (110 KB)	Philippe Le Sager, 27 Mar 2019 11:10
aerchem-zonal-t2m-biases.png (133 KB)	Philippe Le Sager, 08 Apr 2019 13:42
t2m-aerchem-tuning.png (233 KB)	Philippe Le Sager, 08 Apr 2019 13:42
t2m-aerchem-tuning-2.png (754 KB)	Philippe Le Sager, 12 Apr 2019 07:41
sst-aerchem-tuning.png (94.8 KB)	Philippe Le Sager, 06 May 2019 14:35
t2m-aerchem-tuning-3.png (95.9 KB)	Philippe Le Sager, 06 May 2019 14:35
artic-SI-aerchem-tuning.png (103 KB)	Philippe Le Sager, 06 May 2019 14:35
aerchem-tuning-timeseries.pdf (376 KB)	Philippe Le Sager, 06 May 2019 14:36
artic-SI-aerchem-tuning-4.png (123 KB)	Philippe Le Sager, 29 May 2019 14:35
sst-aerchem-tuning-4.png (112 KB)	Philippe Le Sager, 29 May 2019 14:35
t2m-aerchem-tuning-4.png (123 KB)	Philippe Le Sager, 29 May 2019 14:35

aerchem-zonal-t2m-biases-4.png (111 KB)	Philippe Le Sager, 29 May 2019 14:35
t2m-aerchem-tuning-5.png (117 KB)	Philippe Le Sager, 14 Jun 2019 07:19
aerchem-tuning-timeseries-2.pdf (510 KB)	Philippe Le Sager, 14 Jun 2019 07:23
t2m-aerchem-tuning-Series2-1.png (114 KB)	Philippe Le Sager, 14 Jun 2019 07:34
sst-aerchem-tuning-Series2-1.png (112 KB)	Philippe Le Sager, 14 Jun 2019 07:34
aerchem-tuning-timeseries2-1.pdf (213 KB)	Philippe Le Sager, 14 Jun 2019 07:35
aerchem-zonal-t2m-biases-Series2-1.png (149 KB)	Philippe Le Sager, 14 Jun 2019 07:52

Subtasks

Related issues

Related to EC-Earth 3 - ~~Bug report #658~~: CFL violation in EC-Earth3-AerChem after 100 years integration	Resolved	2019-05-13		

Show details

History

All Notes Changes

Updated by **Paul Miller** 4 months ago #1

Hi Twan,
Do you need BVOC output from LPJ-GUESS for this configuration?
Regards,
Paul

Updated by **Twan van Noije** 4 months ago #2

Hi Paul,
No, this configuration uses prescribed vegetation and BVOC emissions from MEGAN.

Updated by **Twan van Noije** 4 months ago #3

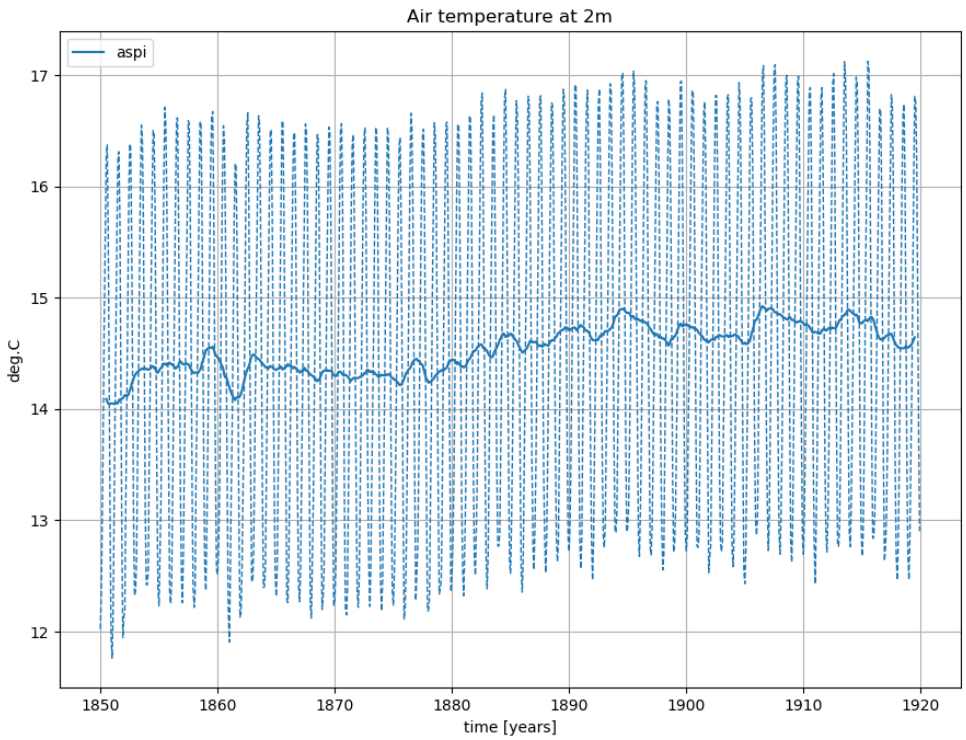
Philippe has started the spinup.

Currently the standard IFS implementation of the orbital parameters is being used. We will later decide whether or not to switch to using `LCORMBD=TRUE` . This will depend on the outcome of Shuting's new piControl (reported in #598-61 and below).

If I am correct we are currently using the same vegetation fields as in the KNMI GCM piControl simulation (corresponding to the initial state of t605; see #610-8). At the same time, the CMIP6 WG today agreed to make the GCM historical simulations using prescribed vegetation fields from t607. Assuming the same vegetations fields will also be used in the EC-Earth3-AerChem historical simulations, we decided to switch the vegetation fields applied in the EC-Earth3-AerChem spinup (and piControl) to the 1850 fields from t607, once these have been made available.

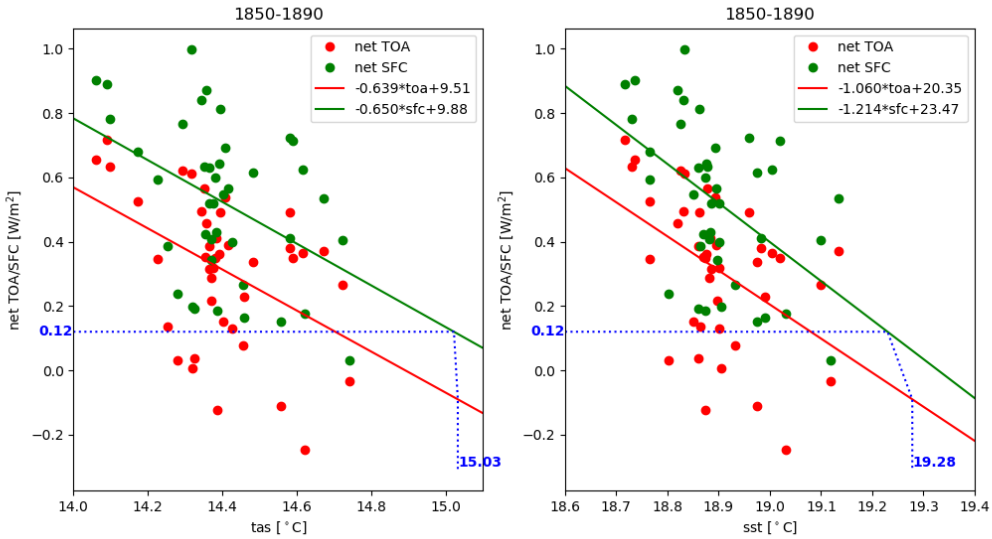
Updated by **Philippe Le Sager** 4 months ago #4

Spinup has reached 40 years. It started from the member 25 of the AOGCM historical initial states (for oasis/nemo/ifs), and from Tommi Bergman "piap" 15-year run with 1750 settings for TM5. After 10 years, we switch to the `icmcl_v32` for the vegetation. Here is the `t2m` time serie:



You canfind the other time series in the aerchem-spin-timeseries.pdf file.

And here's the Gregory plot:



Updated by **Twan van Noije** 4 months ago #5

I am trying to estimate the contribution of the Southern Ocean warm bias to the global mean temperature. As a first approximation we could define the region to be affected by the warm bias as the polar cap south of a certain latitude (lambda), say -45 or -60 degrees. The fractional area of this cap relative to the surface of the Earth is 0.5(1-sin(|lambda|), which is equal to 0.146 at -45 degrees and 0.067 at -60 degrees. To get the contribution to the global mean temperature, these numbers have to be multiplied with the mean temperature bias over the region. For instance, if the mean temperature bias over the region south of -45 degrees would be 3 K and there would be no bias over the rest of the world, the bias in the global mean would be 0.146 x 3 = 0.44. In order to estimate a reasonable range for the global mean temperature that we could use for tuning the model, we need to know how large the correction really is in our simulations. Do we know how large the mean bias over the cap south of, say, -45 degrees is in our simulation?

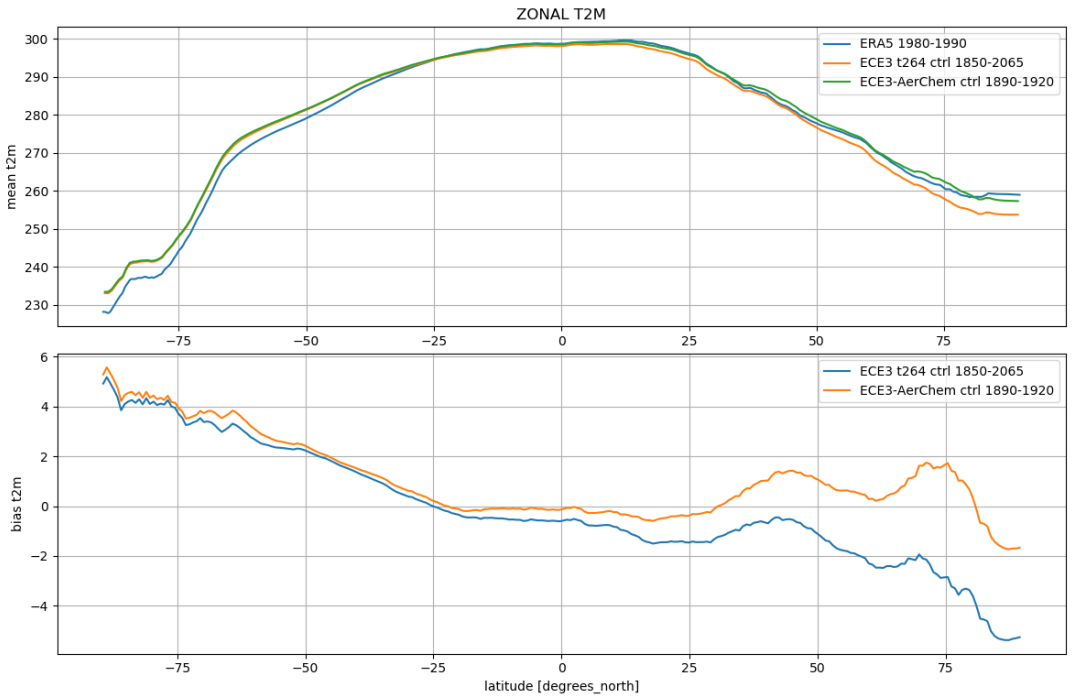
Updated by **Philippe Le Sager** 3 months ago #6

Updated the timeseries posted above (#614-4) with 20 additional years.

Updated by **Philippe Le Sager** 3 months ago #7

Following on Twan's idea, here is a plot of the T2M bias at every latitude. The reference is computed from ERA5 monthly data. Two biases are available: one for the AOGCM control run (t264 experiment, see #598-45) and the other for the EC-Earth3-AerChem (see #614-4

above).



It is quite interesting to note that

- although warmer on a global average, the AerChem model is closer to ERA5 in the northern hemisphere and the equatorial region
- in the southern hemisphere, the difference between the models is a lot smaller, pointing to the difficulty to remove the bias there

Accepting that the global temperature is 0.4-0.5 degree colder in 1850 (GISS/NASA) than in 1980-1990 (the oldest ERA5 currently available), should we try to lower the northern hemisphere temperature by 0.5 or even 1 degree? @Jost: how could we attain that?

Updated by **Philippe Le Sager** 3 months ago #8

Jost gave us the following recommendation:

```
I tried to
1) change as few parameters possible
2) change parameters only getting closer to the cy40 values, not farther (at th
3) change both snow and convection parameters in order not not impact only on s

My results are as follows (assuming I cannot change RLCRIT_UPHYS)
```

For a change of -0,5°C I would recommend to try:

	Original	New	Impact on Net SFC
RSNOWLIN2	0,035	0,03	-0,200
ENTRORG	1,7	1,75	-0,124
			-0,324 (DT = -0,498)

For a change of -1°C I would recommend to try:

	Original	New	Impact on Net SFC
RSNOWLIN2	0,035	0,028	-0,280
ENTRORG	1,7	1,75	-0,124
RLCRIT_UPHYS	0,875	0,893	-0,248
			-0,652 (DT=-1,003)

If you wish to achieve -1°C, WITHOUT touching RLCRIT_UPHYS (because you are happy with the current forcing due to cloud activation) the following combination would also work:

	Original	New	Impact on Net SFC
RSNOWLIN2	0,035	0,028	-0,280
ENTRORG	1,7	1,8	-0,247
ENTRDD	3	2,75	-0,125
			-0,652 (DT=-1,004)

```
The nice thing is that in both cases  ENTRORG is set to the same value as cy40 a
Of course all this is very approximate and assumes that the old sensitivities wl
```

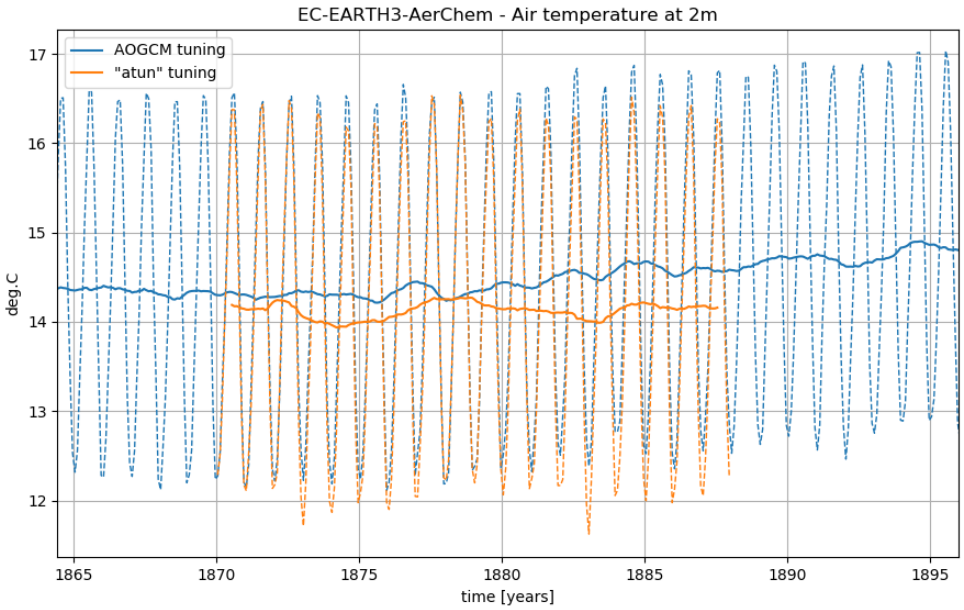
Updated by **Philippe Le Sager** 3 months ago #9

We targeted a decrease of 0.75 degree by using values:

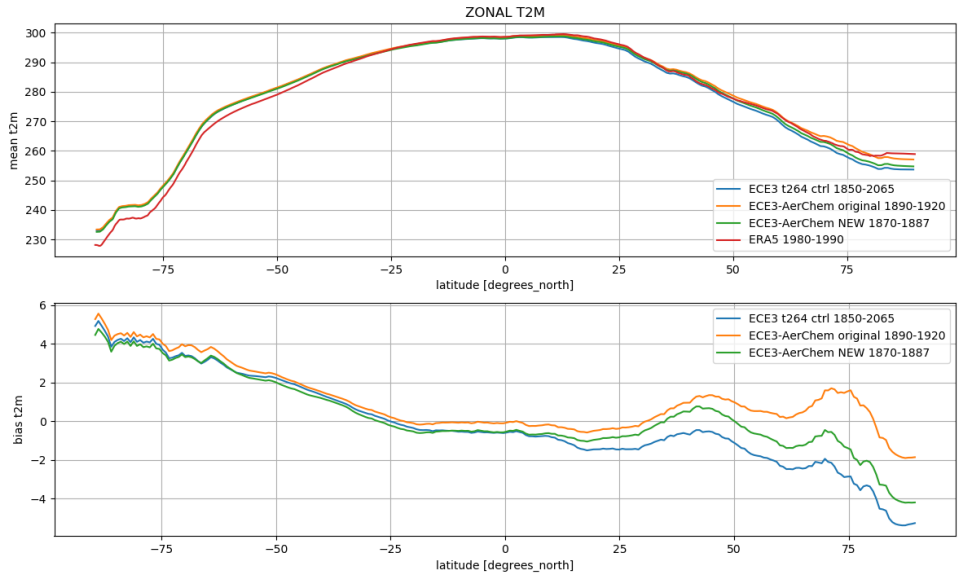
RSNOWLIN2 = 0.029
ENTRORG = 1.75

RLCRIT_UPHYS = 0.884

The overall T2m shows a decrease of about 0.5 degree (orange curve is the one with the new tuning parameters):



And here are the zonal mean and bias w/r/t ERA5:



Updated by **Jost von Hardenberg** 3 months ago #10

Ok, so indeed the norther temperatures have been reduced significantly, as hoped for, while the southern bias has not changed. Interesting. Should we aim at an ever stronger reduction

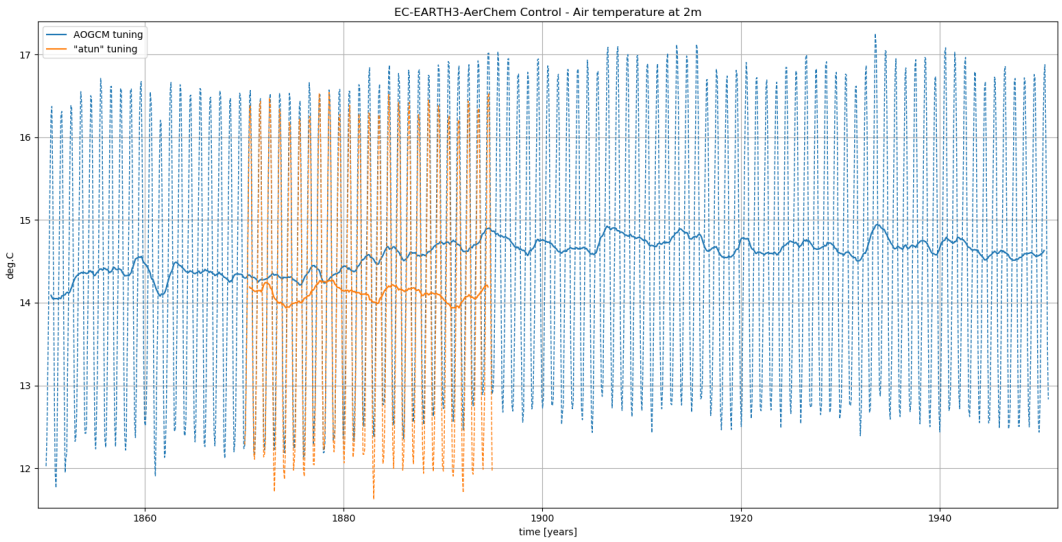
in northern temperatures ?
Maybe you could continue with the parameters which I computed above for a 1° C reduction ....

Updated by **Twan van Noije** 3 months ago #11

Let's continue both runs, and see at which level the simulation with retuned parameters will stabilize. I think it would be just fine if the temperatures would remain close their current levels. At this stage, I don't think we should try cooling it down further.

Updated by **Philippe Le Sager** 2 months ago #12

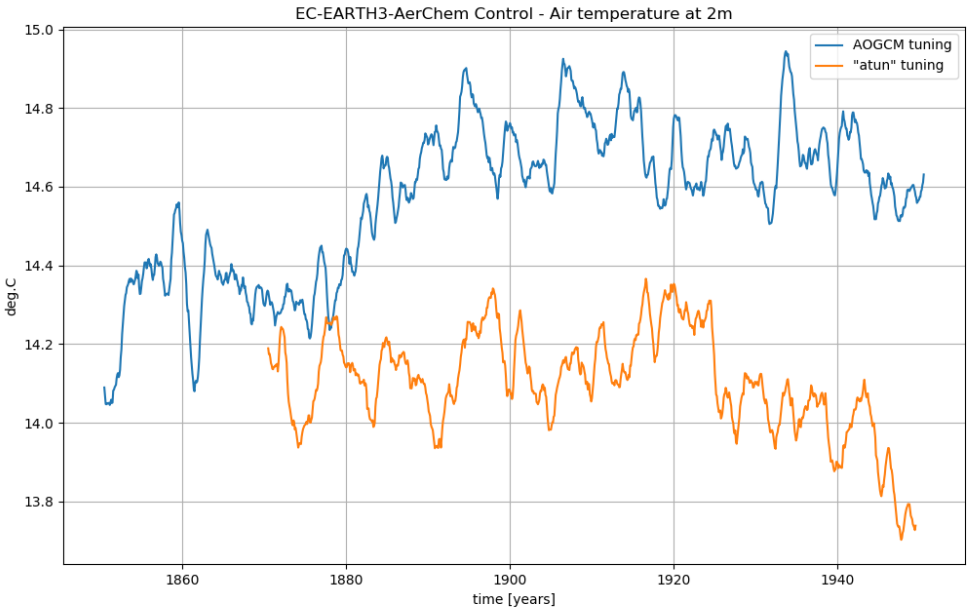
The run with AOGCM has reached 100 years, and the one with updated tuning parameters 25 years. Here's the full timeseries of T2M:

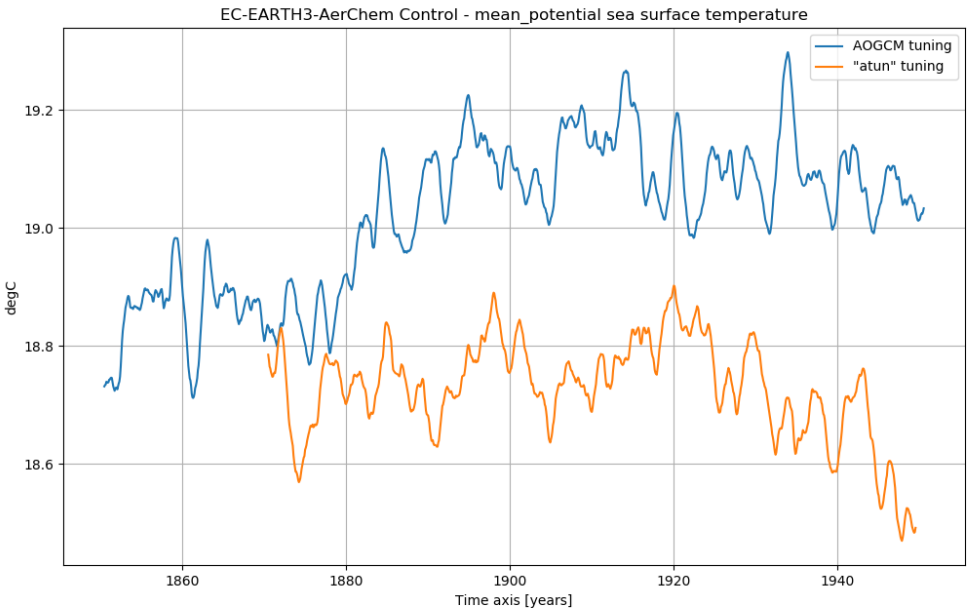


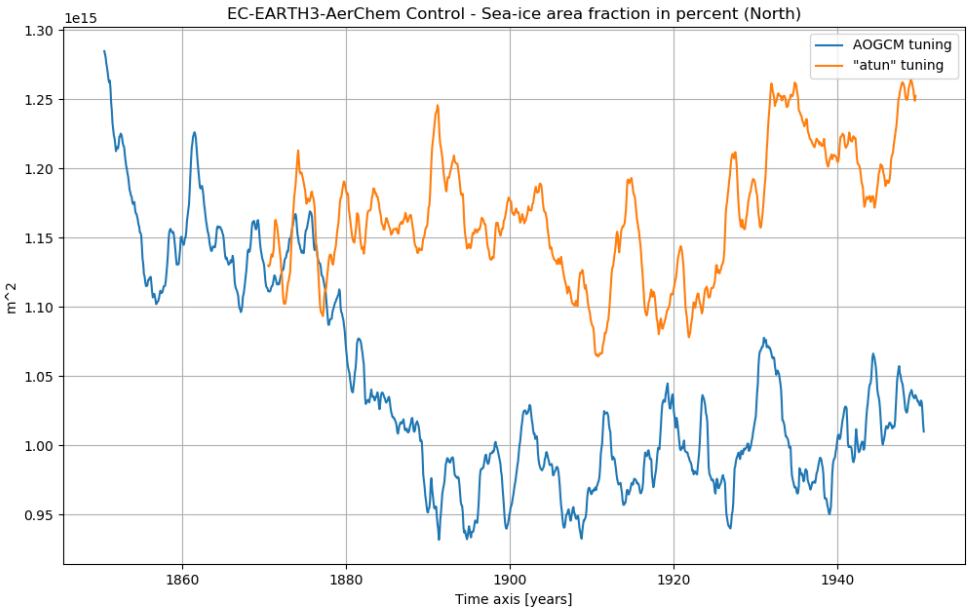
This looks pretty steady, and indeed the zonal biases shown in the previous post have not changed.

Updated by **Philippe Le Sager** about 2 months ago #13

The run with updated tuning parameters has reached 100 years. Note the drop in temperature in the last 20 years, which is accompanied by an drop in sst and an increase in Artic Sea Ice:


EC-EARTH3-AerChem Control - Air temperature at 2m
AOGCM tuning
"atun" tuning
deg.C
15.0
14.8
14.6
14.4
14.2
14.0
13.8
1860
1880
1900
1920
1940
time [years]

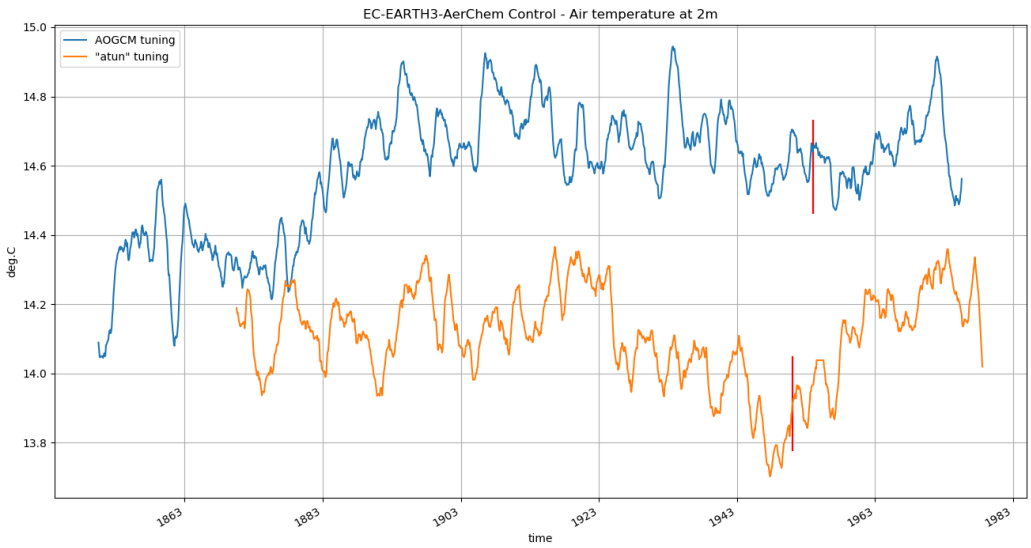

EC-EARTH3-AerChem Control - mean_potential sea surface temperature
AOGCM tuning
"atun" tuning
degC
19.2
19.0
18.8
18.6
1860
1880
1900
1920
1940
Time axis [years]

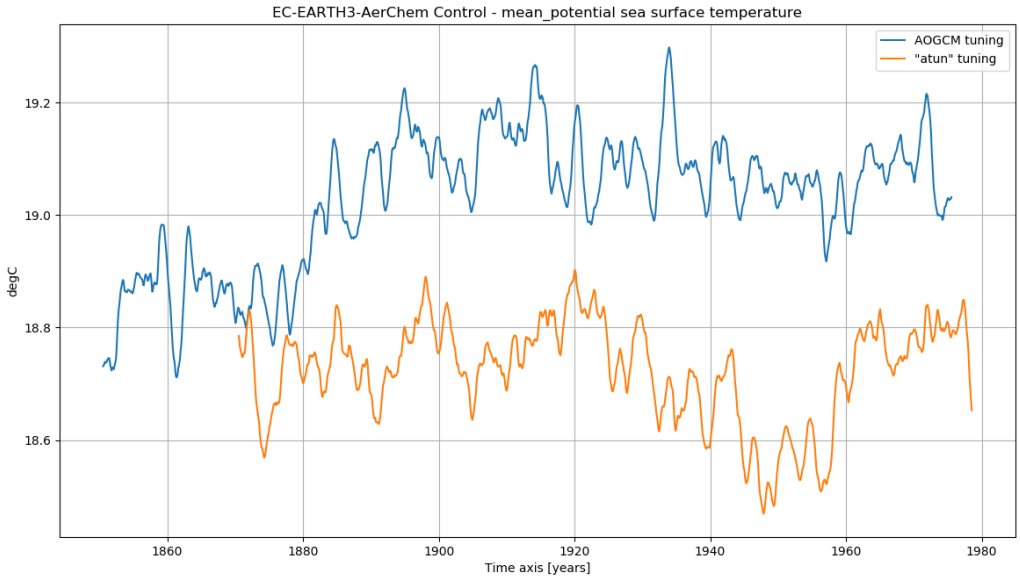


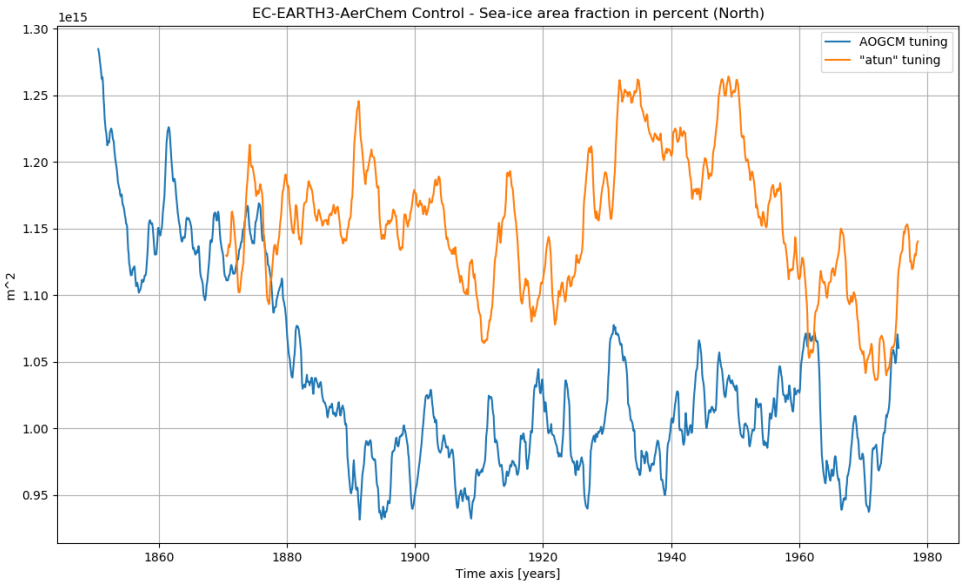
More timeseries available in aerchem-tuning-timeseries.pdf.

Updated by **Philippe Le Sager** 26 days ago #15

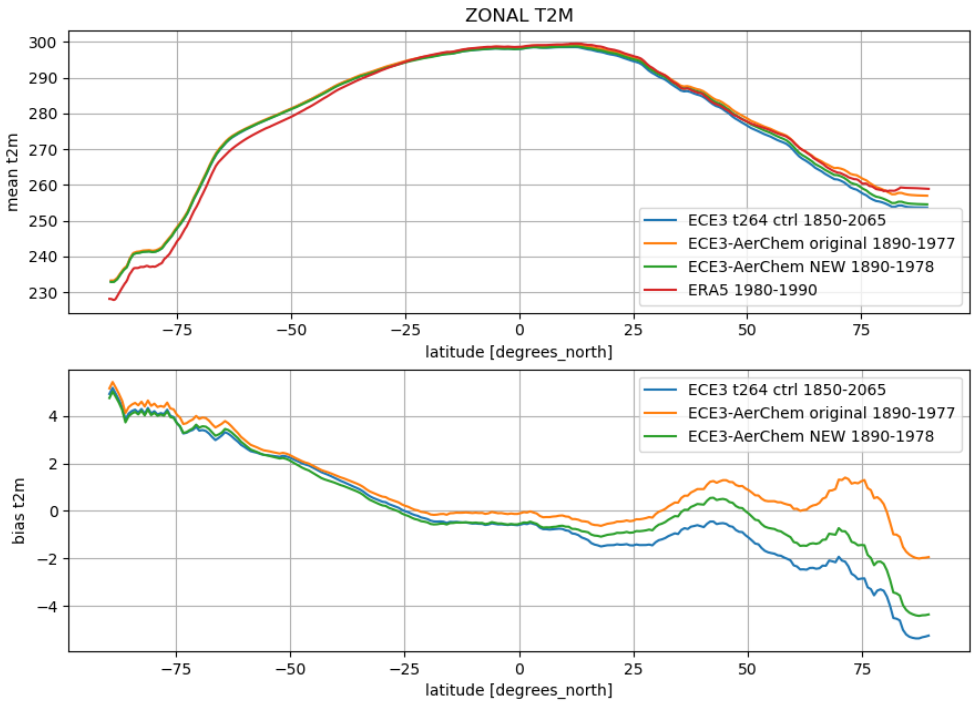
After a little bit more than 100 years or so, both tuning/spinup runs crashed with a CFL violation in TM5. That particular issue has been investigated in ~~#658~~. By applying the first fix mentioned in that issue (i.e. reset the surface pressure to the one received from IFS after each restart), I was able to restart and continue the runs. Here is the status 25 years further down the road (the vertical red lines in the first plot indicate where the runs crashed). With the second set of tuning parameters (`atun` experiment), T2M/SST recovered from the drop mentioned in the previous post, back to an average of 14.1 C for T2M. This is again concomitant to the decrease in artic sea ice:







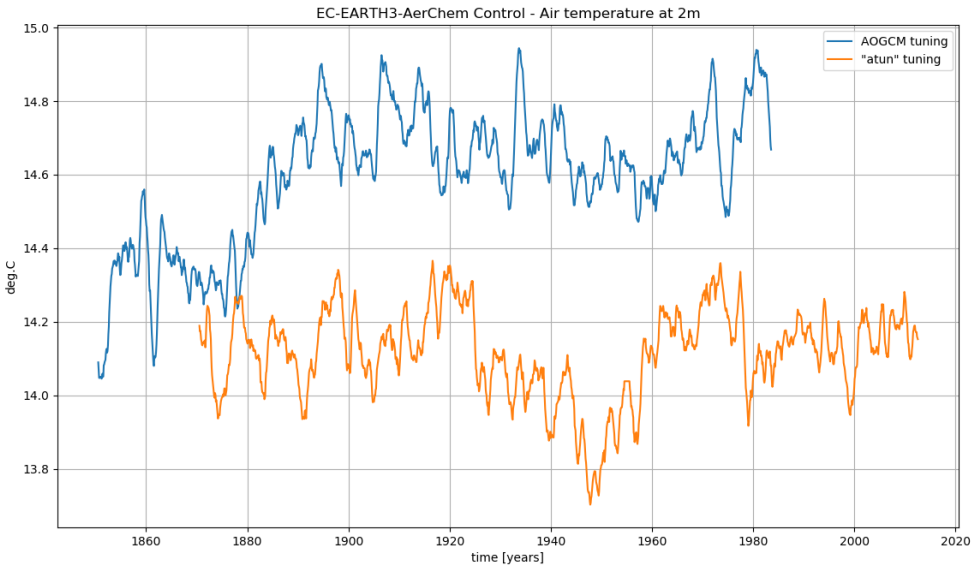
The zonal bias w/r/t ERA5 for both experiments has not changed much:



I will leave the experiments running over the coming weekend, if only to check how stable this is (although if we have to expect 100 years swing, we will never have the final word). I have started two other experiments before the meeting in Reading. They used a newer version of the code, where the IFS surface pressure is accounted for at every coupling step. They are close to 25 years. Timeseries coming soon.

Updated by **Philippe Le Sager** 10 days ago #16

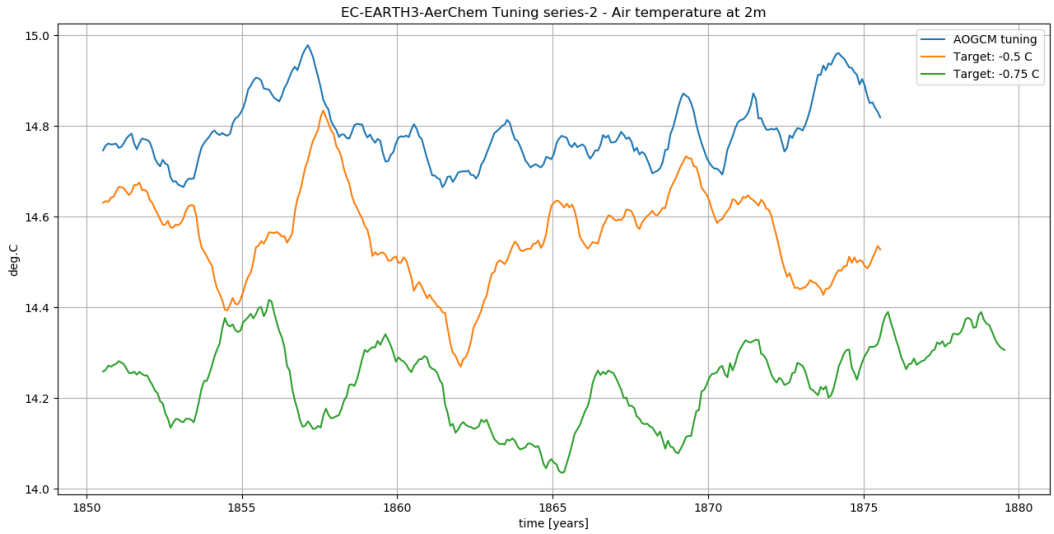
First update on the initial two runs we have been looking at so far:

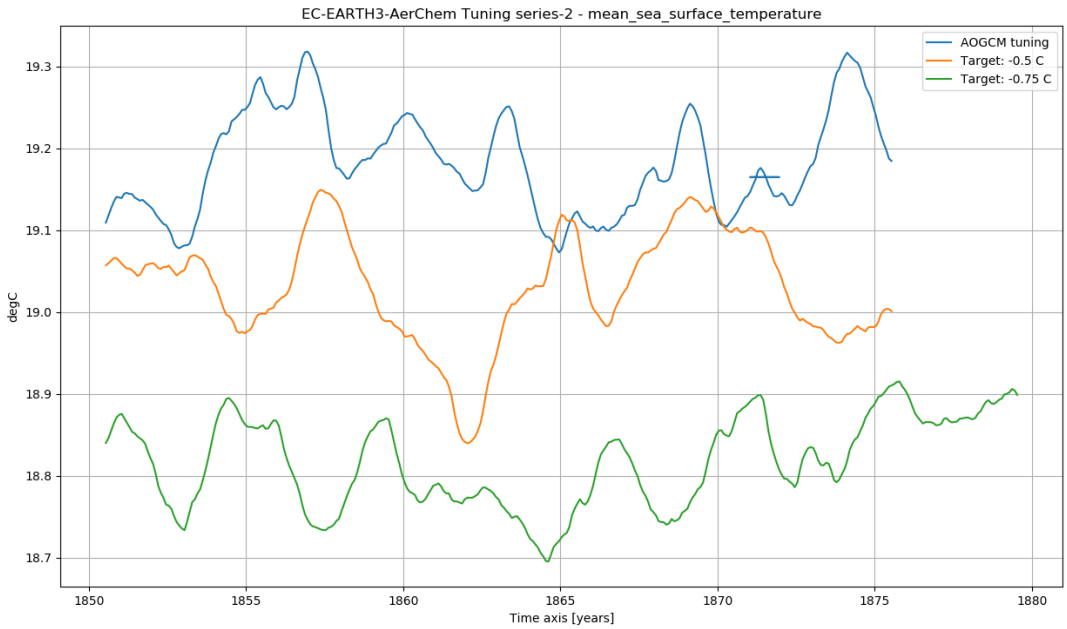


No big news, quite steady. The `atun` recovery after the drop in 1950s is still holding. The aerchem-tuning-timeseries-2.pdf provides the other series.

Updated by **Philippe Le Sager** 10 days ago #17

A new set (I call it series-2) of experiments was launched with the latest version of the model. That is, the tracer mass is conserved at every restart (instead of the mixing ratio). The tuning parameters are: same as AOGCM, targeting -0.5 C, and targeting -0.75 C in the global mean temperature. The first two started from the 1970 state of the AOGCM of the series-1. The third one started from the 1970 state of the "atun" from series-1 (same tuning parameters). Here are the surface temperatures after 25+ years:

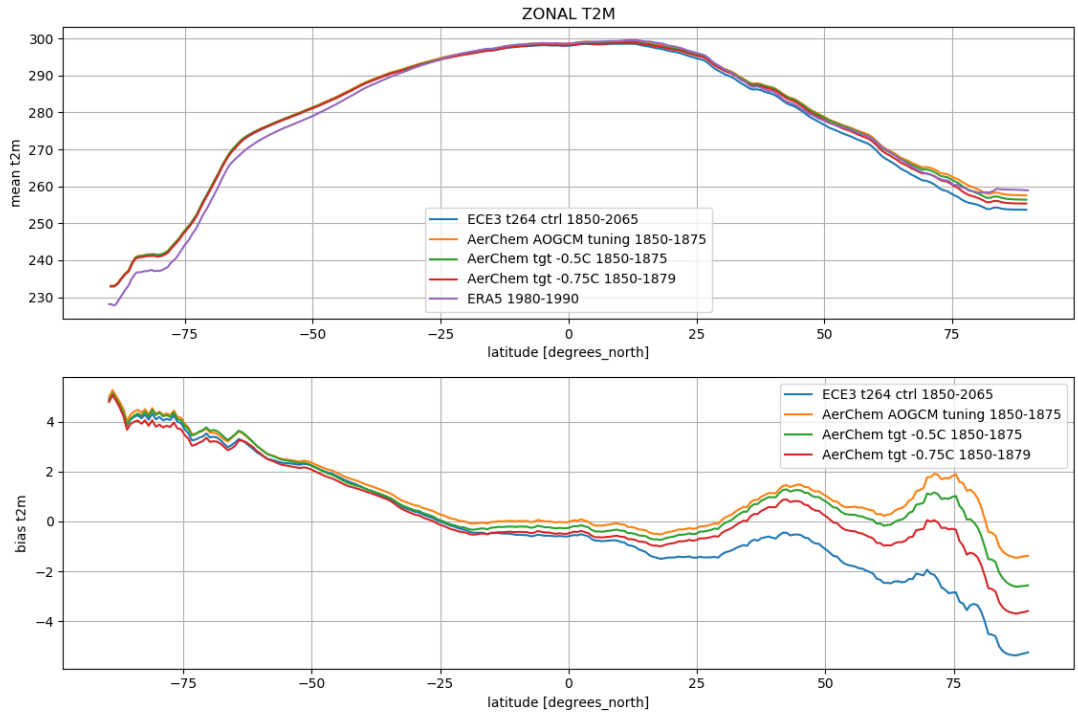




See aerchem-tuning-timeseries2-1.pdf for more time series.

Updated by **Philippe Le Sager** 10 days ago #18

From the new series of run, here is the zonal mean and bias w/r/t ERA5-1980s for T2M:



Again very little if any change in the South hemisphere.

Updated by **Philippe Le Sager** 10 days ago

During the EC-Earth3-AerChem telecon this morning, we decided to continue with `target-0.5` and `target-0.75` runs, and stop the other ones. Favorite candidate for the final version is `target-0.75` (i.e. the continuation of `atun` from Series-1). CMIP6 output will be switched on as soon as the model is synced with 3.3.1.1 (we will remove O3 from IFS output request, see #656-2). That will indicate the switch from spinup to PI-control.

#19