



Saeed Moghimi - NOAA Affiliate <saeed.moghimi@noaa.gov>

Stability issue in the GESTOFS_Pacific_v2 grid

12 messages

Yuji Funakoshi - NOAA Affiliate <yuji.funakoshi@noaa.gov> Mon, Nov 8, 2021 at 5:43 AM

To: Saeed Moghimi - NOAA Affiliate <saeed.moghimi@noaa.gov>, Edward Myers - NOAA Federal <Edward.Myers@noaa.gov>, Gregory Seroka - NOAA Federal <gregory.seroka@noaa.gov>, "Pringle, William" <wpringle@anl.gov>, Zachary Burnett - NOAA Affiliate <zachary.burnett@noaa.gov>, Michael Lalime - NOAA Affiliate <michael.lalime@noaa.gov>

Saeed -

I've been working to run Hurricane Iselle (2014) hindcast with nsem-workflow, and zi found there was a stability issue in the GESTOFS_Pacific_v2 grid.

Since Ali changed the variable "time" in NetCDF, the simulation started running; however, the simulation crashed due to high elevation (greater than error elevation).

I started to run the simulation with a 12 seconds time step, and I reduced it to 6 seconds, 3 seconds, and finally 1 seconds, however, the simulation was not doing well.

Next I tested by changing some parameters, for example ICS (projection), IM (implicit or explicit), and TAU0, but the simulation still crashed.

Finally I used a last option which turned off advection terms (NOLICA and NOLICAT), and then the simulation was completed without any problem.

This is very similar to an issue in the EC2001 grid (there is an instability at the right bottom corner of Caribbean Sea close to the open ocean boundary) because the troubled nodes causing warning elevation were very close to the open ocean boundary between Australia and Indonesia (see google drive).

Anyway, I put autoval results of Hurricane Iselle (2014) on the google drive (including fort. 15):

<https://drive.google.com/drive/folders/11TWMMNWNAGlv-fFRx-vFdvNBpCP4iDFu?usp=sharing>
(Please download the files and go to "www" under the following the directory, and click index.htm)

Tide_baserun: turned on the advection terms with 3 second time step

atm2ocn: turned off the advection terms with 3 second time step

The hindcast looks good although the advection was turned off.

I think if the grid uses operations, like ESTOFS, there is no problem to turn off the advection terms; however, it could be a problem for accurate hindcasts, like COASTAL ACT, especially coupling with Wave Watch III.

Thus we need William's help now. I think we need to add other nodal attributes to reduce instability. What's your thought?

Thanks,
Yuji

--
Yuji Funakoshi, Ph.D.
Coast Survey Development Laboratory
National Oceanic and Atmospheric Administration
[1315 East West Highway](#) - N/CS13
Silver Spring, MD 20910-3282
ph. (240) 847-8246
yuji.funakoshi@noaa.gov

Michael Lalime - NOAA Affiliate <michael.lalime@noaa.gov>

Mon, Nov 8, 2021 at 8:54 AM

To: Yuji Funakoshi - NOAA Affiliate <yuji.funakoshi@noaa.gov>
Cc: Saeed Moghimi - NOAA Affiliate <saeed.moghimi@noaa.gov>, Edward Myers - NOAA Federal <Edward.Myers@noaa.gov>, Gregory Seroka - NOAA Federal <gregory.seroka@noaa.gov>, "Pringle, William" <wpringle@anl.gov>, Zachary Burnett - NOAA Affiliate <zachary.burnett@noaa.gov>

Hi Yuji,

When you turned off the advection terms and the model completed, what time step were you using?

Thank you,
Michael

[Quoted text hidden]

--

Michael Lalime
UCAR, Associate Scientist III
NOAA/NOS/OCS/Coast Survey Development Laboratory
Station 6714
(240) 847-8223

Yuji Funakoshi - NOAA Affiliate <yuji.funakoshi@noaa.gov> Mon, Nov 8, 2021 at 8:56 AM

To: Michael Lalime - NOAA Affiliate <michael.lalime@noaa.gov>
Cc: Edward Myers - NOAA Federal <Edward.Myers@noaa.gov>, Gregory Seroka - NOAA Federal <gregory.seroka@noaa.gov>, "Pringle, William" <wpringle@anl.gov>, Saeed Moghimi - NOAA Affiliate <saeed.moghimi@noaa.gov>, Zachary Burnett - NOAA Affiliate <zachary.burnett@noaa.gov>

Michael -

I used the same time step (3 seconds).

Thanks,
Yuji

[Quoted text hidden]

Michael Lalime - NOAA Affiliate <michael.lalime@noaa.gov> Mon, Nov 8, 2021 at 9:01 AM

To: Yuji Funakoshi - NOAA Affiliate <yuji.funakoshi@noaa.gov>
Cc: Edward Myers - NOAA Federal <Edward.Myers@noaa.gov>, Gregory Seroka - NOAA Federal <gregory.seroka@noaa.gov>, "Pringle, William" <wpringle@anl.gov>, Saeed Moghimi - NOAA Affiliate <saeed.moghimi@noaa.gov>, Zachary Burnett - NOAA Affiliate <zachary.burnett@noaa.gov>

Thanks Yuji

[Quoted text hidden]

Pringle, William <wpringle@anl.gov> Mon, Nov 8, 2021 at 11:59 AM

To: Michael Lalime - NOAA Affiliate <michael.lalime@noaa.gov>, Yuji Funakoshi - NOAA Affiliate <yuji.funakoshi@noaa.gov>
Cc: Saeed Moghimi - NOAA Affiliate <saeed.moghimi@noaa.gov>, Edward Myers - NOAA Federal <Edward.Myers@noaa.gov>, Gregory Seroka - NOAA Federal <gregory.seroka@noaa.gov>, Zachary Burnett - NOAA Affiliate <zachary.burnett@noaa.gov>

Hi Yuji,

Please try positive ICS.

In addition, the most important thing is to think about implicit vs explicit, the time step, tau0, and boundary conditions.

If time step is made smaller it might become smaller than cfl limit so you can switch to explicit which is faster.

Also, for regional domain consider using tau0 = -3 option which can be more stable for wetting-drying.

If strange things are happening at boundary then you could try removing the open ocean boundary from that area if it is like in a narrow and shallow place and/or you can turn off advection only along the boundary. Also, need to use the invertedbarometeronboundary = True namelist option when running with atmospheric forcing.

No need to turn off advection over the whole domain, it doesn't do anything if other parameters are set correctly.

Thanks,

William

[Quoted text hidden]

Yuji Funakoshi - NOAA Affiliate <yuji.funakoshi@noaa.gov> Mon, Nov 8, 2021 at 1:30 PM
To: "Pringle, William" <wpringle@anl.gov>
Cc: Michael Lalime - NOAA Affiliate <michael.lalime@noaa.gov>, Saeed Moghimi - NOAA Affiliate <saeed.moghimi@noaa.gov>, Edward Myers - NOAA Federal <Edward.Myers@noaa.gov>, Gregory Seroka - NOAA Federal <gregory.seroka@noaa.gov>, Zachary Burnett - NOAA Affiliate <zachary.burnett@noaa.gov>

William -

Thank you for your quick response.

I've already tested all ICS (positive and negative), IM (explicit and implicit) and TAU0 (option -3 and -5), but they didn't work.

I recalled the EC2001 grid boundary issue, so I turned off advection terms.

"invertedbarometeronboundary = True" option is a good point, so I will try it as soon as possible.

Yes, I want to keep advections=on for this simulation.

Thank you for your help.

Thanks,

Yuji

[Quoted text hidden]

Pringle, William <wpringle@anl.gov> Mon, Nov 8, 2021 at 2:02 PM
To: Yuji Funakoshi - NOAA Affiliate <yuji.funakoshi@noaa.gov>
Cc: Michael Lalime - NOAA Affiliate <michael.lalime@noaa.gov>, Saeed Moghimi - NOAA Affiliate <saeed.moghimi@noaa.gov>, Edward Myers - NOAA Federal <Edward.Myers@noaa.gov>, Gregory Seroka - NOAA Federal <gregory.seroka@noaa.gov>, Zachary Burnett - NOAA Affiliate <zachary.burnett@noaa.gov>

Yes, so generally when you have an issue at the boundary, the solution is to turn off advection at the boundary through the [advection_state](#) fort.13 attribute. That way you can avoid turning off advection throughout the domain.

Best,

William

[Quoted text hidden]

Yuji Funakoshi - NOAA Affiliate <yuji.funakoshi@noaa.gov>

Tue, Nov 9, 2021 at 7:11 AM

To: "Pringle, William" <wpringle@anl.gov>

Cc: Michael Lalime - NOAA Affiliate <michael.lalime@noaa.gov>, Saeed Moghimi - NOAA Affiliate <saeed.moghimi@noaa.gov>, Edward Myers - NOAA Federal <Edward.Myers@noaa.gov>, Gregory Seroka - NOAA Federal <gregory.seroka@noaa.gov>, Zachary Burnett - NOAA Affiliate <zachary.burnett@noaa.gov>

William -

"invertedbarometeronboundary = True" option didn't work as well.

I want to use the advection_state fort.13 attribute, but I don't know how to make it because I can't find any utility codes or tools.

Could you create it or tell me how to make it?

Thank you for your help.

Thanks,

Yuji

[Quoted text hidden]

Pringle, William <wpringle@anl.gov>

Tue, Nov 9, 2021 at 11:28 AM

To: Yuji Funakoshi - NOAA Affiliate <yuji.funakoshi@noaa.gov>

Cc: Michael Lalime - NOAA Affiliate <michael.lalime@noaa.gov>, Saeed Moghimi - NOAA Affiliate <saeed.moghimi@noaa.gov>, Edward Myers - NOAA Federal <Edward.Myers@noaa.gov>, Gregory Seroka - NOAA Federal <gregory.seroka@noaa.gov>, Zachary Burnett - NOAA Affiliate <zachary.burnett@noaa.gov>

Hi Yuji,

Sure, just make advection_state fort.13 attribute equal to 9999 for the boundary nodes and put -999 as the default value. May use the OceanMesh2D [Calc_f13](#) function with 'Ad' option to help you.

Thanks,

[Quoted text hidden]

Yuji Funakoshi - NOAA Affiliate <yuji.funakoshi@noaa.gov>

Wed, Nov 10, 2021 at 9:32 AM

To: "Pringle, William" <wpringle@anl.gov>

Cc: Michael Lalime - NOAA Affiliate <michael.lalime@noaa.gov>, Saeed Moghimi - NOAA Affiliate <saeed.moghimi@noaa.gov>, Edward Myers - NOAA Federal <Edward.Myers@noaa.gov>, Gregory Seroka - NOAA Federal <gregory.seroka@noaa.gov>, Zachary Burnett - NOAA Affiliate <zachary.burnett@noaa.gov>

William -

I have OceanMesh2D on Orion.

Could you tell me the OceanMesh2D command to make advection_state fort.13 with reading GESTOFS_Pacific_v2.grd?

If you can, please give me the step by step instructions.

Thanks,

Yuji

[Quoted text hidden]

Pringle, William <wpringle@anl.gov>

Wed, Nov 10, 2021 at 3:06 PM

To: Yuji Funakoshi - NOAA Affiliate <yuji.funakoshi@noaa.gov>
Cc: Michael Lalime - NOAA Affiliate <michael.lalime@noaa.gov>, Saeed Moghimi - NOAA Affiliate <saeed.moghimi@noaa.gov>, Edward Myers - NOAA Federal <Edward.Myers@noaa.gov>, Gregory Seroka - NOAA Federal <gregory.seroka@noaa.gov>, Zachary Burnett - NOAA Affiliate <zachary.burnett@noaa.gov>

Hi Yuji,

I think something like this will work. Maybe I make some small mistake on 2) but I think you should get the idea.

1. Read the grid with fort.13:

```
m = msh('fname','GESTOFS_Pacific_v2.grd','aux',{fort.13});
```

2. Compute "advection_state" array:

```
advection_state = 0*m.b + -999; % setting to default value of -999 everywhere  
open_boundary_node = unique([m.op.nbdv]); % get indices of open boundary nodes  
open_boundary_node(open_boundary_node == 0) = []; % delete zero value index  
advection_state(open_boundary_node) = 9999; % set advection_state to 9999 along open boundary nodes
```

3. Add advection_state to fort.13 structure:

```
m = Calc_f13(m,'Ad','assign',advection_state);
```

4. Write out fort.13

```
write(m,'GESTOFS_Pacific_v2','13')
```

[Quoted text hidden]

Yuji Funakoshi - NOAA Affiliate <yuji.funakoshi@noaa.gov>

Fri, Nov 12, 2021 at 4:48 AM

To: "Pringle, William" <wpringle@anl.gov>

Cc: Michael Lalime - NOAA Affiliate <michael.lalime@noaa.gov>, Saeed Moghimi - NOAA Affiliate <saeed.moghimi@noaa.gov>, Edward Myers - NOAA Federal <Edward.Myers@noaa.gov>, Gregory Seroka - NOAA Federal <gregory.seroka@noaa.gov>, Zachary Burnett - NOAA Affiliate <zachary.burnett@noaa.gov>

William -

I successfully made fort.13 and completed hurricane Iselle hindcast with advection terms on.

Thank you for your help.

I put autoval results on the google drive:

<https://drive.google.com/drive/folders/11TWMMNWNAgIv-fFRx-vFdVNBpCP4iDFu?usp=sharing>

The results are good at NOS stations in Hawaii.

Thanks,

Yuji

[Quoted text hidden]