Re: Research Project

Benjamin Oren Goldman <bg502257@live.wpcsd.k12.ny.us>
Sat 3/20/2021 8:36 PM
To: John Fasullo <fasullos@gmail.com>

Great! Thank you!

On 3/20/21 8:35 PM, John Fasullo wrote:
> '
>
> [EXTERNAL EMAIL] EXTERNAL SENDER: This email originated from outside our school district. Do not click links or open attachments unless you recognize the sender and know the content is safe. If you are in doubt, contact the LHRIC Service Desk. Thank you.
>
> Of course - perhaps best to reach me by email initially so that I don't think his call is spam.
>
>> On Mar 20, 2021, at 6:31 PM, Ben Goldman <bg502257@live.wpcsd.k12.ny.us> wrote:
>>
>> Hi Dr. Fasullo,
>>
>>
>> I hope you are doing well. I am writing to ask if you would be willing
>> to say hello to my school guidance counselor, Marcos Monteagudo. I think
>> he has a few questions about our project. May I give him your contact
>> information? Thanks!
>>
>>
>> Ben
>>
>>
>> On 3/4/21 9:24 AM, Ben Goldman wrote:
>>> Hi John,
>>>
>>> Thanks for your help. Looks like a lot of our conclusions are
>>> dependent on the data we receive from the CESM2. I think it would be
>>> easiest once the CESM2 simulations are done for me to redownload all
>>> of both datasets (temp and trefht) from both ensembles. This way I can
>>> make sure they are organized correctly on my computer and no data is
>>> missing.
>>>
>>>
>>> Just to make sure my analysis is correct, is this true? The different
>>> heating rates of the Pacific ocean due to global warming modify the
>>> thermocline depth, leading to greater heat transfer between layers of
>>> the Pacific. This strengthened feedback causes the ENSO cycle to
>>> become more unstable, raising the average amplitude of the Nino 3.4
>>> index. It's clear that there are many other mechanics at work here,
>>> but this is what we have seen so far.
>>>
>>>

>>> Thanks for your suggestions on college planning. So the best path
>>> would be to emphasize general physical sciences, and then I can branch
>>> off once I figure out what I'm really interested in. It's quite
>>> amazing how much there is to learn about physical science. I recently
>>> read a book on chaos in math and physics (James Gleick). I thought it
>>> was quite inspiring, how complex nature really is. It's also really
>>> interesting how applicable the concepts of chaos are to atmospheric
>>> sciences.
>>>
>>> Good luck to your son on his applications!
>>>
>>> Sincerely,
>>>
>>> Ben
>>>
>>>
>>> On 2/25/21 7:50 PM, John Fasullo wrote:
>>>> '
>>>>
>>>> [EXTERNAL EMAIL] EXTERNAL SENDER: This email originated from outside
>>>> our school district. Do not click links or open attachments unless
>>>> you recognize the sender and know the content is safe. If you are in
>>>> doubt, contact the LHRIC Service Desk. Thank you.
>>>>
>>>> Hi Ben,
>>>>
>>>> Thanks for your email. We are waiting for the CESM2 single forcing
>>>> runs to finish, which should be soon. Many single forcing members
>>>> have already completed but the aerosol only ones have not. Once done
>>>> we will be able to compare and contrast CESM1 and CESM2 behavior and
>>>> I think this will provide a more compelling manuscript. Some
>>>> additional comments below. The main next step is for me to get you
>>>> the data you'll need to answer the questions regarding CESM2. Given
>>>> that the grids are the same, this should be an easy application of
>>>> your existing code to a new model and time period (all CESM2 members
>>>> start in 1850) and should not take long once you have the data. We
>>>> can then compare our results and develop our narrative for the
>>>> factors that are governing ENSO variance in both ensembles.
>>>>
>>>> Best,
>>>> John
>>>>
>>>>
>>>>> On Feb 24, 2021, at 7:16 PM, Ben Goldman
>>>>> <bg502257@live.wpcsd.k12.ny.us> wrote:
>>>>>
>>>>> Dear Dr. Fasullo,
>>>>>
>>>>> Hello, I hope your winter is going well. I am writing to check in about
>>>>> our ongoing research project and ask a few questions about what I
>>>>> should
>>>>> do next, and higher education planning.
>>>>>

>>>>> I have finished reading most of the articles you referred me to. They
>>>>> are all very interesting, and our results seem to agree with them
>>>>> mostly. I will let you know if I have any specific questions about
>>>>> them.
>>>>> I was wondering what the next steps for the project are. I believe this
>>>>> is what we know so far:
>>>>>
>>>>> - The CESM1 full-forcing ensemble exhibits significant increase of Niño
>>>>> 3.4 variance in the 21st century.
>>>> CESM2 variance does as well, until 2020, but then decreases.
>>>>> - This increase is mainly attributable to GHG and AER forcing as shown
>>>>> by a bootstrap test where we subtract all-but-one ensembles from the
>>>>> fully-forced ensemble
>>>> My results show GHG is dominant with AER playing a role in some
>>>> periods. I'm not sure about attribution in CESM2 yet. I expect GHG
>>>> play a different role due to the decrease in variance from 2020-2100.
>>>>> - The control simulation exhibits no systematic relationship between
>>>>> the
>>>>> AMO or AMOC modes of variability and ENSO amplitude variability
>>>> Probably true for CESM2. We should check.
>>>>> - The probability distribution of ENSO amplitude in the control is
>>>>> chaotic and varies greatly over time
>>>> Probably true for CESM2. We will need to check.
>>>>> - Global mean state influence on thermal coupling above the eastern
>>>>> Pacific warm pool likely mediates forced changes to ENSO amplitude
>>>> I don't think it is the global mean state as much as the mean state
>>>> of the tropical Pacific (thermocline depth and ocean zonal/meridional
>>>> structure, response of deep convection to temperature). Particularly
>>>> in CESM2 we'll see that global T for example is a poor indicator of
>>>> variance.
>>>>> - Negative correlation between ENSO amplitude and central Pacific
>>>>> subsurface sea temperature suggests that stratification also plays a
>>>>> role. This correlation is weaker in the all-but-one ensembles for both
>>>>> GHG and AER suggesting that the correlation may be driven by industrial
>>>>> emissions.
>>>> That's right, I think this is likely key along with the broader ocean
>>>> structure in the tropical/subtropical Pacific. I think the weaker
>>>> correlation in the single forcing cases may indicate that there is
>>>> merely weaker S/N.
>>>>> What specific calculations or analysis would you like me to do now? I
>>>>> have an idea of what some goals of future methods for this study are,
>>>>> but I'm not sure which specific processes to implement. I have seen
>>>>> that
>>>>> many studies are using the mixed layer heat budget equation as a
>>>>> central
>>>>> method of identifying which processes are mediating forced changes to
>>>>> ENSO. It looks like a very useful method, but I'm not sure how to do it
>>>>> since I have limited experience with differential equations and vector
>>>>> calculus (I am taking BC calculus right now). Of course, if you
>>>>> think it
>>>>> would be realistic, I'd be happy to give it a shot.
>>>> First question is whether you have any of the CESM2 data? I don't
>>>> recall precisely what I've provided for you so we'll need to get our

>>>> datasets complete so you can run the code on the CESM2 output. Do you
>>>> have the TREFHT data? The TEMP data?
>>>>> I looked into the discrepancy with the decreasing amplitude in the
>>>>> full-forcing ensemble in the mid 21st century. I think the original
>>>>> datasets may be different. Would it make sense for me to redownload the
>>>>> ensemble?
>>>> Sure, I can provide these data at the same time as the CESM2 data.
>>>>> I also was slightly surprised at how in my results (shown in the
>>>>> attached figure), the influences of GHG and AER have the same sign,
>>>>> while past research and the differing nature of the two forcings
>>>>> suggest
>>>>> that they should have opposite signs. Is your analysis showing the same
>>>>> conflict?
>>>> That surprises me as well. My analysis does not show that.
>>>>> My other question is about college planning. I am beginning the college
>>>>> application process and I was wondering if you could give me some
>>>>> advice
>>>>> on which programs would be the most helpful for continuing to study
>>>>> climatology, and which colleges I might apply to considering my
>>>>> interests. I understand that most climatologists begin their higher
>>>>> education focusing on general physics and then pursue specific
>>>>> atmospheric research during graduate school. What would you say is the
>>>>> most fulfilling education path for a career like yours?
>>>>>
>>>> I think you want to develop the raw skills for doing climate science
>>>> AND keep your options open for exploring other careers during your
>>>> college experience. This means maintaining a strong focus on math,
>>>> physics, and applied computer science. From that base you can pursue
>>>> dozens of careers. Electives are important as well but you should
>>>> feel free to choose whatever you want with those I think. If you are
>>>> interested in biology or chemistry there are also climate related
>>>> focus areas that deal with those topics. My son is in the process of
>>>> applying to college too, now just waiting for admissions responses.
>>>>
>>>> Best,
>>>> John
>>>>
>>>>> Thank you so much for all your help!
>>>>>
>>>>> Sincerely,
>>>>>
>>>>> Ben
>>>>>
>>>>> _____
>>>>> White Plains School District - PERSONAL & CONFIDENTIAL DISCLOSURE
>>>>> STATEMENT
>>>>> The information transmitted herein may contain privileged and/or
>>>>> confidential material. Any disclosure, copying, distribution or
>>>>> other use of, or taking of any action in reliance upon, information
>>>>> contained herein or attached hereto by persons or entities other
>>>>> than the intended recipient(s) is prohibited. Any misdirection or
>>>>> other error in the transmission of this information is not and shall
>>>>> not be considered a waiver of any applicable privileges. If you have

>>>>> received this transmission in error, please immediately notify the
>>>>> sender and destroy the original transmission and its attachments
>>>>> without saving, distributing or copying in any manner.
>>>>> <bootstrap_1.pdf>
>>>> _____
>>>> White Plains School District - PERSONAL & CONFIDENTIAL DISCLOSURE
>>>> STATEMENT
>>>> The information transmitted herein may contain privileged and/or
>>>> confidential material. Any disclosure, copying, distribution or other
>>>> use of, or taking of any action in reliance upon, information
>>>> contained herein or attached hereto by persons or entities other than
>>>> the intended recipient(s) is prohibited. Any misdirection or other
>>>> error in the transmission of this information is not and shall not be
>>>> considered a waiver of any applicable privileges. If you have
>>>> received this transmission in error, please immediately notify the
>>>> sender and destroy the original transmission and its attachments
>>>> without saving, distributing or copying in any manner.
>> _____
>> White Plains School District - PERSONAL & CONFIDENTIAL DISCLOSURE STATEMENT
>> The information transmitted herein may contain privileged and/or confidential material. Any disclosure, copying, distribution or other use of, or taking of any action in reliance upon, information contained herein or attached hereto by persons or entities other than the intended recipient(s) is prohibited. Any misdirection or other error in the transmission of this information is not and shall not be considered a waiver of any applicable privileges. If you have received this transmission in error, please immediately notify the sender and destroy the original transmission and its attachments without saving, distributing or copying in any manner.
> _____
> White Plains School District - PERSONAL & CONFIDENTIAL DISCLOSURE STATEMENT
> The information transmitted herein may contain privileged and/or confidential material. Any disclosure, copying, distribution or other use of, or taking of any action in reliance upon, information contained herein or attached hereto by persons or entities other than the intended recipient(s) is prohibited. Any misdirection or other error in the transmission of this information is not and shall not be considered a waiver of any applicable privileges. If you have received this transmission in error, please immediately notify the sender and destroy the original transmission and its attachments without saving, distributing or copying in any manner.