EDITOR COMMENTS:

Like many of the reviewers, I found the chapter to be interesting, well written and comprehensive.  However, I do have some comments/suggestions on the manuscript.

SECTION b: SST

1) The SST anomalies in Figures 3.1 and 3.2 are very smooth, likely much smoother than the actual anomalies (e.g., as in Figure 3.4). Is this the product of using 500 estimates for the anomalies, applying a smoother, interpolating to a coarse grid, etc.? Perhaps an explanation for how and why the anomalies have this appearance could be given in the text and/or the figure caption.

2) lines 182-183: “Annually averaged SSTAs in 2020 (Fig. 3.1a) were mostly above average, between +0.5°C and +1.5°C in most of the North Pacific”

Perhaps drop “mostly” or “most” or rephrase the sentence.

3) There are references to Figures 3.1.c & 3.1.d on lines 201 and 202. I think the authors intended it to be 3.2.c and 3.2.d

4) line 201 and elsewhere throughout the text the authors use “cooling (or warming) tendency”.  Cooling and warming, means getting colder or warmer, so they already indicate a tendency.  So, “tendency” can be dropped when used in this context. One of the reviewers suggests using difference rather than tendency for the difference between 2019 and 2020 and that is a fine to use in place of “tendency”.

5) line 237. Worthwhile to include more recent references for the AMO than (Schlesinger and Ramankutty 1994).  This could include papers that discuss additional processes that influence the AMO such as surface fluxes and aerosols (pollution, volcanoes).

SECTION c. OCEAN HEAT CONTENT

6) lines 264-265: “ENSO and ocean warming are related, as reflected in both regional patterns and global integral values (Johnson and Birnbaum 2017).”

I am not sure what this sentence means in the current context.  ENSO (likely happens) without global warming and the two have different overall temperature patterns.

7) lines 331-332: “The opposite pattern is evident during El Niño years (e.g., 2009–10 and 2015–16) when the east-west tilt of the equatorial Pacific thermocline reduces as easterly trade winds subside, and even reverse at times.”

One can’t really tell the pattern for the tropical Pacific based on global averages.  Could drop this sentence or include a figure that shows the zonal structure of the temperature in the equatorial Pacific. I think one or more figures showing the vertical structure of anomalies in the equatorial Pacific would be beneficial to the overall discussion of ENSO conditions in this chapter.

SECTION d. SALINITY

8) lines 421-423: State “In contrast, the more recent strong salinifying tendency along the equator north of the Solomon Islands from 2019 to 2020 (Fig. 3.7b) is owing to the westward migration of the fresh pool with the advent of La Niña in 2020.”

I found this sentence to be confusing. I assume “salinifying” means an increase in salinity, if so I suggest changing “salinifying tendency” to “increase in salinity”.  I suggest giving the latitude & longitude for the exact region you are describing. Finally, if the fresh pool is migrating westward, then why is there an increase in salinity?

9) line 477 perhaps give the latitudes that are used for “basin-averaged” values. This can be given in the caption for Fig. 3.9 for the three ocean basins.

SECTION e. FLUXES

10) line 555-556.  Note that in the tropical Pacific the anomalous heat flux is into the ocean where the is anomalously SSTs are cold and where the SSTs decrease between 2019-2020. This should probably be explained: that the negative SSTs are driven by dynamical ocean processes (advection + upwelling) and that the surface fluxes act to damp the dynamically-driven SST anomalies.

11) lines 556-557:  Perhaps add a clause that the radiative fluxes are important (dominant) in the equatorial west Pacific and eastern Indian Ocean (or could refer to this region as the Maritime continent). SW+LW are also important in the NW-SE diagonal band in the central south Pacific.

12) 558-560: States “The net downward SW+LW heating tendency increased along the Intertropical Convergence Zone (ITCZ) in the equatorial Pacific and the South Pacific Convergence Zone (SPCZ) in the South Pacific”.

The changes in SW+LW may not align with the climatological position of the ITCZ and SPCZ. For example, the ITCZ is roughly at 8 N while the maximum radiative heating in Figure 3.11.c is on the equator (and only in the western Pacific).

13) line 570: Is the reduction in “high clouds” really responsible for the increase in the surface radiative flux of the US west coast? Usually, it is the low stratus cloud deck that influence SW there.

14) lines 576-578: Perhaps a little more discussion here about fluxes damping SST anomalies where the SSTA are mainly due to ocean dynamics vs regions where the surface fluxes primarily drive the SST changes. (see comment 10).

15) It might be helpful to place the climatological mean as black contours in Figures 13.11.a and 13.12.a.

16) lines 589-590: “In most regions of the Pacific and Atlantic Oceans, the net  
freshwater input was reduced  …”

To me it looks fairly evenly split between positive and negative values.

17) line 634: Perhaps add a clause that describes the SST polarity of a positive Indian Ocean dipole event.

18) it’s hard to reconcile the long-term ocean warming with Figure 3.14a.

19) Is it possible to extend Qnet further back in time in Fig. 3.14 by using the radiative terms calculated using ISCCP data?

SECTION f. SEA LEVEL

20) line 360 [NOTE: TYPO, SHOULD BE 680]: Perhaps briefly explain how terrestrial water storage influences sea level.

21) line 711: give the locations of Los Angeles and Palau in (lat, lon) as well.

22) line 740: Perhaps add a sentence describing how the pattern is consistent with a positive Pacific Meridional Mode.

SECTION h. AMOC

23) line 902 – change in font (also noted by a reviewer)

24) line 935 last word - should it be “all” instead of “tall”?

25) line 940: perhaps replace “but” with “and”.

26) line 966-967 add commas: “A MOC time series at 26.5°N generated from the combination of altimetry and Argo data using the method of Majumder et al. (2016)”

To:

A MOC time series at 26.5°N, generated from the combination of altimetry and Argo data using the method of Majumder et al. (2016), …

SECTION i. PHYTOPLANKTON

27) I agree with the reviewer who suggested more information/discussion for areas outside the permanently stratified ocean (PSO) in the phytoplankton section

28) Perhaps it’s worth examining a long-term time series of the area of the POS region, several studies have suggested these low productivity regions will grow in size over time.

29) lines 1046-1037. While the negative SST anomalies in the eastern tropical Pacific are associated with La Nina, it’s not clear that other areas of the globe have a conical La Nina pattern, including the differences between hemispheres.  Other climatological features such as the Atlantic Nino, meridional modes (Atlantic and Pacific) and long-term global changes are may play a role as well.

30) Figure 3.26 and the accompanying discussion.

- it looks like there is a difference in amplitude of the anomalies in the earlier and later period. Is this a true reflection of the change in variability or (at least partly due) to the change in instruments?

- Are the anomalies really calculated from the entire time series? It’s doesn’t look like it by eye. For example, the very last point in Fig. 3.26c is right at the mean, but the anomaly shows it to be negative in 3.26d.

- the correlation between the MEI ENSO index and the two chlorophyll time series should be reported.

- In my opinion the description of figures 3.26b & d do not adequately describe the variability over 2019-2020.

SECTION j. CARBON

31) I am somewhat confused by the sentences on lines 1189-1192. “In the Northern Hemisphere, there is a significant asymmetry in fluxes in the sub-Arctic gyres, with the North Atlantic being a large CO2 sink while the North Pacific is a CO2 source. This difference is partly due to the position of the western boundary currents whose cooling waters are known to contribute to CO2 sinks at high latitudes: …”

I do not see the asymmetry between the North Pacific and North Atlantic, other than the Bering Sea, the patterns look fairly similar and both appear to take up CO2.

In addition, the western boundary currents transport warm, not cold, water. Do the authors mean these currents cool as the water within them is exposed to colder air temperatures?

32) lines 1200-1202: Note that the attribution of a marine heat wave was only for the far northeastern edge of the band not for the entire band.

33) lines 1209-1212: States “This is an indication of the changing patterns of the El Niño-Southern Oscillation (ENSO) in the Pacific with the region of strongest upwelling and winds moving westward to the central equatorial Pacific.”

I believe the authors are referring CP vs EP EL Nino events here.  I believe the westward movement is under some debate (at least if its random or due to climate change) and has mainly been discussed in the context of El Nino as opposed to La Nina events. Thus, I suggest dropping this sentence or just referring to the location where the upwelling actually occurred in 2020.

34) Readers may be confused by what “respectively” on line 1251 is referring to, as the two types of pumps are discussed in the previous sentence.

SIDEBAR 1: MARINE HEAT WAVES

35) line 1304. Perhaps provide a brief description of the meridional mode and what the positive phase indicates.

36) line 1339. States “MHWs will intensify in the coming decades as surface stratification”

Should probably add that this is relative to today’s climate (or the climate of the recent past). (Basically, heat waves are primarily increasing due to a shift in the mean and not a change in the distribution).

37) line 1352: It’s not clear to me what “likely as a result” means in this context. Is it that the anomalously warm surface waters have mixed or subducted into deeper layers.