Editors' Note: The external, independent review of Arctic Report Card 2014 was facilitated by the Arctic Monitoring and Assessment Programme (AMAP) of the Arctic Council. AMAP sent the Report Card to twelve (12) reviewers. Reviewer no. 6 did not return a review, and Reviewer no. 11 returned a review one week later than the deadline. The editors exercised the right to not respond to Review no. 11, as the need to keep to a strict deadline had been made clear to AMAP from the outset.

Reviewer number 1.

		1. Air Temperature
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 2.

		1. Air Temperature
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 3.

		1. Air Temperature
Page No.	Line No.	Comment
1	16	Highlight #1. It is early in the year for stating that 2014 might become the warmest year in the Arctic since the analysis is based on the January-July 2014 mean temperature only (seven months). Is the January-July 2014 mean temperature the warmest "seven first months of the year" since the beginning of the 20th century? This would be a more accurate statement. The premature statement that 2014 might be the warmest year in the Arctic has been deleted. Thus there is no need to answer the question about the January-July mean temperature. An entirely new first paragraph has been written; it describes the temperature anomaly for the period October 2013-September 2014, and explains the choice of reporting period.
1	21	Highlight #2. It is mentioned that extreme monthly temperature anomalies were in excess of +0.5°C over central Arctic, Alaska and Svalbard, …, while the Executive Summary (page iii, para. 2) mentions that in Alaska the statewide temperature anomalies was +10°C in January. Both sentences are correct but would it be better if both the Executive Summary and the Highlights of Chapter #1 provided similar information. This can be confusing. The highlight has been rewritten to be consistent with the Executive Summary.
1	24	Highlights #3. Does the general public know what an "Arctic Dipole pattern" is? Some scientists, students, general public, etc. only read the highlights of the chapters and the highlights should be more "terms-

1	24	Highlights #3. Does the general public know what an "Arctic Dipole pattern" is? Some scientists, students, general public, etc. only read the highlights of the chapters and the highlights should be more "terms-friendly". Maybe a short description can be added in brackets. A brief description of the Arctic Dipole has been added to the highlight. Note that the Arctic Dipole was described in the main body of the text seen by the reviewer.
1	29-32	This is confusing. First it is mentioned that the Arctic air temperature continue to increase (Fig. 1.1 provides the annual mean temperature time series). Then it is mentioned that the analysis for January-July 2014 suggests that 2014 might become the warmest year. Which analysis supports this statement? Was January-July 2014 mean temperature compared with historical January-July mean temperature? The January-July 2014 mean temperature anomaly cannot be compared with the January-December mean temperature anomaly: it this presented in Figure 1.1? It is too early to make a statement about temperature in 2014 based on only 7 months of data! Maybe providing an annual mean computed from July (of the previous year) to June (of the current year) would be more relevant (and accurate)! The authors and editors regret the confusion due to the speculative reference to 2014 possibly being the warmest year on record. Since the speculation has now been omitted there should be no confusion. Also, it is now made more clear that the period October 2013-September 2014 is being described, i.e., the period since the previous Arctic Report Card, and the one for which data were available at the time of writing.
1	34-42	Why was the interval October-January selected (why is it important)?A figure presenting the time series of the Arctic October-January mean temperature would be more convincing in demonstrating that the last six years were warmer than the 20 years in 1981-2000. Do Kosaka and Xie present a global temperature time series in their article? If so then a figure can be added showing the two time series: one for the Arctic mean temperature and the other for the global mean temperature. It is not necessary to repeat "(Fig. 1.2)" twice in this paragraph. The period October-January is no longer used. Instead, the period October-December is used to be consistent with the season defined in the next section on seasonal air temperature variability. Figure 1.1 now includes global annual mean air temperature. The second reference to Fig. 1.2 has been deleted.
2	46	It is mentioned that the annual mean temperature anomalies for 1900-2014 is based on land stations north of 60°N. However, there are very few stations in Canada north of 60°N with data prior 1948. The Canadian stations data are used as input to the CRUTEM4v. It would be more accurate if either an additional graph would be used to show the number of stations reporting temperature every year over 1900-2014, or if a sentence is added mentioning that there are very few stations in the Arctic

2	56	Why using October 2013 to August 2014? The intervals used in this report (annual, January 2014 to July 2014, October 2013 to January 2014, October 2013 to August 2014) are not consistent. This report is intended for a wide audience. Providing information for intervals which appear to be randomly selected is not convincing. Maybe a sentence of explanation as why so many intervals are used in this report should be available at the beginning of the report. The period October 2013-August 2014 was used in the original essay because August 2014 was the last month for which data were available at the time of writing. The period is now October 2013 – September 2014 (September data are now available). A full explanation of the choice of reporting period October 2013 – August 2014 is given in the first paragraph of the essay.
3	65	The seasonal anomalies by the reanalysis reproduce relatively well the anomalies observed in surface data over Canada. The author and editors are not sure of the purpose of this comment. They don't see any need for a response.
4	83	Is it necessary to repeat "and 5°C below normal in January, February and March for much of" since it was already mentioned at the beginning of the sentence? The sentence has been modified and 5°C below normal temperature is now mentioned only once.
4	89	It is not necessary to repeat "(Fig. 1.4)" twice: the second (line 90) is sufficient. Fig. 1.4 is now mentioned only once.
		Good work! Thank you.

General comments: **Editors' Note: No additional comments were provided by the reviewer.**

Reviewer number 4.

		1. Air Temperature
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 5.

		1. Air Temperature
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 7.

		1. Air Temperature
Page No.	Line No.	Comment
iii		"Mean annual air temperature continues to increase in the Arctic, at a rate of warming that is 3 times faster than at lower latitudes.": More quantitative information should be given regarding the faster warming in the Arctic. "Lower latitudes" should be replaced by a specific geographic domain; otherwise, do not use '3 times'. It is now reported that Arctic temperatures are warming at twice (not three times) the rate of global temperatures, and the authors and editors consider this to be sufficiently quantitative. The addition of the global temperature data to Figure 1.1 helps in this regard. The phrase "as is evident in Fig. 1.2" has been added to indicate the geographic domain for the comparison.
iii		"Polar bear populations are being adversely affected by the changing sea ice in some regions. In western Hudson Bay, Canada, a decline in female polar bear numbers and body condition is due to earlier sea ice break-up, later freeze-up and, thus, a shorter sea ice season.":Is it possible to quantify the decline in polar bear numbers? Some polar bear numbers have been added to the Executive Summary.
1	37	See the first comment. See response above.
1	39-42	The authors just mentioned that global warming has been slowed in the last decade on line 36, so how can the slowed global warming be used to explain the Arctic amplified warming here. The link between them should be clarified. The authors and editors consider it unnecessary to go into such detail as to why the Arctic continues to warm even as the rate of global warming has slowed. However, some of the causes of Arctic Amplification, as they are currently understood, are now given.
2	45	I would suggest to plot global annual mean SAT together with Arctic SAT, in order for readers to see the differences between Arctic SAT change and global mean SAT change. Global temperature data have been added to Figure 1.1.
2	52	Here a brief discussion should be given to mention how the surface air temperature data in NCEP/NCAR Reanalysis were obtained in those regions with sparse station data and to comment on the data quality. The authors and editors consider it unnecessary to go into such detail.
3	71	We cannot see month-to-month variability in Fig. 1.3a. There is no such information. That is the point of the sentence, which makes it very clear that the 3-month composites mask the considerable month-to-month variability that occurred.
3	74-75	I cannot see how the warmer temperature in Siberia was caused by low

3	74-75	I cannot see how the warmer temperature in Siberia was caused by low pressure in the Atlantic sector. It would be very helpful for readers to understand this if SLP was also plotted. The statement "similar to the winter pattern illustrated in Fig. 1.4" has been added in parentheses to help the reader see how the pressure field affects temperature.
4	79-80	"8°C above the 1981-2010 January-March average." was not reflected in Fig. 13b. This reflects the difference between a single point and a reanalysis field. It doesn't make one or the other incorrect. No change is needed.
4	86	"greater sea ice extent over the Barents and Kara seas (Kim et al. 2014)." : should say "greater sea ice loss". Also need to mention which season's sea ice loss has such effect.

General comments: Some statements should be addressed in a more quantitative way, and some figures need to be improved in order for readers to easily understand the conclusions, and to better support the conclusions. The editors are satisfied that this request has been satisfied.

Reviewer number 8.

		1. Air Temperature
Page No.	Line No.	Comment
1	15	This is too strong assertion so far as data from January-September 2014 show the third place between means for January-September. May be should say "...suggest that 2014 will between the warmest years in the Arctic since the beginning of the 20th Century." The authors and editors agree. The speculation about 2014 possibly being the warmest on record in the Arctic has been removed.
1	30	See Line 15. A statement " The mean annual air temperatures in 2012 and 2013were lower than in 2011" could be exclude The authors and editors agree. The sentence has been deleted.
3	60	It is understandable more for the public if use the calendar seasons (DJF, MAM, JJA, SON). The same for comparison with other regions. The authors and editors appreciate the reviewer's comment. But, the reporting period is October 2013-September 2014, so it is reasonable to divide it into four seasons: OND, JFM, AMJ, JAS. It is the case that JFM is typically colder, and thus more wintry, than DJF. The authors and editors choose not to make any change.

General comments: **Editors' Note: No additional comments were provided by the reviewer.**

Reviewer number 9.

		1. Air Temperature
Page No.	Line No.	Comment
2	45	Would be nice to see why the authors had chosen the averaging period precisely 1981-2010. The choice of reference period is explained. That is, it is the current period used by the World Meteorological Organization and individual operational agencies such as NOAA.
2	50	The scale of Figure 1.2 doesn't fit real values. According to the picture the lowest value is minus 2.5 (approximately), but not -7.5 as it's shown. This makes the figure looking too 'warm'. The scale in the legend has been changed so that the positive and negative anomalies are the same value but have a different sign, i.e., +3 to -3.
3	71	'Fall 2013' draws non-native English speaker attention. 'Autumn 2013' would look more common to my mind. Autumn is now used throughout the Report Card.

General comments: **Editors' Note: No additional comments were provided by the reviewer.**

Reviewer number 10.

		1. Air Temperature
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 12.

		1. Air Temperature
Page No.	Line No.	Comment
		This is a general comment to many of the essays: The Report Card is excellent on detection but (deliberately?) weak on attribution to environmental drivers. It is generally anticipated that climate warming is the main cause of observed changes. However, the AMAP report from about (?)2007 (Patricia Quinn et al.) (and well handled in IPCC WG I report 2013) shows that deposition of black carbon (BC, soot) has a fundamental impact on the decreasing albedo in the Arctic. According to the AMAP report, BC accounts for about 20% of the observed change. Black Carbon was reported in Arctic Report Card 2013, and is now also noted in the new introductory paragraph of the Air Temperature essay. It is understood that the Arctic Report Card focuses on detection, but attribution to drivers enters in the essays to a varying degree. (See IPCC WG II Chapter 18 on Detection and Attribution). The reviewer is correct. The Arctic Report Card deliberately

		focuses on the description of change rather than attribution of change. When authors do attribute change they must use the published literature as the representation of current understanding of causes.

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 1.

		2. Terrestrial Snow Cover
		Editors' Note: The reviewer did not evaluate this contribution.

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 2.

		2. Terrestrial Snow Cover
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 3.

		2. Terrestrial Snow Cover
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 4.

		2. Terrestrial Snow Cover
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 5.

		2. Terrestrial Snow Cover
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 7.

		2. Terrestrial Snow Cover
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 8.

		2. Terrestrial Snow Cover
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 9.

		2. Terrestrial Snow Cover
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 10.

		2. Terrestrial Snow Cover
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 12.

		2. Terrestrial Snow Cover
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 1.

		3. Greenland Ice Sheet
Page No.	Line No.	Comment
12	Fig 1d	Legend should say 2012, not 2102 The legend has been corrected.
12	L359	For clarity: "July melt anomaly 2014" This has been modified to be clearer and consistent with the description of the June melt anomaly.
12	L359	"percentage of" → "fraction of" Percentage has been replaced with fraction.
13	L377	"highest" → "lowest" Highest has been replaced with lowest.
13	L380	Remove parenthesis at the end Parenthesis has been deleted. Thank you for spotting that error.
14	L395	Clarify: "…ranked as the 7th most negative…". Or something similar. The text has been modified to make it clearer that it was the 7th most negative mass balance in the 24-year observational record.
14	L410	For comparison with the other results, it would be better to have end-of-summer as a reference (the mass balance year). But there might be other

14	L410	For comparison with the other results, it would be better to have end-of-summer as a reference (the mass balance year). But there might be other reasons for this, and a change is not strictly needed. The text describes the data available at the time of writing, when the end of summer observations were not available.
14	L413	Restructure: "..since April 2002, estimated from GRACE measurements. Anomalies are…"

General comments:
This is a very nice overview that builds on well-established methodologies. The results are clear and well presented, and scientific interpretations are kept at a minimum. I only see the need for a few minor corrections as given above. The authors and editors appreciate the reviewer's comments.

Reviewer number 2.

		3. Greenland Ice Sheet
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 3.

		3. Greenland Ice Sheet
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 4.

		3. Greenland Ice Sheet
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 5.

		3. Greenland Ice Sheet
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 7.

		3. Greenland Ice Sheet
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 8.

		3. Greenland Ice Sheet
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 9.

		3. Greenland Ice Sheet
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 10.

		3. Greenland Ice Sheet
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 12.

		3. Greenland Ice Sheet
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 1.

		4. Sea Ice
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 2.

		4. Sea Ice
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 3.

		4. Sea Ice
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 4.

		4. Sea Ice
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 5.

		4. Sea Ice
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 7.

		4. Sea Ice
Page No.	Line No.	Comment
17	520	"2014" should be "March 2014". This change has been made.
17	536	"average minimum ice." should be "average minimum ice extent." This change has been made.
18	539	Insert minimum between "2014" and "being". No change has been made, as the text had already been modified and improved during the internal review.
18	551-552	This sentence should be replaced by "The trend is smaller during March (-2.6% per decade), but is still decreasing at a statistically significant rate." This change has been made.
18	554-560	suggest to show time series of monthly sea ice extent from January to September for 2014 and for 1981-2010, in order for readers to see how different it is from climatology. Rather than add a new figure, a sentence has been added at the end of the paragraph to explain that the retreat of the sea ice in 2014 and comparisons with previous years and the long-term record are illustrated at the NSIDC Arctic Sea Ice News and Analysis.

General comments: See the above specific comments.

Reviewer number 8.

		4. Sea Ice
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 9.

		4. Sea Ice
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 10.

		4. Sea Ice
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 12.

		4. Sea Ice
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 1.

		5. Arctic Ocean Sea Surface Temperature
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 2.

		5. Arctic Ocean Sea Surface Temperature
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 3.

		5. Arctic Ocean Sea Surface Temperature
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 4.

		5. Arctic Ocean Sea Surface Temperature
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 5.

		5. Arctic Ocean Sea Surface Temperature
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 7.

		5. Arctic Ocean Sea Surface Temperature
Page No.	Line No.	Comment
23	670	In recent summers, many Arctic Ocean boundary regions have had anomalously warm SSTs in August relative to the 1982–2010 August mean. This should be reflected in Highlights. This has been added to the highlights.
23	673	Need to mention Chukochi's significant upward trend. The Chukchi Sea SST trend is now in the highlights.
24	686	Why chose the August 2010 sea ice extent as the white shading in Fig. 5.1(b) instead of the August mean sea ice extent for the period 1982-2010? In Figure 5.1a, mean sea ice extent for August 2014 is now used instead of mean sea ice extent for August 2010. In Figure 5.1b, the median ice extent for 1982-2010, and larger labels with arrows for the marginal seas have been added.
26	726	The location of the cyclone should be indicated. The editors agree with the authors' choice to not indicate the cyclone, as its center position changed significantly over a week. Indicating its center position on a given day would be confusing as it does not show the cyclone development, motion, and surface stress gradients. However, a phrase describing the eastward movement of the cyclone across the East Siberian, Chukchi and Beaufort seas has been added, and also a reference to Zhang et al. (2013). This paper mentions the strong cyclonic storm and analyzes the impact of storm development on sea-ice conditions.
26	731-733	This sentence can be simplified for readers to understand the meaning easily. The sentence has been rewritten.
26	733-735	Apparent warming trends could not be found for most regions as shown in Fig. 5.3. Here, linear trends should be analyzed, and their significance levels should be given, in order to draw a firm conclusion from Fig. 5.3. The best-fit slopes for each of the SST curves have been added to the figure, and the figure caption has been rewritten to reflect the addition of that information .

General comments: See the above specific comments.

Reviewer number 8.

		5. Arctic Ocean Sea Surface Temperature
Page No.	Line No.	**Editors' Note: The reviewer provided only the single comment below.**

General comments: SST in the Arctic Ocean affects climate change as a result of summer water heating, amplified by the retreat of sea ice off the coast of the Arctic seas. No less important is SST influence on the winter ice extent in the Nordic Seas, where the increase in the inflow from the North Atlantic reduces winter SIE, increases air temperature and affects the atmospheric circulation. Therefore, it is important to evaluate change of SST throughout the Arctic. The authors and editors are sympathetic towards the reviewer's point, and note that the essay does include the northernmost of the Nordic Seas, i.e., the Barents Sea. The essay provides a comprehensive description of Arctic Ocean SSTs and the inclusion of all the Nordic Seas will be considered for the 2015 update.

Reviewer number 9.

		5. Arctic Ocean Sea Surface Temperature
Page No.	Line No.	Comment
23	677	It's said: "August SSTs, an appropriate representation of Arctic Ocean summer SSTs…" Would be nice to see a brief explanation or a citation answering the question 'why is it appropriate?' An explanation for the use of August SSTs has been added. That is, August SSTs avoid the cooling and sea ice advance that occurs in the second half of September.
24	692	Why was the period 1982-2010 chosen? Would a different period of averaging contribute to the results? The reference period 1982-2010 was chosen to be as close as possible to the reference period (1981-2010) used for sea ice and other variables in the Report Card. The reference period 1981-2010 can not be used for SSTs, as the first available SST data are for December 1981. Reference periods as they apply to air temperature and representation of Arctic change are discussed in contribution #10.
25	720	Fig. 5.3 is not clearly readable. Could be better if the curves were smoothed (by running averaging, for example). At the time being this figure is rather confusing. Rather than smooth the curves, the authors have provided values for the best-fit slopes for each of the curves, and added a dashed line for the Chukchi best-fit. The editors agree with this response.
26	723	Might be better to put the citation of Timmermans et al., 2013, 2014 in the end of the first sentence of string #723. Like 'Cold anomalies have also been observed in some regions in recent summers (the link). And to continue describing the cold anomalies in detail after that. This change has been made.

General comments: The paper overall is written well and shows the main point clear enough.

Reviewer number 10.

		5. Arctic Ocean Sea Surface Temperature
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 12.

		5. Arctic Ocean Sea Surface Temperature
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 1.

		6. Arctic Ocean Primary Productivity
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 2.

		6. Arctic Ocean Primary Productivity
Page No.	Line No.	Comment
27	789	What about light? A phrase about increased light availability has been added.
27	803	Deeper mixing (thus less light) due to more wind/storms could effect as well. This might be the case, but this is not a component of the Belanger et al. study, the subject of the sentence in question. There is no need to add speculation.
27	814	The statement is not correct for all months and years in fig. 6.2, especially for August. The reviewer is correct. Sea ice and chlorophyll biomass seem particularly linked during June and July, and the sentence has been modified to reflect this.

28	815	Consider to split the figure in two in order to increase the size of a-p, respectively. Hard to see details as it is presented now. All font sizes in this figure, including the legend labels and place names have been increased. The editors understand the reviewer's concern about the size of the panels in the figure, but do not think that splitting up the figure is the answer. The increase in font sizes is a big help, together with the descriptions in the text.
29	836	Fig. 5.1 should read 6.1. This has been corrected.
29	836	Not in June 2011 and June, July and August 2012. In general, June, July, and August do indeed show increasing trends after 2008. The language has been tempered to make this general statement.
29	840	Possible reasons for the lower production should be added, e.g. the relationship between depth and availability of nutrients. The Ulfsbo et al. (2014) reference points to the distributions nutrients/sea ice as the prevailing drivers of these trends and words to this effect statement have been added to the text.
30	871	It is the combination of the warming and freshening of the surface layer…. No change necessary, since, as the text states, the Bergeron and Tremblay (2014) study points to freshening/increased stratification as the cause for observed shifts in production.
30	873	Some small-celled phytoplankton species have been found to specifically adapted to colder waters, and are likely to be vulnerable to ongoing effects of surface layer warming (Terrado et al. 2012). Terrado et al. is a very interesting study, but not relevant here because this particular paragraph is very specific to nutrient availability.
30	862-879	In addition: Less sea ice and an increase in atmospheric low pressure systems that generate stronger winds (and deeper mixing of the upper ocean) likely favours smaller species (Sakshaug 2004). Sakshaug et al. is a very interesting study, but is not used here because the emphasis is on more recent studies.
32	937	Rare in deep oceans, yes. However, more common over shelf areas (e.g. Ambrose et al. (2005)). The qualifying statement: "in such deep, high-arctic waters" has been added.

General comments:

Not clear to me why only *Melosira arctica* is mentioned and not the importance of other ice algal communities with respect to primary production, if this report card is going to describe primary production in Arctic Oceans. There is, however, another report card describing the sea ice biota, but why *M. arctica* in the present report card if it is supposed to be only primary productivity in the water column? In addition, what about macroalgal primary productivity? Furthermore, in

shallow areas the benthic communities are dependent on ice algal being released when sea ice melts. Less sea ice in the Arctic can be dramatic for these benthic communities (described further in the benthic report card). The focus is on *M. arctica* because it was the most highlighted finding in recent research (2013/2014) for sea ice production. Indeed, the entire primary productivity essay focuses on the most important recent publications because there is not enough space to discuss every aspect related to marine primary productivity. The question of whether the essay should focus only on water column primary productivity, or water column and sea ice primary was discussed with the editors before the essay was written, and it was agreed that it should describe both, with a focus on the most recent results.

It is not quite clear in the present report card which implications a possible change in species composition (i.e. smaller species) will have for the total primary production of the Arctic Oceans contra longer growth season, including a secondary bloom in autumn. Possible to add a few words about this? The Arctic Report Card focuses on what is known/has been observed. Authors are discouraged from speculating, and presenting model predictions about what might happen in the future.

I would also add a sentence on possible consequences of shifts in the timing of phytoplankton blooms, e.g. possibilities for miss-match for grazing communities.
The Arctic Report Card focuses on what is known/has been observed. Authors are discouraged from speculating, and presenting model predictions about what might happen in the future.

What about polynyas as important areas for primary production in the Arctic? Should be mentioned? It's true that polynyas are important for primary production, but this essay focuses on the bigger picture, i.e., the regional seas and a pan-Arctic perspective.

Reviewer number 3.

		6. Arctic Ocean Primary Productivity
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 4.

		6. Arctic Ocean Primary Productivity
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 5.

		6. Arctic Ocean Primary Productivity
Page No.	Line No.	Comment
27	794	It is good to see a cross-reference with another chapter in the ARC (SIB). Thank you. Every effort is made to cross-reference among the essays in the Arctic Report Card.
27	798-799	We have % increases in PP given here – it would be good to have a include the natural variability in these three seas for comparison. The following statement has been added: Studies using Sea-viewing Wide Field-of-view Sensor (SeaWiFS) and Moderate Resolution Imaging Spectroradiometer (MODIS) across the entire Arctic Ocean reveal that the Barents and Greenland seas are the most productive marine environments in the Arctic, whereas the East Siberian and Chukchi sectors are the least productive (Petrenko et al. 2013).
27	813-814	It states that "increases in chlorophyll biomass are linked to declining sea ice cover". A reference should be given, or the "are" changed to "may be" or something similar. "may be" was added to this sentence.
28	815	Fig.6.1 This figure is useful but too small to read properly (I could not read the legend numbers at all except by zooming in online). If space permits, I suggest this figure be spread over two pages (or the legend increased in size). The maps themselves should not be any smaller. All font sizes in this figure, including the legend labels and place names have been increased. The figure will be easier to read when it is published at the Arctic Report Card Web site.
28	819-820	The Fig.6.1 caption argues that chl-*a* is shown rather than PP to foster direct measurements of ocean colour and minimize the use of modelled output. No explanation is given why direct measurements of ocean colour should be fostered (i.e., promoted). While ARC notes to reviewers state that modelling should be avoided (and I assume this is why modelled output is being avoided here), the audience may not know this. I suggest that this constraint be included in the overall ARC introduction to inform the reader. The following statement has been added the text: Chlorophyll-*a* concentrations are shown here to illustrate direct measurements of ocean color rather than further processing the data into primary production rates and using model output for illustration.
29	832	Fig.6.2 These two graphs illustrate the point well, but error bars, ranges, or confidence intervals should accompany the plotted points. Error bars have been added for both sea ice % and chl-a concentration in Figs. 6.2a and 6.2b.
29	836-837	The Fig.6.2 caption states that sea ice declines precipitously in the region after 2008. This is true, but there have been precipitous (but temporary) declines before 2008, as the graph demonstrates. The key difference is that sea ice concentrations remain low after the precipitous drop in 2008.

29	836-837	The Fig.6.2 caption states that sea ice declines precipitously in the region after 2008. This is true, but there have been precipitous (but temporary) declines before 2008, as the graph demonstrates. The key difference is that sea ice concentrations remain low after the precipitous drop in 2008. The text could read instead "...sea ice declines precipitously and remains low in the region...." "and remains low" has been added to the caption.
30	862-879	This paragraph is difficult to follow, and it is not obvious how the conclusions were drawn – I suggest that is be simplified a bit, given the audience. The authors and editors agree that this paragraph can be improved. This has been achieved by adding the following sentence to the beginning of the paragraph: "Other recent studies further emphasize the importance of nutrient availability as a critical driver for primary production in Arctic Ocean environments."
31	907-909	Fig.6.3 It should be specified whether the nitrate drawdowns are at a specific depth, or integrated across the water column. The various error bars/ranges, %-iles, etc. are helpful. "integrated across the water column" has been added to the figure caption.
32	934	A timeframe should be given for "Rates of deposition" (annual? seasonal?) The following statement has been added for clarification: "At the time of observation (August-September 2012), the deposition of ice algae on the sea floor (stations of 3500–4400 m water depth) had a median of ~9 g C m^{-2}."
32	945	It would be useful to have a short concluding paragraph. The paper ends rather abruptly and does not tie together the various points. The following statement has been added at the end of the essay:

General comments: This chapter on Primary Productivity is well written scientifically and synthesizes the results of a number of publications from 2013 and 2014. The chapter covers the circumpolar Arctic well, highlights the changes being detected and offers possible explanations for these changes. I enjoyed reading it and found it interesting. Thank you.

If there is time, I suggest the authors consider another relevant paper (published very recently, possibly after most of this chapter was written): Monier, et al (2014) https://www.researchgate.net/publication/267044554_Oceanographic_structure_drives_the_assembly_processes_of_microbial_eukaryotic_communities, which is concerned with the effects of freshwater outflow on the depth of nutrient-rich water and SCM. The following statement, with the reference to Monier et a., has been added: "For instance, Monier et al. (2014) observe that areas affected by river discharge (e.g., the Mackenzie River plume) experience a deepening of chlorophyll maxima in the water column because this fresh water displaces more nutrient-rich waters to deeper depths."

I assume the fuzzy appearance of the text when zooming in on the electronic version is due to sharing a low-res version for review. Hopefully, a high-res version will be available when published. The reviewer is correct. A low resolution PDF, low megabyte file was provided to the reviewers in order to facilitate transfer by e-mail. Higher resolution figures will be used in the final, online Report Card.

Finally, given that the audience is meant to be the interested non-specialist, some of the text could be simplified a bit (without losing scientific integrity) to be more easily understandable to this group. Numerous clarifications made in response to the reviewers and editors should make this piece more readable for a general audience.

Reviewer number 7.

		6. Arctic Ocean Primary Productivity
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 8.

		6. Arctic Ocean Primary Productivity
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 9.

		6. Arctic Ocean Primary Productivity
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 10.

		6. Arctic Ocean Primary Productivity
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 12.

		6. Arctic Ocean Primary Productivity
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 1.

		7. Tundra Greenness
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 2.

		7. Tundra Greenness
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 3.

		7. Tundra Greenness
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 4.

		7. Tundra Greenness
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 5.

		7. Tundra Greenness
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 7.

		7. Tundra Greenness
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 8.

		7. Tundra Greenness
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 9.

		7. Tundra Greenness
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 10.

		7. Tundra Greenness
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 12.

		7. Tundra Greenness
Page No.	Line No.	Comment
36	1060	This "browning" can in some areas of the Low Arctic be due to permafrost degradation and subsequent hydrological change (drainage). The role of permafrost degradation and subsequent hydrological changes has been added, together with some references.

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 1.

		8. Polar Bears: Status, Trends and New Knowledge
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 2.

		8. Polar Bears: Status, Trends and New Knowledge
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 3.

		8. Polar Bears: Status, Trends and New Knowledge
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 4.

		8. Polar Bears: Status, Trends and New Knowledge
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 5.

		8. Polar Bears: Status, Trends and New Knowledge
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 7.

		8. Polar Bears: Status, Trends and New Knowledge
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 8.

		8. Polar Bears: Status, Trends and New Knowledge
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 9.

		8. Polar Bears: Status, Trends and New Knowledge
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 10.

		8. Polar Bears: Status, Trends and New Knowledge
Page No.	Line No.	**Editors' Note: The reviewer provided only the single comment below.**

General comments: This section provides brief overview on the most important issues on the polar bear ecology and evolution relevant to our understanding of climate change impact on this species which is considered the most vulnerable to the global warming. Provided information makes available for the general public principal results of the recent studies. Text is clear, well structured, all conclusions are well grounded and referred to solid scientific papers. There are no particular comments to the review. The authors and editors appreciate the reviewer's positive comments.

Reviewer number 12.

		8. Polar Bears: Status, Trends and New Knowledge
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 1.

		9. Climate and herbivore body size influence how the Arctic terrestrial ecosystem functions
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 2.

		9. Climate and herbivore body size influence how the Arctic terrestrial ecosystem functions
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 3.

		9. Climate and herbivore body size influence how the Arctic terrestrial ecosystem functions
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 4.

		9. Climate and herbivore body size influence how the Arctic terrestrial ecosystem functions
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 5.

		9. Climate and herbivore body size influence how the Arctic terrestrial ecosystem functions
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 7.

		9. Climate and herbivore body size influence how the Arctic terrestrial ecosystem functions
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 8.

		9. Climate and herbivore body size influence how the Arctic terrestrial ecosystem functions
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 9.

		9. Climate and herbivore body size influence how the Arctic terrestrial ecosystem functions
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 10.

		9. Climate and herbivore body size influence how the Arctic terrestrial ecosystem functions
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 12.

		9. Climate and herbivore body size influence how the Arctic terrestrial ecosystem functions
Page No.	Line No.	Comment
47	1437-38	Impacts of rain-on-snow events from Svalbard should be included here (cf Hansen et al. 2013, Science). The role of rain-on-snow events, and the reference to Hansen et al., have been added.

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 1.

		10. Depictions of Arctic Change: Dependence on the Reference Period
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 2.

		10. Depictions of Arctic Change: Dependence on the Reference Period
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 3.

		10. Depictions of Arctic Change: Dependence on the Reference Period
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 4.

		10. Depictions of Arctic Change: Dependence on the Reference Period
Page No.	Line No.	Comment
49	1520	Fig. 10.2 is not readable. The resolution needs to be improved substantially. I don't know what the different colors represent. Maybe different stations? Much improved high resolution figures (10.2a and 10.2b) have been provided.
50	1552	Do you mean autumn air temperatures? Please specify whether it is air and sea surface temperature being discussed here. The text and figure (10.4) caption now indicate that autumn air temperatures are being described.
51	1565	Do you mean autumn air temperatures? Please specify whether it is air and sea surface temperature being presented here. The text and figure (10.4) caption now indicate that autumn air temperatures are being described.
51	1582	"to state clearly the reference period chosen to calculate any anomaly value" should be stressed more clearly if possible. No change has been made. The editors consider the sentence to be very clear, particularly as it is the final sentence of the paragraph.

General comments: **Editors' Note: No additional comments were provided by the reviewer.**

Reviewer number 5.

		10. Depictions of Arctic Change: Dependence on the Reference Period
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 7.

		10. Depictions of Arctic Change: Dependence on the Reference Period
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 8.

		10. Depictions of Arctic Change: Dependence on the Reference Period
Page No.	Line No.	**Editors' Note: The reviewer provided only the single comment below.**

General comments: The problem of reference period for depicting of climate change in the Arctic seems far-fetched. It is related to outdated conception of mid-20th century about stable climate and the random deviations from it. Development of global warming and the accumulation of climate data showed a discrepancy of this representation to observed variability of climate in which an increasing contribution belongs forced climate change with long time scales. Assessment and analysis of these changes in order to compare, define relationships and interactions between different regions, different climatic characteristics do not require the introduction of reference period. Application of statistical methods helps to solve these problems without use of reference period. For example, the method of variational series allows to rank and compare the observed values regardless of the length of the series. Correlation, spectral and other methods of time series analysis allow to estimate a contribution of different time scales, the relationship between climatic parameters and so on. To evaluate changes in the Arctic climate is more important a problem of choice of spatial averaging of the observed characteristics especially air temperature. The author and editors appreciate the reviewer's comment and agree that there are other, more modern methods to depict climate change. However, the fact remains that reference periods continue to be widely used. A paragraph has been added in response to the reviewer; it recognizes that reference periods might be outdated, but remain in wide use.

Reviewer number 9.

		10. Depictions of Arctic Change: Dependence on the Reference Period
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 10.

		10. Depictions of Arctic Change: Dependence on the Reference Period
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**

Reviewer number 12.

		10. Depictions of Arctic Change: Dependence on the Reference Period
Page No.	Line No.	**Editors' Note: The reviewer did not evaluate this contribution.**

General comments: **Editors' Note: No comments were provided by the reviewer.**