

Reviewer Comments				
Comment Number	Reviewer ID Number	Page	Line	Comment Text
<b><i>These are specific comments provided by reviewers, and they each apply to a particular page and line number(s) of the Revised Research Plan as noted.</i></b>				
1	1	2		“The vision for the CCSP is: A nation and the global community empowered with the science-based knowledge to manage the risks and opportunities of change in the climate and related environmental systems.”
2	1	2		p. 2, refers to a “thorough, deliberative process that includes intensive stakeholder engagement” for developing the next Strategic Plan. There are no examples of stakeholder outreach projects planned for execution in support of this “thorough, deliberative process.”
3	1	3		“Observations: Enhance observations and data management systems to generate a comprehensive set of variables needed for climate-related research.” It would be helpful for the work programs of the interagency working groups focused on Climate Variability and Change/Modeling, Observations and Data Management, and Modeling to be made available.
4	1	3		the Core Approach promises to “Communicate results to domestic and international scientific and stakeholder communities, stressing openness and transparency.” There are no specific plans or examples cited in the RRP to accomplish this purpose.
				Two recent examples of efforts along these lines raise more questions than they answer. The first, the 2005 Decision Support workshop cited in the Research Plan, appears to have been attended by virtually no stakeholders outside the university or federal agency world and therefore could be seen as an example of poor stakeholder outreach rather than a model. More recently, this month’s “Western Water Managers’ Input into CCSP Strategic Planning” workshop co-hosted by the CCSP in Boulder, CO left some of the Water Utility Climate Alliance participants unclear as to how the workshop was in fact linked to development of the CCSP’s future Research Plan or Strategic Plan.

8	1	3		Where we have the ability to predict the nature of extreme climate events – most critically drought and storminess -- this should be among the highest priorities of the CCSP.
9	1	3		We believe these should be among your highest priorities because drinking water providers and storm system managers are <i>today</i> concerned with how to adapt to the effects of climate change. It is not an abstract, far in the future, exercise for many of us. It is here today. The range of concerns varies. Some water utilities are most worried about accelerating snowmelt. Others’ greatest concern is sea level rise and the effect on coastal infrastructure and communities. Others cite evidence that stormwater collection systems are already being overwhelmed by powerful storm event frequencies that don’t exist in the hydrologic record. All of us are concerned about precipitation projections, on which the science remains speculative. In all our agencies, one or more factors are a present concern and the subject of internal planning. Our need, therefore, as outlined in these comments, for improved data and observational systems, more accurate predictive modeling, robust stakeholder engagement, and integrated decision support systems is urgent.
10	1	5		“Global change research activities across CCSP’s thirteen departments and agencies includes research conducted by scientists in federal agencies, academia, industry, and non-profit organizations through a mix of directed and competed programs.” We recommend that the CCSP and its member agencies include a requirement for stakeholder engagement/outreach in framing, on the front end, and disseminating, on the backend, all research conducted through the mix of directed and competed programs.
11	2	7	13	given the factor of three sensitivity that exists in climate sensitivity, it is hard to conclude that climate science is ‘mature’. In fact, the implication that it is, and can therefore provide meaningful predictions for policy makers, is quite misleading if the uncertainties are not equally emphasized.
12	9	7	17	The development of the scientific basis has also led to better communication and application of this knowledge (understated in 7/17). As an example, the development of a probabilistic approach to predicting extreme events and how their likelihood may shift is a very important perspective to communicate to the public.
				The text is fairly direct about the human contribution to high-latitude

15	3	11	26-28	Cook et al's findings pertain to drought in the western U. S., as I recall. Lines 26-28 seem to extend the conclusion to the entire United States
16	1	11		"Interpreting changes in the characteristics of extreme events remains one of CCSP's ongoing research frontiers." As noted previously, we urge research on extreme events be made a priority climate research area for the CCSP.
17	3	12, 19		The conclusions pertaining to carbon uptake are based on only one or two studies. This seems risky. Similarly, the conclusion on p. 15 about how permafrost thaw relates to carbon release is based on one study and results for one location. Again, risky.
18	2	13	33	published in 2008 <b>as part of</b> CCSP SAP 2.3 (it isn't the whole report).
19	9	13	16-18	The six primary greenhouse gases must include the chlorofluorocarbons 11 and 12, since each of these are much larger than any of the three F-gases noted. Please avoid falling into the Kyoto-gas trap. Further, tropospheric ozone increase is anthropogenic and with much larger impact than nitrous oxide (although it is not emitted directly).
20	9	14	4-5	This list misses entirely the indirect effect of aerosols through the alteration of clouds (both water and ice). This aerosol influence is believed to be larger than the aerosols' direct effect on "absorption and scattering of light". Please fix.
21	1	15		"Reducing uncertainty is crucial to providing decisionmakers with useful, reliable tools for assessing strategies for adaptation, mitigation and other forms of risk reduction. However, the wording of the goal is incomplete -- "reducing uncertainty" is only part of the story. Improving the projections themselves and understanding both the nature and implications of uncertainties are equally important, as noted in the NRC Metrics report (2005). The thrust of this goal is therefore to improve projections, and to characterize their uncertainty, in order to improve the utility of projections of how the Earth's climate and related systems may change in the future in response to natural and human-induced forcings. CCSP has significantly advanced the ability to estimate future Earth system conditions at time scales ranging from months to centuries and at spatial scales ranging from regional to global. The primary tools for Earth system prediction and projection are computer models that reflect the best available knowledge of Earth system processes. Reducing uncertainty requires continual integration o
				References are needed for the cloud-albedo feedback results (lines 18-

24	9	17	17-23	Picking a single study as an example of emerging science can be fine, but why pick a random study that contradicts all of the IPCC work (and presumably much of the SAP work) on climate sensitivity. Drop it.
25	9	17	5-15	This truly ancient paleo-study is perhaps the least relevant to today's climate crisis. In addition the lack of good proxies for trace gases and related climate variables at the time make this a very soft study, why not pick some of the more important and relevant work on the eemian or other interglacials.
26	3	19	14-15	What is sea ice doing in the middle of that paragraph about terrestrial ecosystems?
27	10	16	36	These references are incorrect, the people who showed that the satellite data are consistent with global warming are: Fu, Q., and C.M. Johansson, 2005: Satellite-derived vertical dependence of tropical tropospheric temperature trends. Geophys. Res. Lett., 32, L10703, doi:10.1029/2004GL022266.
28	9	20	36-41	While discussion of the Pielke paper is reasonable and the premise is true, it appears biased in that it avoids the issue of increasing likelihood of more intense hurricanes.
29	7	20		The paragraph on human health on page 20 should either be informed by research funded by EPA and other agencies, or deleted. It is embarrassing to have only one paragraph devoted to the potential human health consequences of climate change in the U.S., and to have that paragraph focus on climate knowledge, the 2003 European heatwave, issues related to human settlements, and use of seasonal weather forecasts to improve forecasting malaria epidemics in Africa. The NRC review concluded that there is a critical need to increase knowledge and capacity of the health impacts of climate change. The CCSP plan ignores this recommendation without justification.
30	2	20-30 and else		a lot of repetition concerning CCSP's 'participation' in IPCC, etc. No need to keep saying this.
				We provide comments here on specific programs mentioned in the CCSP that could enhance the three components of decision support as defined in the CCSP's Plan. Adaptive management and planning resources - of particular interest is the development of the "water supply stress index" into a dynamic model that can be incorporated into regional supply projection programs. This index has the potential to be an invaluable tool for integrating climate data into regional water

32	1	22		the project bringing together researchers, individuals, and organizations in the U.S. Southwest to predict water availability and the Drought in Coupled Models Project would be useful for water management and might be better integrated into the “water supply stress index” or the End-to-End Hydrologic Projection to prevent repetition and inaccuracies.
33	1	23		the Consortium for Atlantic Regional Assessment (CARA) website (see <www.cara.psu.edu>) is an example of potentially rich source of tools for decision-making but as yet is broad and applicable only to the U.S. mid-Atlantic and northeastern states. The website’s tools are easy to use and visually simple and could be a major asset for public involvement, education, and input in the decision making process. The CARA model should be extended to other regions so that water supply agencies in other areas can take advantage of the resources and tools that CARA has to offer.
34	10	26-27	26/20 a	The mention of paleoclimate data here gives it far greater prominence than it should actually have. If you are going to mention data sources, then mention them all, or mention which sources were important for each of the bullets listed. Paleoclimatic data make a useful, but modest contribution to current progress. Other data sources are more important. Why all the special pleading for paleoclimate data? Taking climate data sets in to the future is a far greater and more important challenge.
35	10	27	13-19	Can we have a bit more meat on the bones of these bullets. I cannot even understand what you are talking about, much less discern the issues. Why do we jump from these bare bullets into a long discussion of assessment reports, which have previously been discussed? Need better organization and balance in the discussion.
36	5	27		The “issues” mentioned on p. 27 seem to be topics rather than issues.
37	3	28-29		The Plans for Observations and Data Management sound quite vague. Again, what has CCSP done that extends beyond what the individual agencies are doing? Let’s hope that one or two of the 21 synthesis reports can provide more substance.
38	3	29		The planned IPY activities seem to be “too little, too late”. The IPY funds have been largely committed, and most Arctic scientists (at least the ones I know) consider the U.S. involvement in IPY to be disappointingly weak and fragmented.
				Does CCSP have a process or prioritization of the introduction of

41	3	32		CCSP provides...funding for centralized coordination of international research programs". Rather than the few programs mentioned later in that same paragraph, it would be nice to see a list of these contributions (and whether particular agencies of CCSP actually provided the funding).
42	10	34	34 to n	A very reasonable statement of how progress is made and the state of the art.
43	9	34	9-13	Minor recommendation: The open publication in the peer reviewed literature (34/9-13) could be strengthened if CCSP/GCRA adopted NIH rules about open access publication.
44	1	34-35		"Over the past several years, advances in the state of knowledge of model physics together with the rapidly-increasing capacity of computational resources means that it is now possible to develop scenarios showing potential regional, rather than continental or global, changes and impacts." To what degree have pilot programs or engagement strategies been implemented so that decisionmakers can take advantage of this new modeling potential? Programs that lead to the application of advancements in research should be among the most important programs under CCSP Goals 3, 4, and 5.
45	2	34-35	1,2 (on	while finer resolution allows for 'potential regional' scenarios, there is no confidence in them. Note that there are very few locations in which 80% of the models agree on the direction of water availability changes for the future climate, and even fewer for whom the change is greater than the standard deviation of the changes forecast by the different models. An inference that we are now capable of providing regional climate predictions is very misleading and inconsistent with the current state of the science.
46	2	36	9	to say that 'climate' changes over the span of weeks (or even seasons) is a misuse of the word 'climate'. Note the NWS issues "climate averages" for 30 year time-frames. Even in this fast changing world of ours, it still means at least several decades.
47	9	36	11	We cannot "harness" ENSO or the forecasting of it.
48	10	36	33-41	The document does not argue why these goals are important. They are important as a necessary step toward producing better forecasts of seasonal climate change and regional structure of change associated with global warming, and uncertainty estimates for these forecasts.
				I think the title Oceans, Atmosphere, Land, etc. should be removed from this section as it does not fit and is unnecessarily stove piped.

52	8	37		need to incorporate study of ocean acidification to the observations listed and studies on the factors affecting the rate and fate of CO2 taken up by ocean biota.
53	2	38	37-39	another example of a conclusion that is still subject to much experimental and theoretical evaluation...giving one reference to draw conclusions about this difficult subject is ridiculous. Furthermore, on the very next page (39) it is indicated that CCSP research will investigate this very issue. Instead of 'has shown', it would be more appropriate to say that his work 'suggests'...
54	8	39		A number of key land observations related to land surface feedbacks are missing. These include observations of phenology of the land surface related to snow-ice extent and duration; vegetation seasonal dynamics; land use dynamics. These seasonal observations are critical in understanding the change in seasonal and interannual albedo interactions, exchanges in water vapor, aerosol emissions from land surface, and emissions of critical greenhouse gases that affect climate.
55	2	40	13-29	this is a nice concept, but seems on the surface impossible to implement. Many of the characteristics observed by remote sensing instruments are for parameters that the model itself produces. If a model produces a cloud, and the satellites claim clouds should not be there – what then? Importing remote sensing observations into weather forecasts as initial conditions is very different from using them directly in climate models, for whom initial conditions are largely irrelevant. The most remote sensing can do is to provide input parameters for parameterizations (snow albedo values, for example), as well as providing climate parameters to which the models' own results can be compared.
				Potential for advancing scientific understanding - The plans for land-ocean-atmosphere include a specific objective of data fusion (p The plans for land-ocean-atmosphere include a specific objective of data fusion (p40), which is a useful method for integrating long-term observations and remote sensing data to understand trends and associated consequences of the variability in the land-ocean-atmosphere system. This is a good goal, however, I would change the wording of the specific example to replace the National Ecological Observatory Network, which isn't even operational, with

58	8	40		Data Fusion. A coordinated effort is needed for an observational cross-comparison of Landsat-CBERS-SPOT and other data sets from Japan and India over the last 5 years and into the next several so that Landsat-like data continuity is feasible with new assets coming on line prior to the next Landsat mission.
59	8	40-41		Continuity Measurements. Need to start a cross-comparison of land cover mapping analysis based on various candidate satellite data sets to develop translational corrections between sensors being deployed now and in the near future.
60	2	41	5-10	concerning what climate-related instruments will be on NPOESS – the discussion here is inconsistent with the one on p. 29, 2 <sup>nd</sup> paragraph, where it indicates some climate instruments were put back on.
61	10	42	15	4) then nothing. Something is missing here.
62	8	42	27-29	Continued study of N dynamics in conjunction with C studies is important to understand changes in radiative forcing of the atmosphere due emissions of N2O.
63	3	42		p. 42: #4 is missing.
64	5	42		P. 42, the list of research outcomes from the Strategic Plan has the number “4”, but no item listed for that number.
65	2	44	22-24	what exactly do you think that aircraft are emitting that cause contrails? Is it aerosols, implying that a lack of ice condensation nuclei is the reason for the background supersaturation; or is it water vapor, in which case the background wasn't necessarily supersaturated at all. Or maybe it's heat, which induces vertical motions. Should clarify this...
66	10	45	13	How is the Networks of Observations on line 13, page 45 related to Goal 2, causes of change, as opposed to another goal? Is this a carbon cycle program, or an ecosystems program?
67	10	45	28	It is hard to see how invasive species could be a big factor in climate change compared to the human species. Invasive species are important for other reasons.
68	8	45	28-36	Why the focus only on invasive species? Land use change has major effect on ecosystem processes related to land cover and land use. There needs to be a parallel track to deal with land use effects on ecosystem processes affecting feedback (related to changing albedo, emissions of radiatively active gases including water vapor, and land derived aerosols, to climate change.
				Why is this bit under Goal 2? It looks like an effort to predict land



71	8	45		Land observations: The National Ecological Observation Network (NEON) will provide an integrated suite of observation to better quantify the forces contributing to climate change. These observations need better set of process studies to augment the observation suite to better understand the human induced from natural forces affecting climate.
72	10	46	16	This section is a hodge-podge of different things, some of which belong under Goal 1 and some under Goal 3. It contains a lot of acronyms of programs and they are not clearly related to specific goals and objectives. This section really needs work, I think. It is not clear why any of this is being done and how it fits together.
73	10	48	44	What does the word Historical mean here? Will the reanalysis assimilate historical data as well as instrumental data?
74	10	48	6	Is Southern Ocean Modeling a specific planned activity, or just a broad theme? Why was it selected from all the possible ocean themes? What special will happen in 2008-10?
75	2	48-49		one might think that this is the height of hubris; we don't even know the central pressure of low pressure systems over the oceans today very well, so what leads one to suspect that we can do a global analysis (every 6 hours!) of tropospheric weather patterns for the entire 20 <sup>th</sup> century? Another example of wishes outpacing reality...
76	10	49	4	Again, is this a description of a collection of activities that is expected to continue, or it is a planned program?
77	8	49-50		Goal 3 Land Science to improve uncertainty - These sections do not include consideration of key land system processes that affect C and other GHG emissions and other feedback processes of integrated plant, soil, nutrient, and water dynamics that affect albedo, water vapor, aerosol, and GHG emissions. The changes in land use and response to climate changes of land ecosystem dynamics have a critical change on the climate system which is not being addressed explicitly in the illustrative issues described in page 49-50.
78	3	50		The "Drought in Coupled Models Project" is a good one. It is timely and addresses a high-impact topic. Coordination is clearly important in such a modeling activity. If CCSP can play up what it has done for this project, it will gain a few supporters from the climate community.
				should include in this discussion sensitivity of terrestrial ecosystems to temperature changes as well as changes in soil moisture – there are
			34-40	

81	8	52	Goal 4 on oceans. The description of the oceans issues are relatively vague. Given recent studies to indicate ocean acidification is occurring in cold water regions of the ocean, studies related to potential impact of ocean acidification to coral reefs, marine foodwebs, and to ocean carbon balance would be useful studies. In addition, the observations of decreased sea ice extent on polar ecosystems and people needs more study. Lastly it would be appropriate to better understand the impact of large amounts of freshwater injection from high latitude regions into the polar oceans to understand the implications of these on marine ecosystems. These issues could be studied through experimentation and modeling studies.
82	8	52-53	The land section poorly represents issues dealing with human adaptation responses. Issues related to human health and climate, threats to built infrastructure related to sea-level rise, permafrost thaw, reduced water availability, etc are not well developed in this section on adaptation related to human systems. Studies that include socio-economic implications of climate change need to be better developed.
83	8	52-53	Regarding the natural and manage ecosystems, the issue of better understanding multiple stresses on ecosystem dynamics and ecosystem services is not well represented. Integrated studies are needed to better understand the effects of combined stresses on ecosystems such as changes in CO2 concentrations, ozone, N deposition, and climate change on ecosystem responses.
84	8	52-53	An example of related to impacts can be found in insect and disease outbreaks threatening terrestrial and aquatic resources.
85	8	52-53	In addition, the manner in land use change will be an important aspect of adaptation strategies to cope and adapt to climate change, studies which incorporate land use systems under climate change would be useful to better understand land system dynamics under changing climate and the potential suite of natural and manage land system adaptation needs.
			“Crucial areas in which decision support is needed include the understanding of effects of changing climate in coastal zones, where sea level rise and changes in storm intensity and frequency may occur; in urban areas where effects on stream drainage and potential flood impacts may be felt...” While SAP 3.3 appears to address this issue, no future analysis is considered in the 2008-2010 plan despite the

88	8	55-56		Goal 5 Plans - Development of an integrated observation, modeling, and information system to support adaptive management schemes to better assess opportunities and vulnerabilities to climate change needs to further developed.
89	8	55-56		Develop a better framework to incorporate information related to extreme events due to direct and indirect climate change effects on land and water resource decision making.
90	8	55-56		Plan to operationalize critical earth system observations (e.g., OOI, NEON, EarthScope, WATERS, etc.) from in-situ to remote sensing assets in support of decision support tools. Incorporate these observations within US-GEO. Couple these observations in support of research to better evaluate the process dynamics affecting response and impacts of changing climate on natural and managed ecosystems and human systems.
91	1	56		the BASINS watershed modeling system for “assessment of the influence of climate variability and change on water quantity and quality and provid[ing] a capacity to evaluate adaptation strategies that increase the resilience of water systems to changes in climate” is of particular interest for planning and integrating resources on a watershed level that can be applied to regional data. This could be an integral decision support tool if made available for a variety of local watersheds.
92	1	58		how the End-to-End Hydrologic Projection and Application will be developed and made available, and whether water sector input will be sought, should be identified.
93	2	59	4	this definition of ‘abrupt’ climate change could be applicable to the greenhouse warming forecasts themselves. It is inconsistent with what is normally meant by the term, which refers to a rapid change that is greater than what would be implied linearly by the forcing. For example, an introduction of fresh water to the North Atlantic resulting in a massive shutdown of NADW and a return to very cold conditions circum-North Atlantic.
94	1	73		We provide comments here on specific programs mentioned in the CCSP that could enhance the three components of decision support as defined in the CCSP’s Plan.
95	1	73		Scientific syntheses and assessments - to assist in accomplishing Goal 5, SAP 5.1 describes the development of an online catalog of decision-support demonstration projects and scientific information valuable to the decision making process. This and/or subsequent products should integrate the resource management resources outlined below that are recognized as being important planning and forecasting programs.

96	1	73	Scientific syntheses and assessments - The Global Climate Observing System, which is a core CCSP activity in the U.S., measures a wide variety of climate variables deemed essential for understanding Earth system processes, but this data is not necessarily available on a regional scale. This data should be made available on a regional or local scale so that it could be incorporated into planning and policy tools.
97	1	73	Historical reanalysis of weather and hydrologic data would be valuable in more accurately anticipating climate variation and, if integrated into climate change models, could profoundly influence policy, especially when understanding the over allocation of the Colorado River because of an unusual wet period.
98	1	74	the proposed decision support evaluations using forecasts and observational data is meant to bring together research and user communities to facilitate communication. Social scientists would be brought in as well to comment on forecasting techniques. These social science disciplines play key roles in policy support and regional management but have very little representation in the projects proposed by CCSP. It is not clear what type of forum this will create, how often it would be updated, or how information would be disseminated, so it is difficult to say how useful this would actually be for decision makers and resource managers.
99	3	76	There may be some hype in the statement that “a dozen long-term observing projects are now an integral part of AON (Arctic Observing Network)”. Workshops are still being held to try to decide which of the IPY observations should be sustained. The next such workshop is scheduled for April 2008 in Edmonton.
100	1	79	the Ground Water Climate Response Network and the USGS National Streamflow Information Program (NSIP) are other programs that have potential to bring together stakeholders for exchange of ideas and policies regarding groundwater monitoring and integration.