Lee Corbett
GEOL 371
4/8/09

Review of: Cyclical and increasing precipitation and runoff in the Winooski Basin, northern Vermont
Authors: W.R. Hackett, P.R. Bierman, L.E. Besaw, D.M. Rizzo

In this manuscript, the authors present a study that uses publicly available data to assess the relationship between temperature, precipitation, discharge, and lake level in the Winooski River Basin of northern Vermont. The authors use basic statistical methods to analyze temporal trends in the data (e.g. increasing temperature over the last few years) as well as relationships between different datasets. The authors also use spectral analysis to determine whether Vermont precipitation is correlated with the North Atlantic Oscillation.

Overall, the manuscript is refreshing because of its simplicity. All of the data is easy to acquire and the analysis is relatively straightforward to perform, making this a technique that will be applicable to many regions and fields of study. Without much background in hydrology, I can't speak to its originality, but I would be surprised if similar work hasn't been conducted before. However, I think the correlations the authors make with the Winooski Basin historical land use data is unique and interesting. The manuscript is very well-researched, intuitively organized, and a pleasure to read.

Please refer to the hard-copy edited version of the manuscript for small comments regarding structure and rhetoric. In addition, I have several broader comments:

1.) It might be helpful to include some sort of temporal information in your title so that your readers will know whether you're talking about the most recent 100 or 100,000 years. Maybe something like "Cyclical and increasing precipitation and runoff in the Winooski Basin, northern Vermont, during the 20th century" will help to clarify your time period of interest.

2.) I think your abstract is clear, concise, and appropriate for the material you present. However, you don't include any information as to *why* you've conducted this work. Why are your findings relevant to the field of hydrology and important to society? One additional sentence bringing in the big picture ideas here would be helpful.

3.) Your introduction is quite lengthy. It's all important information and you've obviously done a lot of work with the literature, but it's a little unwieldy to wade through that much background information for a relatively short paper. If you plan on keeping the rest of your manuscript the same length, I'd suggest trimming down the introduction.

4.) Can you include more information about the Winooski River Basin in your Study Area section? For instance, it would be helpful to include some brief statistics about elevation, current land use, current climate, etc. That would also create a good way to refer to your location figure, which should probably be referenced in your Study Area section instead of (or in addition to) your Methods section.

5.) In your Results section, it would be helpful to remind the reader what type of statistical test(s) you used to obtain the p-values you present.

6.) It might be worth experimenting with adding subheadings to your discussion. Your work covers a lot of different ideas, and your discussion sort of meanders around freely. Adding some subheadings would help give the reader an idea of how the information is grouped, and what they can expect to find in a certain area.

Good luck with edits and publication. Well done!

Lee

Cyclical and Increasing Precipitation and Runoff in the Winooski River Basin, Northern Vermont

William Hackett, Paul Bierman, Lance Besaw and Donna Rizzo

Review by Andrea Pearce, 7 April 2009

Hackett et al. present summary statistics of flow and climate data from the Winooski River watershed in Vermont. The results show trends in the watershed consistent with the predicted and observed climate changes for the region over the past 70 years. The observations are significant and have implications for many aspects future life in Vermont and New England.

The introduction, discussion and conclusions clearly frame the motivation for the research and the significant findings by the authors. This is an excellent demonstration of a data mining project exploiting free, available data for new research. There is some vagueness about the methods which, if clarified would make the paper much stronger.

General Recommendation
This manuscript should be accepted with minor revisions. The description of the statistical methods could to be more specific, including mention of exactly which data are used for which tests. I'm not quite sure if this is all regression based analysis or there are t-tests involved. If so, are you checking that the data are normally distributed? If not, do you use a non-parametric test?

Specific Recommendations

- If you began the introduction with the second paragraph followed by the third you could really set up the main points you make in the paper, focusing on cyclical phenomena and observations of climate change.
- Lines 187 – 201: Are the predictions in this paragraph focused on temperate climates only or global predicted changes? If it is you might want to make that clearer. If not, since the study area is a temperate region it might be more coherent if it is especially if combined with lines 215 -219.
- Line 303: How and why did you choose to divide the data into the 1935-1962 and 1963-2005 classes? Is there something significant about '62 and '63? And, why are you not using the most recent three years of available data?
- Lines 312 – 313: Can you specify how you define intensity? Maximum short term intensity or event average intensity?
- Lines 322 – 330: Are you comparing the same months between the '35-'62 and '63-'05 records or something else? It isn't clear to me.
- Line 390-392: I may be reading this incorrectly, but this sentence seems to contradict itself… forest makes land less flashy, thus increasing flows?
- Line 406: I don't follow how you demonstrate a significant increase in temperature variability. Can you be more specific about what analysis you used to come to this conclusion?

- The bit about the periodicity of the NAO corresponding with periodicity of trends in the watershed seems to be a substantial part of the abstract and conclusions, you may want to provide the reader with more background on the technique you used to determine this and more details about how you performed the analysis.

Cyclical and Increasing Precipitation and Runnoff in the Winooski River Basin, Northern Vermont

By William R. Hackett, Paul Bierman, Lance E. Besaw and Donna M. Rizzo

04/08/09
Review by Christina Syrrakou

This paper presents an analysis on climate and discharge data concerning the Winooski River Basin and Lake Champlain, their temporal evolution (specifically over 70 years) and they way the patterns created are connected to the North Atlantic Oscillation and change in landuse. The writers use statistical methods in order to process the data which show a clear increase in precipitation, temperature, discharge and the level of Lake Champlain over the last 70 years together with a strong relationship to the NAO.

The writers manage to use a relatively simple language which makes the manuscript quite easy to follow, without an extensive use of jargon. Also, the results seem reasonable since they agree with similar studies in New England as mentioned in the discussion. In my opinion some parts of the introduction could be less detailed, especially the part that refers to global warming and New England. Also, in the Methods I didn't quite understand which of the methods are just refers and which are the methods resulting in the data presented later at the "Results and Data" part. For example I can see a linear regression of annual average values of discharge and precipitation in Figure 2 but I cannot see one for lake level and temperature. Also, I can see the frequency of extreme storms per year in table 3 but I cannot see the total precipitation delivered over the 20 wettest days of each year.

Generally, I think that this is a good work and therefore, I recommend that this paper is published with minor revisions which are the following.

-l137 Where can I see in this paper the fact that in the last 70 years mean annual temperature at Burlington has increased specifically by 1.4 degrees?
-l174-186 In the beginning of this paragraph it says that climate change can be due to natural or human-induced reasons (which I suspect is the change in landuse). However, in the rest of the section I didn't see any reference to human-induced reasons until the paragraph which starts at l220. So, if this just an introductory phrase for the whole section to follow you might want to take it of the specific paragraph and keep it on its own (as a separate paragraph).
-l200-201 It is mentioned that there is a disagreement on how the amplitude and frequency of NAO and ENSO will change. For me this is an interesting phrase and perhaps you could explain that argument a bit more.
-l262 I think that this sentence (in red) referring to table 1 would be more appropriate in the previous section which analyses the study area.
-l299 How can I see that the trends are at the 80% confidence level?
-Why are the data separated into data for 1935-1962 and 1963-2005? I suspect by looking at figure 2 that if you "cut the data" at this point the linear regression would have a better fit for the two separate periods, but is that the reason?

-l306-307 Except of the increase of the percent of water contributed by Little River there is an increase in the percent contributed by Dog River, Mad River and Winooski River (Essex Jct).
-l311 I suspect that confidence limit is the same as significance level. You might want to use the same term.
-l312 Why four stations? What about the other two?
-l316-317 Where can I see that in table 3?
-l322-325 You don't mention that 3 of the stations show no change in July.
-l338-340 Where can I see that in figure 5? The x-axis refers to yearly data.
-l344 Are the periods with the strongest spectral densities between 7-8.5 years?
-l355-357 Is the fact that the periodic variation is reflected by NAO status shown by the fact that the lines in figure 7 appear similar?
-Figure 2 Is the x-axis yearly data referring to mean values or peak values?
-Use bigger font for the letters in the tables.
-What does N/A stand for in table 3?

In conclusion, I believe that this was a very good paper, easy to read and with good flow. Good Luck.

Joe Bartlett

4/8/08

Review of Hackett et al

This study utilized publicly available river and lake stage and precipitation data to analyze periodicity and temporal trends for the Winooski River over a 70 year period. Annual and monthly linear regressions were used to establish long term trends and seasonality. Cyclic oscillations were determined using a linear spline. Relatively strong temporal trends were identified in precipitation, discharge, and lake level. This study also found a correlation between several variables and the North Atlantic Oscillation (NAO) with a periodicity of 7.6 years. They also found that increasing development in the watershed and global climate change have produced minor effects on discharge and baseflow levels.

This study shows a relatively simple method for getting useful information out of publicly available data. The paper is well written, but there are a few grammatical and sentence structure issues. The abstract needs a brief description of analytical methods, otherwise it is appropriately concise. The introduction contains a thorough literature review and provides good background information on climate and hydrologic modeling. The purpose statement is also good, but the introduction needs to contain a few sentences to better frame the importance of this study. In other words, why did you do this and why should we care? The methods section is good and concise. Too much space in the results is spent listing confidence levels and significant. I think this would read better if you specified an overall confidence level in the methods and then simply listed p-values in the results. The discussion is good and thorough. Is the NAO correlation expected or somewhat surprising? I found it very intriguing that the increased runoff from land use change was offset by reforestation and climate change. The conclusion is good but would benefit from a better final sentence.

This paper should be accepted with moderate revisions to the Journal of Hydrology. In its current draft, the paper lacks proper justification and impact. The study is very interesting due to its simplicity and utilization of public data and with better justification it will be a good article. Specific recommendations for improvement are as follows:

- L88: Elaborate on cyclical or reword the title
- L135: Might want to mention that the Winooski drains into Lake Champlain
- L136: Confusing
- L157: This sentence needs to be better integrated into the paragraph
- L160: Do you need to give the ENSO example if you are then going to describe NAO?
- L170: Mention the average time frame of NAO cycling
- L229: passive
- L278: Confusing
- L429: Last sentence could be stronger

04/08/09

UVM internal Review of:

Cyclical and Increasing Precipitation and Runoff in the Winooski River Basin, Northern Vermont

Authors: William R. Hacket, Paul R. Bierman, Lance E. Besaw, and Donna M. Rizzo

The general focus of this paper is determination of hydrological and climatic changes in Northern Vermont through use of long term data records found in the Winooski River basin and the greater New England region. Results found from analyzing this data was interoperated in context with changing land use in the Winooski Basin. Results from the data analysis found long term trends of increasing precipitation, discharge, and temperature. Cycling of precipitation, river discharge, and lake elevation was found through use of spectral analysis. Clustering of cycling was found at intervals of less than 3 years and at a longer time scale of between 7 and 8 years. The longer period was found to be on the same timeline as the North Atlantic Oscillation of 7.6 yrs.

This paper made use of large well managed datasets making this paper inherently strong. Cleaning of the data set the process was presented logical with simple well described methods. The author then presented a large set of statistically significant results showing the trends for hydrological processes in Northern Vermont, which may become invaluable to the design of new storm or wastewater treatment systems. The interpretations presented in this paper were well thought out and provide possible explanations for the changes in seasonal trends throughout the Winooski River Basin. For the most part the writing in this paper was easily followed due to the concise structure of most sentences. Further clarification and rewording could be beneficial to the methods section of this paper to make it easier to follow and reduce confusion on part of the reader. I found the illustrations in this paper, particularly in the results section, to be the strongest part of the paper. Prior to this paper I was unaccustomed to the format in which the author presents the results, but the ease of interpretation using this method made understanding of the data presented intuitive. Particularly the arrow system used in the p-value tables allowed for quick referencing of the changes seen over time for the data. Due to the wealth of statistically significant data that may have further applicability to water and land management practices in Vermont this paper should be accepted with only minor revisions.

- The results from this paper showed that there was a strong relationship between stream flow and the NAO. The introduction to this paper also noted that the study would also look at the relationship between the ENSO and the data that

was collected for this study. There are two ways that this can be changed the easiest would be to only show the impact that the ENSO/el Nino has on western weather patterns but not mention that it will be studied in this paper. The second work around is to included spectral analysis of the Pacific Ocean surface temperatures and comment on how it corresponds with the data collected.

- Prior to this paper I have had some encounters with deconvolving of variable data and understand the basic interpretation of the output from these methods. The exact procedure of spectral analysis is still somewhat vague however and is not detailed enough in this paper to understand the method used. I would like to see a bit more detail in this section particularly on the Lambda factor and the difference between red and white noise (perhaps some equations). This would allow for better understanding as to why these specific methods were chosen.

After reviewing the Journal of Hydrology's guide for authors information section this paper seems to be mostly in order for submission. There is only one part that seems to be missing prior to submission, which is numbering the sections and subsections. Other than that the paper looks great, best of luck with your submission.

Jaron

Jared Nunery
GEOL 371
April 8th, 2009

Review of:

Hackett et al., **Cyclical and Increasing Precipitation and Runoff in the Winooski River Basin, Northern Vermont**

For submission to:
Journal of Hydrology

This manuscript uses publically available data to analyze temporal trends in 70 years of data for the Winooski River Basin. This paper highlights an interesting relationship between the NAO, precipitation, and stream discharges.

Overall I thought this manuscript was very well written. I really only had several comments in each section that might help to strengthen the paper. My two main points are: 1) focusing on tying the interactions between NAO and discharge early on in the introduction would help set the stage for the rest of manuscript; 2) standardize how you present your statistics (specifically confidence intervals). Below are specific comments related to each section.

Title:

The multiple use of ands makes it sound wordy. Is it possible to re-phrase this with only one and?

Abstract:

The abstract was short, concise, and well written. I only have two comments that might help to improve the abstract. The first, there are two points, on line 136 and 140, where you use semi-colons to tie two thoughts together. Breaking these sentences up might help the overall flow of the abstract. The second point is more stylistic preference. I prefer to read abstracts written in the past tense, as the work has already been completed. This is my own preference though, and you should choose what you think works best.

Introduction:

Overall I thought the intro was well written, and provided a good overview of ENSO/NAO as well as the effects of landuse history on runoff in the region. The one area I would suggest focusing on is the first paragraph. This paragraph was very broad, and almost tangential to the study. This is personified in the first sentence, which reads at a different level

than the rest of the manuscript. Providing a more specific opening paragraph that focuses on the interconnections between NAO, runoff and precipitation will really strengthen the introduction.

Study area/methods:

Both of the sections were well written. My only suggestion would be in the methods, be careful about using terms before introducing that you used that methodology. For example, on line 274 you state "For each bi-variate plot….", but the fact that you used/created bi-variate plots is not yet introduced. Other than that, I felt that this section was very well written.

Data and Results:

This section did a great job of presenting the data very clearly. The use of subsections was a very effective way of clearly parsing out the different sections of the results. One suggestion that I do have is about the presentation of the statistical analyses. It is confusing to use multiple levels of significance; in this section you use three levels of significance. If you are comparing these findings, how can you do so if they are at varying levels of significance? I would pick one level (i.e. α=0.05) and present everything as either significant or not, with the specific p values. By presenting the p-values you allow the reader to interpret the results on their own, and you are not providing misleading statements of significance with 80% CI. Also on line 329 give the actual p values, as using the actual numbers strengthens this section and separates it from the discussion.

Discussion/Conclusion:

You did a great job highlighting the key points from the results. The conclusion section in particular, does an excellent job of bringing everything together. I have two main comments about these sections. The first is, be careful not to be too general in your discussion. On line 355, you note that trends in Vermont are similar to nearby states, adding in what states specifically will help strengthen this statement. Also on line 367, you discuss a study in France, noting that France has a similar temperate climate or something else that relates this study to yours will strengthen this statement. The second point is to be careful with the multiple use of landuse and land use. Throughout this section these two terms are used simultaneously, it might be worth standardizing your use of the term, especially as it is used on lines 390, and 424.

Great job Will, good luck with the submission and feel free to contact me if you have any specific questions.

Jared Nunery
jnunery@uvm.edu

Paper Title: **Cyclical and increasing precipitation and runoff in the Winooski River basin, Northern Vermont**
Paper Authors: W. R. Hackett, P. R. Bierman, L. E. Besaw and D. M. Rizzo

Reviewer: **Lance E. Besaw**
Date: April 8, 2009

Summary
The authors study 70 years of precipitation, river discharge and lake level data collected from publically available sources. Their site is in northern Vermont. Through their analysis they found that precipitation, discharge and temperature have increased within the basin over the period of record. In addition, they found the ~7 year North Atlantic Oscillation (NAO) cycle evident in the data. Their study highlights that the NAO cycle, climate change and changes in landuse have lead to an increase in baseflow within the basin.

Evaluation
Regarding the data quality. The data collection seems good, but more description as to how data is aggregated to the daily (by USGS and NCDC) and monthly and yearly (by the authors) may be beneficial. Also a description of the statistical tests run would be much appreciated (especially if the authors would like to have this study be presented as a guide for other such studies around the country).

Overall the figures present good material to the reader. In Figure 1, I would suggest adding some more descriptions to the icons labels (e.g. Essex Jct.) so as to not confuse the readers. I also winder if more tribs would make the basin look more like a basin? (p.s. Can I have the New England image for my paper?) Figure 2 would better utilize space by having the panels side by side rather than top and bottom. I would also redue the graphics to produce a better image.

Tables present a ton of material that is not well textually presented by the authors. I think the authors should add more description in the paper to guide the reader though some of their tables and the vast amount of information contained therein. I also wonder if some of the information can be omitted and only present/highlight the most important parts. In addition, the text size of the tables is very small and should be made more legible. Also it is difficult to tell the difference between open up and open down arrows. An alternative scheme may resolve this.

Recommendation
Overall, I think the manuscript is well written and it contribution is significant. I recommend the manuscript be accepted with amendments made as described herein.

Specific Comments
I feel like the introduction is too long and contains too much background material. Much of the material contained within this section is very important to the authors work but might fit better into a background/literature review section. Keeping this information in

the intro presents the reader with too much material and can take them away from the contributions of this particular work. It is my preference to quickly tell the reader some motivation and what the paper is about; then go into greater detail in the background section to explain all the gory details. However, the section is well written.

I feel like the methods section is too brief. There are numerous loaded sentences within it that could be expanded upon to more clearly convey to the reader what was done. Have anyone else ever done anything like this? Are these typical methods for analyzing long-term trends? If there are no references for this stuff then I think the methods should be expanded.

In my opinion, the data and results section is rather difficult to read. The authors present so many results that it is difficult to comprehend all of it. I feel like some things may be better conveyed if there was a smoother theme. It seems like little snippets are taken from the tables and figures just to introduce them, not to explore what they are presenting. This may be solved by reduce the amount of information presented in the table (see above comments).

I did not feel the majority of the discussion section talked about what the finds meant. The first paragraph and a half appear did a nice job describing how things are rising and there is evidence of the NOA cycle in the data. After that it seems like the authors make a claim and then cite some references that have similar findings. In addition, the authors suggest that effects of landuse change are “minor” and in the very next paragraph discuss how it is important to the increasing baseflow. Maybe it is just a subjective thing on my part, but I think the discussion has to be refocused and discuss the findings a little more, rather than citing references with which the paper is in agreement.

Conclusions are very well written and provide a nice summary of the papers findings.

The paper does seem a little short compared with what I have typically found in the Journal of Hydrology (not sure if this is good or bad).

Authors should mention the major dams in the basin (especially at the Little River).

Meredith Clayton
GEOL 371
8 April, 2009

Cyclical and Increasing Precipitation and Runoff in the Winooski River Basin, Northern Vermont; Hacket et al. 2009

This paper describes the findings of a study conducted to analyze temporal trends and periodicity in 70 years of publicly available Lake Champlain Lake level data, as well as stream discharge and climate data for the Winooski River Basin of Northern Vermont. Data analysis yielded a general increase in annual precipitation discharge and mean lake level over the 70 year period. Discharge increased a total of 18%, while precipitation increased approximately 14% over the same period. The period of record also revealed a temperature increase of 1.4 degrees at the Burlington Airport weather station. Upon investigating periodicity, these data demonstrate an approximate 7.6 year periodicity which corresponds with large scale climactic forcing by atmospheric dynamics. More specifically, this sub-decadal periodicity corresponds with the North Atlantic Oscillation (NAO), where above average precipitation and subsequent discharge are most likely when NAO is in a positive mode. The relationship with NAO suggest a strong link between discharge and precipitation, while changing landuse, and changing climate during the period of record appear to have subtly changed the seasonality of discharge and caused an increase in base flow. The results demonstrate that amount of precipitation is the most important variable affecting runoff but the data also subtly suggest that seasonal shifting and land use change likely also affect runoff. These data also suggest that despite reforestation in much of the Winooski River Basin and the subsequent increase in hydrologic significance of evapotranspiration, the overall increase in precipitation and impervious surface area appear to be offsetting these affects. Overall, climate change, particularly seasonal shifting is playing a critical role in hydrologic system changes in the basin.

Overall I believe that this paper is sound. There does not appear to be any "major" problems with the structure and grammar that would prevent the publication of this piece. My only notable concern with this piece surrounds the ability to draw the reader in. Generally speaking I think that you have done a good job of concisely summarizing many major factors affecting precipitation and runoff today; however, the efficiency with which you summarize the factors may be detracting from how it reads as a whole. It almost seems a bit choppy. I am not sure that I would recommend removing any of your introduction but I would suggest that you make sure that you tie each factor's relevance back in during your discussion. After reading this paper twice I felt comfortable with the overall grammar and structure but felt like I was not convinced as a reader as to why I should really care. This may seem harsh, and I do not intend for it to be so, but for a piece being submitted to Hydrology I suggest strengthening your introduction to frame the importance and implications of these changes. After identifying these key points be sure to address them more specifically in your results and discussion. Look at your tables for help identifying these pieces. Another consideration may be to keep this a shorter review of the major changes associated with climate change rather than a full paper, though this would be unfortunate after all of the hard work In order for this to remain a full journal

article I think you need to be more specific. One thing I found particularly interesting about your results is the assumption that net reforestation of the Winooski River Basin has increased infiltration and that this coupled with increased precipitation has offset the increase in evapotranspiration resulting from the increase in number of trees and annual temperatures. You touch on this in your discussion and include an example of this seen in Iowa but I think you could still elaborate on this. This result is quite notable! In summary, I think this piece has a lot of potential. There isn't anything necessarily *wrong* with it as is, but I think you could zoom in a bit and submit a stronger, more informative paper.

- Work on framing the importance of this study and these results during your introduction and tying this framework back in during your discussion.
- Consider "zooming in" to be more specific and less general? I think this piece can be general but could use a boost to convey significance
- Change noted grammatical errors throughout text
- Complete missing pieces with figures, tables, cited literature.

Review of: Cyclical and increasing precipitation and runoff in the Winooski River Basin, Northern Vermont

By Hacket et al.

This manuscript outlines an investigation of dynamic temporal changes in climate, discharge, and lake level data for the Winooski River Basin in Northern Vermont. This data is publicly available and is used in this study to detect temporal changes. The introduction discusses the implications of climate change stressing our existing infrastructure. Besides long-term climate change, there are oscillatory behaviors in weather patterns. El Nino and the North American Oscillation (NAO) are important cycles that occur on the scale of ~7 years bringing increased precipitation. The Northeast has experienced a general increase in temperature and precipitation over the last century. The northern latitudes of the globe are expected to have continual average temperature increases and increased precipitation especially in winter. In the Northeast it is expected that stream discharge will decrease, in face of increasing precipitation, because the longer growing season will lead to higher rates of evapotranspiration. Linear regression was used to determine significant trends in data over time. Periodicity in the seventy year data set was studied with use of a linear spline. It was found that precipitation and discharge did change overtime. The frequency of extreme precipitation increased. Monthly trends in data were determined. Temperature increase was quantified. Significant periodicity was found in all data, and is described as lining up with the NAO.

Overall the study is very interesting because it quantifies real trends in climate data that are occurring in the Northeast. After revision I think this paper should be accepted to the Journal of Hydrology. I think that you have done a great job with the expansive data set you have been working with; by clearing up some of the figures and statistical interpretations even further I think the paper will read more smoothly. For example I was unclear about the arrows in the tables. I understand that they signify positive or negative trends, but I cannot grasp the magnitude of this change. Also, is the 50% significance level really significant? I have not done too much regression modeling but I would think that p-values less than 0.2 (80% significance) would be a limit (I am sure you will discuss this with people who know more about this than I do). Figure 6 was not completely clear to me, so by adding further description in the caption it will be more apparent what is going on.

Following are a few points that I believe should be addressed in your edits:

- The introduction has great content, but I believe that if you can organize the different topics more effectively then it will read even better. For example you talk about climate trends that are occurring globally and regionally and you kind of jump back and forth. Maybe you can start of globally and then focus in on the Northeast?
- Maybe clear up the smallest annual maximum threshold sentence in the methods. In generally I think you could help stream line the methods by being slightly more descriptive in some of the analyses (ex. the splining) and more direct in explaining the statistical methods you used to determine significance.
- I think you can simplify discussion on how the precipitation and discharge are correlated, because they are autocorrelated and should have a significant correlation.

I have placed some in line comments on your annotated copy of the draft to provide more editorial advice. I hope this was helpful and good luck.

Martin

Paper: 'Cyclical and Increasing Precipitation and Runoff in the Winooski River Basin' by William R. Hackett, Paul R. Bierman, Lance E. Besaw and Donna M. Rizzo

Reviewer: Nikos Fytilis – 04/8/09

The authors present a research on available stream discharge and climate data measured in the Winooski River Basin of Northern Vermont and Lake Champlain over the past 70 years. The trends and periodicity of these parameters after the spectral analysis and use of statistical methods were correlated with the North Atlantic Oscillation. Also, the relationship between precipitation, discharge, and lake level was examined as well as the relationship between these parameters and cyclical drivers such as El Nino – Southern Oscillation. Other parameters which were also examined are base flows, storm frequency and intensity, and seasonality. The results from this project show that precipitation and discharge values as well as temperature have been increasing over the past 70 years. The cyclical signals and the trends of these parameters are closely related to the NAO. In addition, the changes observed in this paper and the land cover data from a previous research conducted by the same authors were used to speculate about the relative effects on the magnitude in flow records of the Winooski River and its tributaries. Finally, results from similar studies from the wider area of New England agree with the results and the logic used in this paper.

The abstract succeeds in describing the important thrust of the research including the major findings. I think that the last sentence of your abstract was hard for me to follow so I believe you could break it up into two sentences. The introduction provides a lot of background and states general accepted issues related to climate changing. This section is too big and my thought is that you could present less information about global warming (for example line 194-196) or you could change your title into "Cyclical and Increasing Precipitation and Runoff due to climate changing in the …..". In addition, there some points in your introduction where you could say more (line 200-201) and other that you could break them into two sentences (line 217-219). The introduction ends with a solid paragraph and a very good description of the work about to be presented.

The next two subsections which describe the study area and the data sources are well written and Figure 1 is very helpful. My suggestion would be if you could add in this Figure the National Weather Stations you mention at the end of the data sources section. In your methods section you don't show all the results from each method. For example, you didn't mention the threshold values for large storms or the rainfall. In this section, I couldn't understand the sentence in lines 290-291 maybe because the structure or my English is bad. There is no clear connection between this section and the results or the figures at the end. In the next section, do you mean that 0.5 and 0.7 R^2 values show that precipitation and runoff are well correlated because I believe that there are small numbers? Also, at the end of the Annual records subsection you mention only the Little River but as far as I can tell the Wrightsville, Winooski contribution is increased significantly. One other point is that the readers could easily confused by the two different terms you use for the confidence level.

In the Monthly analyses, you could add that there is no change on July because 3 of the 6 rivers don't change. As for the Temperature section, I couldn't see the values you mention in line 334 in Table 6. If you had similar values for Montpelier you could mention them. Figure 6 and Spectral Analysis totally confused me because I don't know what I have to get from Figure 6 which is related to the corresponding subsection. If I understood correct the NAO affect on northern England climate reflected to a periodic variation with 7 to 8 year cyclicity. I had the same problem with Figure 6 in Figure 7 where I can see the trends but is there anything else I have to see in this Figure? Please refer to the hard-copy edited version of the manuscript for small comments regarding structure and rhetoric.

Overall, this first draft is very well and I think it should be published with revisions. Good luck with all edits. Well done.