Comparative Content Analysis of USGS Geomorphologic Field Surveys

Asiah Giuntoni
University of California, Berkeley

Abstract

This research investigates the ways that Geomorphologists under the United States Geological Survey (USGS) write field surveys by analyzing the content (sections and types of information) of sample documents that focus on topics in geomorphology. A comparative content analysis of the sections and information included in six sample geomorphologic field surveys were conducted to identify the format and content of the document. The results show that all sections can be categorized into universally-used sections and subject-dependent sections based on whether the information is generalizable to all geomorphologic field surveys or if it is dependent on the subject matter. The Abstract, Introduction, and Conclusion sections appear to be universally used, whereas the Study Area section is placed in the subject-dependent section. The Methods/Results/Discussion sections are placed in a section that combines both universally-used and subject-dependent sections. The research provides insight for novice geologists who aim to pursue careers in industry and are interested in learning how to write a geomorphologic field survey.

Keywords: Geomorphologic field survey, U.S. Geological Survey, Comparative Content Analysis, Sections.

1. Introduction

A geologic field survey is a document written by geologists to publish important research on the features or hazards of a particular region. One major organization that utilizes geologic field surveys is the United States Geological Survey (USGS), a government-run organization that focuses on mitigating geological natural hazards by geologists conducting "risk assessment" research surveys of particular regions of interest. Geomorphologists under the USGS use field surveys as a means of communicating their findings of geologic phenomena or hazards to the general public on online databases. Given the increasing demand for geologists who are specialized in assessing natural hazards, it is imperative for young geologists to enter the field knowing how to write geologic field surveys. However, there is a significant lack of college-level geology students who have basic skills in writing technical geology papers following the conclusion of their undergraduate education. This research proposes to identify the ways that specifically geomorphologists write geologic (or now, geomorphologic) field surveys relative to the information they include and the sections used to categorize data. The research will achieve the following goals:

(1) To identify the types of information and sections that are used in the geomorphologic field survey;
(2) To recognize whether the information/sections used in the document are dependent on the specialty of the writer and the specific topic of the paper.

2. Methodology

This research report consists of two parts; a comparative content analysis of six sample geomorphologic field surveys and a literature review of existing USGS guidelines. The research consists of both in-depth descriptions of where and how sections are used to categorize data, and what types of information a geologist is expected to include in each section. The sample geomorphologic field surveys cover varying topics within the scope of geomorphology: tectonics, mass wasting, fluvial processes and hydrology, biogeochemistry, and climate. More information of the sample field surveys can be found in table 1.

The comparative content analysis was used to indicate when and how sections are included in the document, and the types of information categorized in each section. Each of the sections in the six sample geomorphologic field surveys were broken down based on the information they included and where they appeared in the document. Afterward, the results from the six samples were compared to visualize trends for when sections and information are included. The sections were separated into two categories. The first category pertains to the universally-used sections, where the style and information used are uniform across most or all of the sampled geomorphologic field surveys. The second category organizes subject-dependent sections, which pertains to sections where the styles and information depend heavily upon the subject of the research.

In addition to categorizing the sections and information included, a literature review of USGS guidelines was used to explain how their geologists are expected to write the geomorphologic field survey relative to where and how sections are placed and the information included there, helping to explain the trends among the sections and information included in all six samples. The purposes of the content analysis and literature review are to indicate whether or not the inclusion of certain sections and information is dependent upon the specialty of the writer and the specific topic that the paper is written about, or if there exists a single format for the sections used in the document.

---

3. Results and Discussion: Comparative Content Analysis of Geomorphologic Field Survey Components

Among the six sample geomorphologic field surveys, there seems to be a general guideline of the types of sections and information that are typically included. Besides the observed samples including many of the same sections, they also tend to use sections that are dependent upon the subject matter of the paper. Refer to Table 2 for a comparative graph of the results.

3.1. Universally-Used Sections

There seems to exist a universal guideline for certain sections used across most or all USGS geomorphology papers. The sections that are most universally used and display the least variation in structure among the six sample geomorphologic field surveys are as follows: abstract, introduction, and conclusion.

3.1.1. The Abstract

An abstract is "a concise summary of the completed manuscript…that summarizes the important content of the report and nothing more," (U.S. Geological Survey, 1991). Most USGS research documents include either informative or indicative abstracts; informative abstracts contain "essential facts reported in a document" whereas indicative abstracts discuss the generalized and non-specific content of the document (U.S. Department of the Interior, 1974).

All six samples include abstracts, however, only sample papers 1, 2, 3, 4, and 6 adopt the following guidelines for informative abstracts; they include introductions to the topic, the factors that were specifically studied, the techniques and methods applied, summaries of the results, and closing remarks to the significance of the research and advice for future research. Instead of using this abstract style, Sample 5 uses two sentences to discuss the aim of the research and methods applied and 13 sentences to provide background information of the history of the region's tectonics activity and geomorphological processes. Sample papers 1, 2, 3, 4, and 6 follow quantifiable, measurable approaches whereas Sample 5 consists of a qualitative historical explanation of the processes that occurred in a particular region. This is an example of how the subject of the geomorphologic field survey may change the way sections are used.

3.1.2. The Introduction

The introduction of the geomorphologic field survey consists of an explanation of basic information and past research on the region, the occupancy of a gap, and a discussion of the purpose of the report. Among USGS geomorphological field surveys, the main purpose of the introduction is to provide background information on research previously conducted in the region and to discuss the purpose for writing the document (U.S. Geological Survey, 1991). Various published guidelines indicate that the introduction of USGS research documents typically includes discussions of the geomorphologic processes (related to climate, geographic setting, tectonics, fluvial systems) that occur in the region of interest (U.S. Geological Survey, 1991; U.S. Geological Survey 1995), however, five of the six sample papers discuss this information in a separate section.

Samples 1, 2, 3, 4, and 5 follow a similar introduction pattern using four distinct sub-sections: information of geomorphologic features/processes relative to the region studied, analysis of past research conducted in the region, discussion of the gaps in past research, and overview of what the research aims to accomplish/contribute to geological knowledge. It is also important to note that the introductions of these five samples span more than three paragraphs or a minimum of 20 sentences, indicating that each sub-section of the introduction is discussed at great depth. Sample 6, on the other hand, follows a very different format; the introduction consists of seven sentences that give a brief context of the history of the basin and what geomorphic properties were specifically studied in the field survey.

The USGS notes that "introductions in Survey books and articles vary greatly in size and content, depending mostly on the length and subject matter of the report," (U.S. Geological Survey, 1991). One main reason for the variance in composition and length of the introductions is likely due to the shift of subject-dependent information into the "Study Area" section, which tends to follow a customizable format that consists of information relative to the particular region studied.

3.1.3. The Conclusion

The conclusion section of the geomorphologic field survey is "a concise statement of the main points covered by the report," (U.S. Geological Survey, 1991). It consists of a summary of the major results yielded from the tests conducted, an interpretation of the results in relation to the region, and a discussion of the significance of the research in a broader global context. Additionally, the conclusion is where geologists are able to briefly discuss their advice for future research on similar subjects and the effect that more research will have when formulating our geological knowledge of the planet.

All six sample geomorphologic field surveys consisted of the same format: a brief explanation of what was studied and the method used, discussion of the results, interpretation of results for the region studied, the significance of the research completed, and brief regards for future research and practices. The samples followed the same format because there exists a couple of USGS guidelines that suggest the authors to make the conclusion a brief summary of the entire paper and reference for future research. The only variation in the conclusion section refers to the proportion of each information referenced; For example, Sample 2 devotes most of the conclusion to demonstrating the need for new environmental management solutions to reduce flooding events, rather than summarizing the research conducted on discharge and flow rates of modified river channels, and after discussing how sediment transport and water discharge were drastically reduced in modified rivers.

3.2. Subject-Dependent Section

This category discusses the section used in the six sample geomorphologic field surveys that shows no clear connection in content. Not only do the sub-sections among these categories vary, but also the types of information mentioned and lines of reasoning established.

3.2.1. The Study Area

The Study Area section (also known as the History of Formation section) in the geomorphologic field survey is used to discuss various geological and geographical information about the region studied. In particular, this section may include valuable information about the geological history (formation timeline of the region, rock composition), observable geological and geomorphic processes (tectonic activity, landslides, flooding events, sediment transport, biogeochemical cycles), geographical features (biome and regional features, latitude and longitude, distance to other major formations), and the climate (temperature and weather trends, glaciation). This section differs from the introduction because it only includes details specifically about the region studies rather than discussing important foundational information about research conducted there.

There exist many variations in the information included in this particular section and where it is placed in the document. For example, Sample 1's "Regional Area" section comes right after the Introduction and discusses the tectonic setting of Glacier Bay National Park to discuss earthquake hazards related to landslide events, the history of glaciation of the region, and the rock formations and compositions underneath the glaciers. Such information helps to explain important features of the region that are going to be of importance for the research conducted. Sample 4, on the other hand, places the "Study Area" section under the "Methods" section and discusses the region's geographical location, climate (precipitation, weather cycles, biogeochemistry), tectonic activity, depositional environments, and the plant species found there to provide a closer connection between the features of the region and the specific factors measured there.

One reason for the variation in the ways that geologists utilize the Study Area section is because the section is highly dependent upon the subject matter of the research and the specific type of geological research conducted. Although all six sample geomorphologic field sturveys focus on a subject in geomorphology, they each take up subjects in different sub-fields of geomorphology; for example, Sample 1 focuses on submarine landslides in Alaska, Sample 6 discusses the paleoclimate glacial history of a lake in Southern California, and Samples 2 and 4 focus more on hydrology (rivers and basins) in North America. As a result of the variation of sub-field topics researched, each document uses the Study Area section as what is deemed most appropriate to give enough contextual information about the region studied.

3.3. Universally-Used and Subject-Dependent Section

3.3.1. Methods, Results, and Discussion

The Methods, Results, and Discussion sections are placed in a separate category where there exist aspects of both universal use and subject dependency; they are all placed together as one "section" because geologists tend to repeat the same sub-sections under the Methods, Results, and Discussion to maintain an organized structure when addressing sub-questions. The Methods section is primarily used to discuss the procedures or techniques used to measure particular variables relative to the research project, whereas the Results section simply lists the outcomes (data) as a result of applying the method when studying geological phenomena. The Discussion section, on the other hand, is dedicated to interpreting and drawing conclusions from trends in the data to make generalizations of what is occurring. For example, in Sample 3, the authors include the "Mangrove Porewater" sub-section under the Methods, Results, and Discussion sections so each sub-section is focused primarily on porewater, but the variation in information discussed stems from the different purposes of the sections.

Therefore, each of the six samples follow the same basic guideline relative to the generalized information included (i.e. the Methods section describes techniques for yielding data), but they vary in the types of subject-dependent geological information included. For example, Sample 2 includes the sub-sections "Changes in stage/discharge relationships," "Stage exceedance," "Flow distribution," and "Topography" in each of the Methods, Results, and Discussion sections. However, the information used under each sub-section changes slightly relative to the purpose of the main section header; the authors discuss the techniques applied when measuring sediment transport under the "Changes in stage/discharge relationships" sub-section under the Methods, but they discuss the actual results after applying the method to their research in the "Changes in stage/discharge relationships" sub-section under the Results. Since this structure is seen across all six sample geomorphologic field surveys, it can be assumed that the repetition and subject dependency of the sub-sections under the Methods, Results, and Discussion sections must be generalized across most geomorphologic field surveys.

Geologists use this structure to be as organized as possible when discussing the research; particularly, a single geomorphologic field survey consists of at least 3 or 4 smaller research questions that measure different aspects of an occurrence in a region. As a result of focusing on many variables at once, geologists tend to repeat the sub-sections as a means of organizing their papers and the information discussed. An example of this among our samples can be seen in Sample 5, where the aim of the research is to investigate the history of geomorphological change of Lake Manix, however, their project is broken down into 7 sub-research projects that include a GPS digital surface mapping project of deposits in the region, tephra analysis of sedimentation of rock layers, radiocarbon dating of sediments and clamshells, uranium-series dating of limestones, faunal analysis of microfossils, amino-acid analysis of ostracode protein found in crustaceans, and well water analysis for groundwater survey. Therefore, it becomes evident that a cohesive organizational structure for the geomorphologic field survey is needed to accurately explain what was measured and found for each of the sub-research studies.

---

5. Conclusion

Although this research focused specifically on the content of geomorphologic field surveys within the discipline of geomorphology under the USGS, it is important to note that these documents are used in a wide variety of settings. In particular, geomorphologic field surveys are also used extensively in academic settings, especially by university researchers who spend many years studying particular geological phenomena and regions. Therefore, it is imperative to understand how geologists write and use geomorphologic field surveys in different work environments to understand how the document's content and purpose change under various circumstances.

Nevertheless, this research creates a framework of how to structure the sections and information included in geomorphology USGS geomorphologic field surveys, and provides insight for geology students and young geologists who intend to enter industrial geology and wish to prepare themselves for the writing they will be expected to produce.

References

Avdievitch, N.N., Coe, J.A., 2022, Submarine Landslide Susceptibility Mapping in Recently Deglaciated Terrain, Glacier Bay, Alaska: U.S. Geological Survey, Colorado, U.S.A.

Durning, L.E., et al., 2021, Hydrologic and geomorphic effects on riparian plant species occurrence and encroachment: Remote sensing of 360 km of the Colorado River in Grand Canyon: U.S. Geological Survey Bureau of Reclamation, U.S.A.

Kroes, D.E., et al., 2022, Hydrologic modification and channel evolution degrades connectivity on the Atchafalaya River floodplain: U.S. Geological Survey, Louisiana, U.S.A.

Miller, D.M., Dudash, S.L., McGeehin, J.P., 2021, Paleoclimate record for Lake Coyote, California, and the Last Glacial Maximum and deglacial paleohydrology (25 to 14 cal ka) of the Mojave River; U.S. Geological Survey, U.S.A.

Reheis, M.C., et al., 2021, Geomorphic history of Lake Manix, Mojave Desert, California: Evolution of a complex terminal lake basin: U.S. Geological Survey, U.S.A.

U.S. Geological Survey, 1991, Suggestions to authors of the reports of the United States Geological Survey: U.S. Geological Survey, Virginia, U.S.A., v. 7.

U.S. Geological Survey, 1995, Guidelines for Writing Hydrologic Reports, U.S. Geological Survey, U.S.A.

U.S. Geological Survey, 1974, Abstracting and Indexing Guide, U.S. Geological Survey, U.S.A.

Wigand, C., et al., 2021, Recent nitrogen storage and accumulation rates in mangrove soils exceed historic rates in the urbanized San Juan Bay Estuary (Puerto Rico, United States): U.S. Geological Survey, U.S.A.

Appendix

	Title	Authors	Publication Date	URL
1	"Submarine Landslide Susceptibility Mapping in Recently Deglaciated Terrain, Glacier Bay, Alaska"	Avdievitch, N.N., Coe, J.A..	24 March 2022	https://doi.org/10.3389/feart.2022.821188
2	"Hydrologic modification and channel evolution degrades connectivity on the Atchafalaya River floodplain"	Kroes, D.E..	15 February 2022	https://doi.org/10.1002/esp.5347
3	"Recent nitrogen storage and accumulation rates in mangrove soils exceed historic rates in the urbanized San Juan Bay Estuary (Puerto Rico, United States)"	Wigand, C., et al.	12 November 2021	https://doi.org/10.3389/ffgc.2021.765896
4	"Hydrologic and geomorphic effects on riparian plant species occurrence and encroachment: Remote sensing of 360 km of the Colorado River in Grand Canyon"	Durning, L.E., et al.	31 August 2021	https://doi.org/10.1002/eco.2344

5	"Geomorphic history of Lake Manix, Mojave Desert, California: Evolution of a complex terminal lake basin"	Reheis, M.C., et al.	1 November 2021	https://doi.org/10.1016/j.geomorph.2021.107901
6	"Paleoclimate record for Lake Coyote, California, and the Last Glacial Maximum and deglacial paleohydrology (25 to 14 cal ka) of the Mojave River"	Miller, D.M., Dudash, S.L., McGeehin, J.P.	12 August 2021	https://doi.org/10.1130/2018.2536(12)

Table 1. Information about the six sample geologic field surveys.

	Abstract	Introduction	Conclusion	Study Area	Methods/Results/Discussion
1	X	X	X	O	✓
2	X	X	X	O	✓
3	X	X	X	O	✓
4	X	X	X	O	✓
5	O	X	X	O	✓
6	X	O	X	O	✓

Table 2. Results among six sample geologic field surveys.

Each box indicates the styles used for each section among all six samples. The "X" indicates universal use, "O" indicates subject dependency, and "✓" indicates both universal use and subject dependency.