A Case Study in Plagiarism:
Detection, Investigation, and Response

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Transient numerical simulations by Peterson and Wilson (1988) demonstrate the importance of recognizing unsaturated flow when predicting the increase in recharge from stream infiltration that occurs when water tables are lowered by groundwater pumping. This unsaturated-flow condition usually occurs where a relatively low-permeable clogging layer is present on the channel bottom. If the free surface on a groundwater mound rises from the shallow regional water table to intercept the water level in the channel, the stream–aquifer system is *hydraulically connected* (Fig. 5). On the other hand, if unsaturated sediments exist between the channel and the regional water table, then the system may be *hydraulically disconnected* (Stephens 1996). However, the simulations of Peterson and Wilson (1988) show that even when the unsaturated condition is present, the stream and aquifer may in fact be connected, in the sense that further lowering of the regional water table could increase channel losses. At some critical depth to the water table, however, further lowering has no influence on channel losses, as previously mentioned (Bouwer and Maddock 1997). At this depth, which depends mostly on soil properties and head in the channel, the aquifer becomes hydraulically disconnected from the stream.

Paragraph at bottom of the right column of page 52 of Sophocleous (2002). Shading indicates material that has been copied from page 177 of Stephens (1996) without use of quotation marks.

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I. Introduction

Plagiarism is a serious form of research misconduct that knows no disciplinary boundaries (Shahabuddin, 2009). Although the full extent of the breadth and impact of plagiarism is unclear, surveys of researchers in business and science have found depressingly high rates of reported knowledge of plagiarism by others (Bedeian et al., 2010; Pupovac and Fanelli, 2015). A key task for the research community is to define a strategy to reduce the frequency of such activity. The purpose of this report is to contribute to that process by describing all aspects of, what is to my knowledge, one of the most extensive cases of plagiarism that has been reported in the hydrologic sciences.

II. Detection

On Feb. 21, 2013, I was preparing to serve as the representative of the Kansas Geological Survey (KGS) for a panel on the High Plains aquifer scheduled for the next day at the University of Kansas (KU) when a major snowstorm swept through eastern Kansas, shutting down KU for two days and postponing the panel. I decided to use my time snowed in at home to further prepare for the panel by reviewing recent papers and a book chapter on the Kansas portion of the aquifer written by a fellow KGS staff member, Marios Sophocleous (henceforth, the author). As I read those materials back to back, I noticed a similarity in phrasing. I quickly found that a majority of the post-introduction material in one of the more recent papers was a repeat of material in earlier works by the author. Most of the overlap was word-for-word, much of the rest appeared to be a close paraphrasing of the earlier material; quotation marks were never used. I read more closely and began to find material that had been copied verbatim without quotations (henceforth, copied) from works by other authors, and I realized significant portions of the repeated material from earlier works by the author were originally copied from the works of others. Given the common definition of plagiarism as "appropriation of another person's ideas, processes, results, or words without giving appropriate credit" (e.g., University of Kansas, 2010), I concluded these papers had significant amounts of plagiarized material and informed the KGS Director.

III. Investigation

The investigation had three stages: 1) an internal KGS assessment to determine whether a formal misconduct complaint was merited; 2) a review of the misconduct complaint by a single "gatekeeper" appointed by KU to determine whether the alleged misconduct required further investigation; and 3) an in-depth review by a specially appointed KU committee (Investigation Committee; henceforth, IC) to determine whether research misconduct had occurred, and, if so, to recommend appropriate institutional action to address the misconduct. These were followed by further reviews by KU leadership. All parties had multiple opportunities to express their viewpoints during the process.

After the "gatekeeper" determined further action was warranted, a few colleagues and I prepared a detailed assessment for the IC. We knew little of plagiarism detection software so we consulted others about using it. We were discouraged from doing so because of the reported difficulty in use, interpretation of results, and getting access to needed databases. Our efforts to document the plagiarism, therefore, involved a manual assessment of seven papers (Sophocleous, 2000, 2002, 2010, 2012a,b,c; Sophocleous and

Merriam, 2012); all seven were review-style papers. The assessment consisted of identifying possible copied passages and then electronically searching potential sources. Our assessment was far from complete, and we ceased evaluating a paper when the percentage of paragraphs with copied material got large (varied from 70% to over 85% [higher percentage for papers with more easily accessible sources]).

A typical page from Sophocleous (2002) is presented in Figure 1 to illustrate the extent of the copied material; all shaded material has been copied from works by other authors. The material within the box in Figure 1 is expanded in Figure 2a to present the details of a typical example of the problematic material (similar examples can be found throughout all seven papers): all shaded material has been copied from Stephens (1996); breaks in shading occur when the copied material does not include every word from that source or when the material has not been copied from that source. The key question was whether a citation like “(Stephens 1996)” in Figure 2a indicates the words in that paragraph are those of Stephens (1996), despite the absence of quotation marks; our view was readers would assume that those were the words of the author. The inclusion of citations copied from the source material, such as “Peterson and Wilson (1988)” in Figure 2a, and additional citations inserted by the author, such as "(Bouwer and Maddock, 1997)" in Figure 2a, made it even harder to accept that the author had made clear the words were not his own.

The vast majority of the problematic material in these papers was similar to that in Figure 2a. Although there were a number of instances where there was no citation in a paragraph that had largely been copied from work of others, there was usually a citation in a nearby paragraph. We did not assess whether material had been copied from uncited work.

IV. Response

The IC reviewed the KGS analysis of the seven papers as well as materials provided by the author, interviewed all parties, and held a hearing. After deliberations, the committee issued a draft report to which all parties could respond. Following the issuance of the final report by the IC, which concluded that the author had committed research misconduct by plagiarism, the KU Vice Chancellor for Research made the final decision regarding the appropriate institutional actions. Upon conclusion of the process, KU released a public censure statement (University of Kansas, 2013; Unglesbee, 2013). The author retired during the course of the investigation (June 2013).

The seven papers had been published in four journals. In January 2014, KU contacted those journals and requested the papers be retracted. The journal response was mixed.

The journal *Groundwater* (formerly, *Ground Water*) concluded that retraction of the two papers in that journal (Sophocleous 2012b,c) was warranted and retraction statements were published (Anonymous, 2014a,b). Titles of both papers in the Wiley online archives are prefaced with “Retracted:” and the pdfs have a large “Retracted” watermark on every page.

The journal *Natural Resources Research* concluded that retraction of the paper in that journal (Sophocleous and Merriam, 2012) was warranted and a retraction statement was published (Anonymous, 2015). The paper title in the Springer online archives is prefaced with “Retracted Article:” and the pdf has a large “Retracted Article” watermark on every page.

The *Journal of Hydrology* concluded that retraction of the two papers in that journal (Sophocleous 2000, 2012a) was not warranted. An editorial described the situation and the justification for the decision (Corradini, 2014); that editorial was linked to both papers in the Elsevier online archives. The primary justification was 1) the referencing style was not inappropriate for these types of papers, 2) the number of citations of the papers by Sophocleous demonstrated their value, and 3) the time between publication and allegations was lengthy (14 years for one paper and two years for the other). Corradini (2014) also noted that most of the works from which material was copied could not be identified with their plagiarism detection software.

The *Hydrogeology Journal* concluded that retraction of the two papers in that journal (Sophocleous, 2002, 2010) was not warranted. An editorial described the situation and the justification for the decision (Voss, 2015); that editorial was linked to both papers in the Springer online archives. Although the referencing style was characterized as "unacceptable," the Executive Editor (EE) felt the presence of a nearby reference to the copied material indicated the author "did not claim that the copied ideas were his own" (Voss, 2015). The EE stated that the large number of citations of the Sophocleous papers demonstrated value and concluded "retraction would be a disservice to the community" (Voss, 2015). This decision by the EE was in contrast to the recommendation of retraction given by the publisher, Springer, after consultation with the Committee on Publication Ethics (Tamara Welschot, Springer Science+Business Media, Manager eOperations, personal communication, Oct. 2, 2014). Springer, however, does not own the *Hydrogeology Journal*; they publish it for the professional society, the International Association of Hydrogeologists (IAH). Thus, the final decision was made by the EE, presumably in consultation with the journal's owner, the IAH.

V. Path Forward – Shared Responsibility

This case study demonstrates that dealing with plagiarism is not the unique responsibility of any single individual or group. Each of us must play an important role in helping reduce the frequency of plagiarism, and all of us are already participating in one or more groups involved in the process. Those groups and, based on my experience, a key issue and recommendation that each should consider are as follows:

a. Reviewers

Issue: Cursory reviews can result in publication of papers with significant problems.

Recommendation: Greater emphasis should be placed on clearly defining reviewer responsibilities; these should include assessing recent papers by the same author(s) on similar topics. Conscientious reviewers are an important line of defense against plagiarism; many of the problems with the papers discussed here could have been identified in the review process.

b. Readers

Issue: Readers may hesitate to bring problems to the attention of editors.

Recommendation: Readers should be encouraged to contact editors if problems are suspected. Students and early career researchers may, for understandable reasons (e.g., Shahabuddin, 2009), hesitate to do so. However, they are often the most diligent readers of the literature, so reporting avenues that ensure confidentiality are essential. Attentive readers can provide an important means of identifying problem publications, as was the case in an earlier investigation in which I was involved (*Ground Water* editorial staff, 2004). We can only speculate that, given the amount of copied material in these seven papers, it is likely that readers had previously noted problems but were hesitant to get involved because of the potential for controversy and the stature of the author.

c. Editors

Issue: Editors may hesitate to take appropriate action for reasons ranging from lack of time to distaste for controversy and fear of litigation.

Recommendation: Editors should have the mindset and resolve to deal with "thorny" issues and have their foremost allegiance to the scientific endeavor. Repeated episodes of verbatim copying without quotations would almost certainly lead to strong disciplinary sanctions for students at most universities. A number of recent analyses, however, have discussed an apparent double standard in handling of plagiarism, with senior individuals treated more leniently than students (e.g., Honig and Bedi, 2012). Editors must be vigilant against such tendencies. Stature of author, number of citations, time since publication, and concerns about negative publicity should play no role in plagiarism decisions. Conflicts of interest, perceived or otherwise, can often arise, so editors should appoint an independent group to follow up plagiarism complaints. Retirees, who may have the time, energy, and willingness to contribute, could be an important resource in this regard.

d. Professional Societies and Publishers

Issue: Societies and publishers may hesitate to interfere in decisions by journal editors.

Recommendation: Professional societies and publishers should provide a check on journal responses to allegations of plagiarism. When the societies are the journal owners, they take on particularly important responsibilities in this regard. Regardless of ownership, the publisher should, and most do, have an independent review mechanism for responding to plagiarism concerns. In cases of society ownership when the publisher recommends retraction but the editor does not, the society should appoint an independent committee with the authority to determine the appropriate course of action.

e. Universities/Research Institutions

Issue: Investigating committees and offices of research integrity may only review presented material and oversee the defined administrative process, respectively.

Recommendation: Institutions should have mechanisms for assisting in the investigation of alleged plagiarism (e.g., access to and advice on use of plagiarism detection software) and for following up suspected additional problems once a misconduct determination has been reached. The investigation of the seven papers described here took a substantial effort on the part of a few individuals. We knew of additional review-style papers by the same author that appeared to have similar problems, but did not have the resources for further assessments. A formal institutional mechanism for investigation of additional possible problem papers would be useful in such cases.

VI. Concluding Thoughts

The most troubling aspect of the case reported here is the mixed response of Editors, Professional Societies, and Publishers, and the ramifications of that. For example, two of the four journals declined to retract the papers, despite the clear-cut nature of the case, the official finding of research misconduct by KU, and, for one journal, the recommendation of the publisher to do so. Furthermore, we informed the editors and publishers of two of the journals that there were additional review-style papers in their journals by the same author that appeared to have similar problems. However, to our knowledge, there has been no follow-up of that information, despite the factors listed above.

Based on our experience, it appears that the individuals who uncover plagiarism in the geosciences must often devote considerable time to document it if it is going to be addressed, and even then it is no sure thing. Unless one has been "wronged" by the plagiarism, such as an individual whose work has been copied or, as in this case, whose institution's reputation has been put in jeopardy, why should we expect anyone to expend the time and effort to do that? Dependence on altruistic behavior should not be the de facto linchpin of our strategy to address plagiarism.

We have no choice but to accept that plagiarism is an unfortunate fact of life for the geosciences and virtually every other discipline and will likely continue to be so for the foreseeable future (Martin, 2013). We can, however, do much to reduce its frequency (Shahabuddin, 2009) and we have a profound responsibility to our discipline and future generations to do so. As shown here, each of us has a critical role to play - we all, whether we like it or not, have “skin” in this game.

Addendum

Corradini (2014) indicates the failings of their plagiarism detection software, while the *Hydrogeology Journal* EE (C.I. Voss, personal communication, Oct. 31, 2014) provided analyses produced by their plagiarism detection software that did not identify many of the copied sources. In an effort to help assess the utility of such software, we will make our analyses of the two papers discussed by Voss (2015) (Sophocleous, 2002, 2010) and the most recent of the two papers discussed by Corradini (2014) (Sophocleous, 2012a) available upon request. These analyses provide details (source and page number) for each copied passage. If the plagiarism detection software cannot identify the vast majority of these sources, its value, at least for the hydrologic sciences, is limited.

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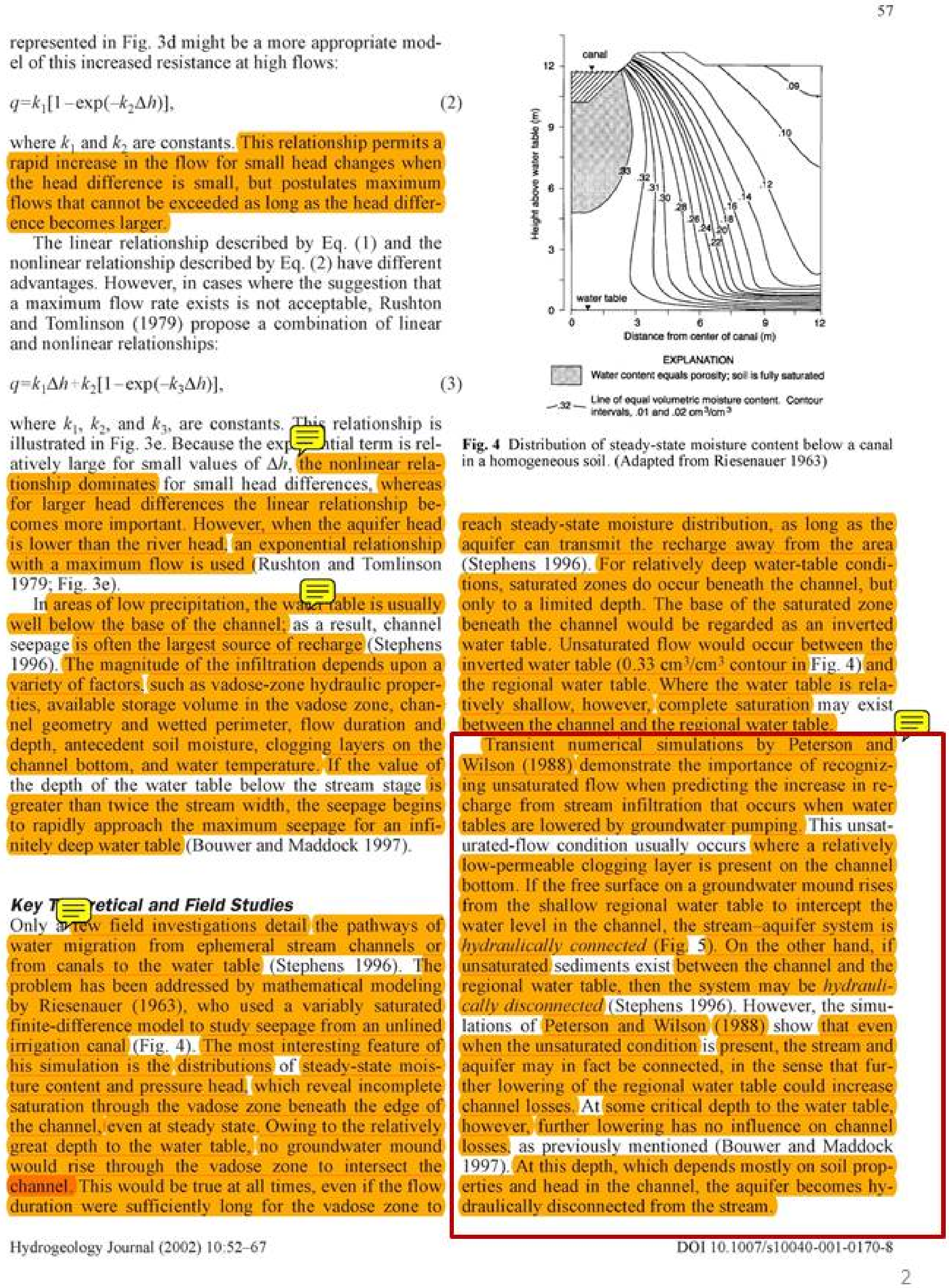

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represented in Fig. 3d might be a more appropriate model of this increased resistance at high flows:

$$q = k_1[1 - \exp(-k_2 \Delta h)], \quad (2)$$

where k_1 and k_2 are constants. This relationship permits a rapid increase in the flow for small head changes when the head difference is small, but postulates maximum flows that cannot be exceeded as long as the head difference becomes larger.

The linear relationship described by Eq. (1) and the nonlinear relationship described by Eq. (2) have different advantages. However, in cases where the suggestion that a maximum flow rate exists is not acceptable, Rushton and Tomlinson (1979) propose a combination of linear and nonlinear relationships:

$$q = k_1 \Delta h + k_2[1 - \exp(-k_3 \Delta h)], \quad (3)$$

where k_1, k_2, and k_3, are constants. This relationship is illustrated in Fig. 3e. Because the exponential term is relatively large for small values of Δh, the nonlinear relationship dominates for small head differences, whereas for larger head differences the linear relationship becomes more important. However, when the aquifer head is lower than the river head, an exponential relationship with a maximum flow is used (Rushton and Tomlinson 1979; Fig. 3e).

In areas of low precipitation, the water table is usually well below the base of the channel; as a result, channel seepage is often the largest source of recharge (Stephens 1996). The magnitude of the infiltration depends upon a variety of factors, such as vadose-zone hydraulic properties, available storage volume in the vadose zone, channel geometry and wetted perimeter, flow duration and depth, antecedent soil moisture, clogging layers on the channel bottom, and water temperature. If the value of the depth of the water table below the stream stage is greater than twice the stream width, the seepage begins to rapidly approach the maximum seepage for an infinitely deep water table (Bouwer and Maddock 1997).

Key Theoretical and Field Studies

Only a few field investigations detail the pathways of water migration from ephemeral stream channels or from canals to the water table (Stephens 1996). The problem has been addressed by mathematical modeling by Riesenauer (1963), who used a variably saturated finite-difference model to study seepage from an unlined irrigation canal (Fig. 4). The most interesting feature of his simulation is the distributions of steady-state moisture content and pressure head, which reveal incomplete saturation through the vadose zone beneath the edge of the channel, even at steady state. Owing to the relatively great depth to the water table, no groundwater mound would rise through the vadose zone to intersect the channel. This would be true at all times, even if the flow duration were sufficiently long for the vadose zone to

Fig. 4 Distribution of steady-state moisture content below a canal in a homogeneous soil. (Adapted from Riesenauer 1963)

reach steady-state moisture distribution, as long as the aquifer can transmit the recharge away from the area (Stephens 1996). For relatively deep water-table conditions, saturated zones do occur beneath the channel, but only to a limited depth. The base of the saturated zone beneath the channel would be regarded as an inverted water table. Unsaturated flow would occur between the inverted water table (0.33 cm^3/cm^3 contour in Fig. 4) and the regional water table. Where the water table is relatively shallow, however, complete saturation may exist between the channel and the regional water table.

Transient numerical simulations by Peterson and Wilson (1988) demonstrate the importance of recognizing unsaturated flow when predicting the increase in recharge from stream infiltration that occurs when water tables are lowered by groundwater pumping. This unsaturated-flow condition usually occurs where a relatively low-permeable clogging layer is present on the channel bottom. If the free surface on a groundwater mound rises from the shallow regional water table to intercept the water level in the channel, the stream–aquifer system is *hydraulically connected* (Fig. 5). On the other hand, if unsaturated sediments exist between the channel and the regional water table, then the system may be *hydraulically disconnected* (Stephens 1996). However, the simulations of Peterson and Wilson (1988) show that even when the unsaturated condition is present, the stream and aquifer may in fact be connected, in the sense that further lowering of the regional water table could increase channel losses. At some critical depth to the water table, however, further lowering has no influence on channel losses, as previously mentioned (Bouwer and Maddock 1997). At this depth, which depends mostly on soil properties and head in the channel, the aquifer becomes hydraulically disconnected from the stream.

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Figure 1 – View of KGS analysis of page 52 of Sophocleous (2002). Shading indicates material that has been copied from works by other authors. Yellow comment tags provide the details (source and page number) for copied material in each paragraph. Material within the box is expanded in Figure 2a. The KGS analysis of Sophocleous (2002) is available upon request.

Transient numerical simulations by Peterson and Wilson (1988) demonstrate the importance of recognizing unsaturated flow when predicting the increase in recharge from stream infiltration that occurs when water tables are lowered by groundwater pumping. This unsaturated-flow condition usually occurs where a relatively low-permeable clogging layer is present on the channel bottom. If the free surface on a groundwater mound rises from the shallow regional water table to intercept the water level in the channel, the stream–aquifer system is *hydraulically connected* (Fig. 5). On the other hand, if unsaturated sediments exist between the channel and the regional water table, then the system may be *hydraulically disconnected* (Stephens 1996). However, the simulations of Peterson and Wilson (1988) show that even when the unsaturated condition is present, the stream and aquifer may in fact be connected, in the sense that further lowering of the regional water table could increase channel losses. At some critical depth to the water table, however, further lowering has no influence on channel losses, as previously mentioned (Bouwer and Maddock 1997). At this depth, which depends mostly on soil properties and head in the channel, the aquifer becomes hydraulically disconnected from the stream.

Figure 2a – Expanded view of material within the box in Figure 1 (paragraph at the bottom of the right column on page 52 of Sophocleous [2002]). Shading indicates material that has been copied from page 117 of Stephens (1996) without use of quotation marks (see Figure 2b for the original paragraph in that work).

Transient numerical simulations by Peterson and Wilson (1988) clearly demonstrate the importance of recognizing unsaturated flow when predicting the increase in recharge from stream infiltration that occurs when water tables are lowered by groundwater pumping, especially where a relatively low permeable clogging layer is present on the channel bottom. If the free surface on a groundwater mound rises from the shallow regional water table to intercept the water level in the channel, the stream-aquifer system is hydraulically connected (Figure 6). On the other hand, if there is unsaturated media between the channel and the regional water table, then the system may be hydraulically disconnected. Peterson and Wilson's (1988) simulations showed that even when the unsaturated condition was present, the stream and aquifer may in fact be connected, in the sense that further lowering of the regional water table could increase channel losses. There is some critical depth to the water table, however, where further lowering has no influence on channel losses. At this depth, which depends mostly on soil properties and head in the channel, the aquifer becomes hydraulically disconnected from the stream.

Figure 2b – Paragraph from page 117 of Stephens (1996) that was the source of the shaded material in Figure 2a.