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SOME EXPERIENCE WITH DIGITAL PUBLISHING, OPEN ACCESS REPOSITORY, RESEARCH IMPACT AND QUALITY

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Abstract : The higher education and professional environments have been transformed for the last 20 years by the digital publishing revolution. Electronic resources and open access repositories are now part of research and professional tools. Herein the writer describes his experience with institutional open access repositories, and some implications in terms of research, impact and quality in civil engineering. It is critical to appreciate that civil engineering is not a "virtual" science, and that the digital "band-aids" do not replace scholarship, personal experience and smart thinking.

Keywords : Open access repository, civil engineering, hydraulic engineering, ePrintsUQ, UQ eSpace, Research, Impact, Quality.

INTRODUCTION

For the last three decades, the higher education and professional environments have been completely transformed by the electronic/digital information revolution. This includes the introduction of the spreadsheet (1979, Visicalc) and modern personal computers (1984, Apple Macintosh), the development of the world wide web (1991, CERN), the Internet search engines (1998, Google), the open access repositories, and the broadband Internet connections at home (Fig. 1). This trend has been associated with the emergence of digital publishing, conference CD-ROMs and e-journals. Associated changes have included the development of computer-based courses and "virtual learning", at the expense of technical contents and practical studies in the university curricula. Will we see: "*Google as lecturer*" as hinted by MARTIN (2006)? For some time, the universities have had access to some scientific resources: i.e., the international scientific databases like EI Compendex™ and ISI Web of Science™. These databases are increasingly utilised by some university management and government education departments as metrics of academic research quality and impact. Another source of academic information is the open access repositories (OARs). These collections of electronic resources regroup primarily academically-oriented digital resources that are open access and easily searchable by anyone.

Herein the writer presents his experience with institutional open access repositories, and some implications in terms of research, impact and quality. The article is based upon his experience as an university professor, a hydraulic researcher and an expert consultant working closely with the industry.

Context

The writer is a senior academic in Civil Engineering at the University of Queensland (Australia). His academic responsibilities are shared equally between teaching and research. For example, he had one of the heaviest teaching loads in his department for the past 4 semesters, while his research publication record accounts to 35 to 50% of the civil engineering publications for the past 5 years depending upon the selection criteria. His research interests include the design of hydraulic structures, experimental investigations of two-phase flows, coastal hydrodynamics, water quality modelling, environmental management and natural resources. The writer is the author of 12 books and over 350 refereed research publications. He has developed his own webpages since 1998, and he started to

contribute to an institutional open access repository in 2002. Since 2005, all his research publications have been available in the institutional open access repository, ePrintsUQ, and now UQ eSpace. He has currently 289 and 340 deposits at ePrintsUQ and UQ eSpace respectively, which were downloaded 127,525 and 17,565 times respectively on 1 January 2008.

Fig. 1 - The information revolution - From bottom right, anticlockwise: the Apple Macintosh (1984), logo of the CERN (world wide web, 1991), Sherpa (2002) and RoMEO publisher's copyright listings, the open access repositories OAIster (2002) and Eprints (2000)

WHY DEPOSIT IN AN OPEN ACCESS REPOSITORY?

For an academic, the motivation to deposit research works into an open access repository is multiple. It may encompass (a) open access for undergraduate students and postgraduate coursework students, (b) the availability of research materials to research students and junior researchers, (c) the access to quality research publications by professional engineers worldwide, and by academics and researchers in developing countries, (d) some marketing of his/her own research work, and (e) some knowledge of the impact of his/her own research using the OAR's retrieval statistics.

For many academics, the primary usage of an institutional OAR is the open access of research publications by undergraduate students, as supporting materials for undergraduate and postgraduate teaching. While the supporting material is often his/her own publications, it may include the works of colleagues. In that role, it is essential that the institutional repository comply with the Copyright Act. More generally, an open access repository allows the open access of research publications by research students, researchers and professionals based worldwide. This is especially important in civil engineering where the very large majority of consulting companies do not have electronic access to commercial publications because they are just too expensive. It is further crucial for academics, professionals and researchers based in developing countries because the costs of Internet usage and electronic publishing access are prohibitive.

Digital publishing and electronic resources have changed our working environment. In the course of civil engineering projects, bibliographic searches are conducted using internet search engines, electronic repositories including commercial databases and open access

repositories. These new techniques yield often too much information that could become useless unless they are critically evaluated by experts. The electronic aids have induced a widening gap between universities and small engineering companies, and between developed and developing countries, because many commercial services, including databases and digital publishing, are outrageously expensive. Many companies can only access commercial search engines like Google Scholar™ and open-access digital repositories because "*it's just much too expensive*" to do otherwise. In that environment, the open access repositories have a major role to play. They provide quality research works in a "digital world" filled with "blogs", personal webpages and unreliable information.
The development of the world wide web has lacked and will continue to lack quality control. The explosion of the number of e-resources is associated with a vacuum of reliable information. There are just too many erroneous and untrustworthy materials. Academics and researchers have a leading role to fill this void, and to fulfil the needs of the research community. The OARs are one means to provide the world wide web with high quality materials.

Experience with institutional repositories
At the University of Queensland, the institutional OAR was ePrintsUQ between 2002 and 2006. Although ePrintsUQ is still accessible and highly visible, the new institutional repository is UQ eSpace which replaced ePrintsUQ in December 2006.
The writer used both institutional repositories. While UQ eSpace brought some new interesting features, it was flawed with bugs and inconvenience at the beginning. During the first 3 months of operation, the system was full of bugs which hindered the submission process. For nearly 6 months, items deposited in UQ eSpace were not listed on Google Scholar, although the repository manager repeatedly petitioned Google Scholar to index the contents. Even today, some bugs were not fixed more than 12 months after the inauguration: e.g., it is impossible to save a draft record before final submission; ePrints UQ allowed this feature.
The experience with ePrintsUQ and UQ eSpace showed the needs for the OAR system to be user-friendly, in particular for its main users : i.e., the institutional researchers who deposit their research works. The experience demonstrated also the close links between OAR record usage and specialised e-resources like Google Scholar and Wikipedia. In practice, institutional researchers want to see some benefits from their efforts in depositing materials. One benefit is a broader exposure if the deposit is visible in search engines and e-resources.
A major criticism of UQ eSpace is linked with a shift of emphasis from open access to a Research Quality Framework (RQF) utility tool and some encumbering interference from the upper management of the University. The RQF process is a political exercise which is incompatible with the purpose of an OAR. An OAR must be designed for its users : i.e., the researchers who deposit materials, and the public who access the materials.

DIGITAL PUBLISHING, RESEARCH QUALITY AND IMPACT

The rapid expansion of digital publishing, including databases and OARs, has been associated with an increased concern on the ethics and honesty of some submissions and publications. In parallel, some interest has developed for some assessment of research quality and impact.

Ethics, Scholarship and Dishonesty
With the developments of digital publications and softwares, some contributions in civil engineering have involved unethical behaviour. That is, "*the ignoble art of cheating in scientific publications*" discussed by HENZE (2005) and MAVINIC (2006) who drew upon their experience as journal editors to present unscrupulous activities, and by the AIAA

Publications Committee (AIAA Journal 2007). Each researcher and professional should read these editorials. While the problem of "cheating" and dishonesty may be relatively small in absolute numbers, this is a critical issue because it discredits the entire profession. Engineers and researchers must be honest, and a reputation for integrity is based upon years of professional records.

As a senior expert reviewer, editorial board member and editor, the writer is regularly engaged in peer-reviews. He experienced several unethical situations among which the following examples are drawn. The writer reviewed a single-author paper for the 2005 IAHR Biennial Congress. That manuscript was already published: i.e., 75% of the text and all the figures were published one year earlier in a journal. The congress submission was prepared by an individual who had some malicious intent of duplication. In late 2006, the writer reviewed a contribution written by three people from a prestigious university. The same identical manuscript was submitted simultaneously to two journals, containing several misleading and deceptive statements. This is grossly unethical, by any standard. In May 2002, the ASCE-Journal of Hydraulic Engineering published a fraudulent paper on viscous dam break wave. The paper was based upon some experimental work done by a Ph.D. student (DEBIANE 2000) and some analytical development by his Ph.D. supervisor (PIAU 1996). Neither the Ph.D. student nor the supervisor were acknowledged and cited, although the paper included several figures that were directly copied from the thesis.

The writer experienced first-hand some dishonest actions which were detrimental to his own research. In a few instances, some unscrupulous individuals copied the writer's documents ([1]), and published these under their own name(s). In another case, an individual used the writer's experimental data without a single acknowledgement nor citation. During the recent review of a manuscript submitted to the IAHR-Journal of Hydraulic Research, one reviewer claimed that "*this paper included* [an] *other researcher's results, but did not show the name of the researcher*". The statement was grossly misleading and incorrect. All the work derived from an experimental study conducted two years earlier by the writer and his students, and published in a refereed technical report (CHANSON 2002). In this instance, the journal editor reviewed the technical report, received an independent advice from the technical report's referee and ultimately discarded the dishonest review. The manuscript was ultimately published (CHANSON 2007).

All these examples demonstrate some appalling ethical standards. They underline that honesty and integrity is a duty of each author, reviewer and of member of journal editorial boards. In that context, OARs provide (a) an opportunity to secure intellectual copyrights, but also (b) they facilitate reproduction, plagiarism and cheating. On one side, the rapid OAR deposit of a peer-reviewed publication does guarantee some form of intellectual property, allowing world-wide researchers including expert-reviewers and editors to access to the original material (e.g. a technical report). At the same time, the open access nature of the deposit implies that anyone can access and download the deposited materials. From his own experience, the writer always completes each research project with the publication of a peer-reviewed technical report. The research report is used to support manuscript submissions to international scientific journals, as well as a proof of intellectual copyright. Ultimately, however, the role of the OAR is directly linked with its usage by the researcher(s) who deposit the materials.

OAR statistics

All the commercial databases and open access repositories record some information on the data usage. The formers do not release these details because of a combination of commercial secrecy and technological challenges (e.g. EPS 2006). But the OAR statistics are freely

[1] For example, CHANSON (1993), CHANSON (2002), and also numerous photographic works.

accessible and the outcomes are challenging.
At the University of Queensland, the OAR ePrintsUQ records the file download statistics, while the newer UQ eSpace repository provides further insights into the geographic access of the data. The retrieval statistics are based typically upon the number of file downloads for a given period (e.g. 3 or 12 months). For example, in 2007 alone, the publication files of the writer were downloaded 53,300 times and 12,670 times from ePrintsUQ and UQ eSpace respectively. The geographic distributions of document retrievals showed a strong demand from North-America, Europe, Middle-East and India, but very little interest from Far-East Asia and Africa. Among the writer's top 50 most downloaded articles at UQ eSpace, 32 were not listed in Web of Science™. These were book chapters, scientific papers in journals not listed in Web of Science ™, international refereed conference papers including keynotes and refereed research reports. Figure 2 illustrates a related example: the 50 most downloaded publications at ePrintsUQ for the Year 2006. These 50 contributions were downloaded 30,000 times in 12 months. The statistical results suggest that the impact of a researcher is not truly characterised by commercial databases (citation report, h-index), and that the real impact of a research publication could be assessed in terms of the number of file retrievals additionally.

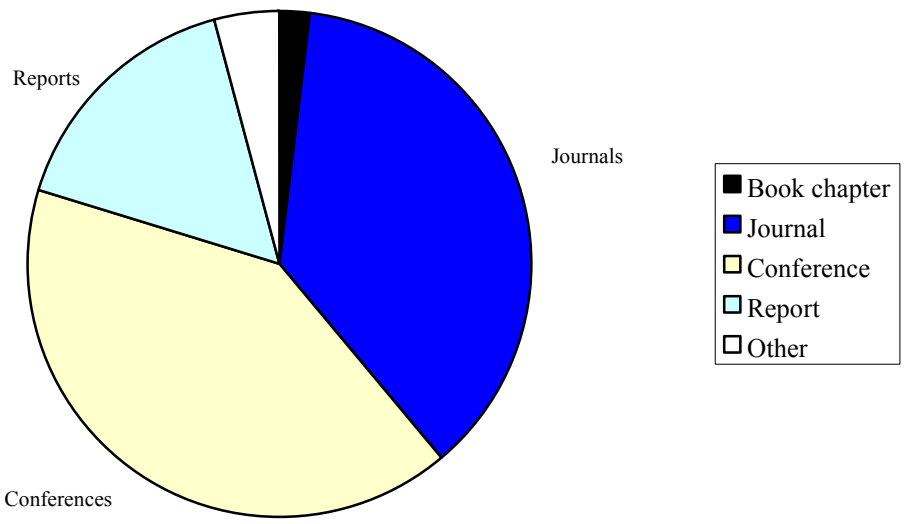

Fig. 2 - Distribution of publication downloads in 2006 for the top 50 papers by Hubert CHANSON (ePrintsUQ)

	Abstracts	Downloads
Views	619	608

Views by country (derived from IP address of query) for all years

Country	Abstracts	Downloads
United States	112	63
Iran, Islamic Republic of	31	62
Australia	61	40
India	24	39
?	52	36
Canada	64	29
Peru	11	21
Germany	5	19
Sri Lanka	5	17
Ireland	3	14
United Kingdom	18	14
Brazil	10	13
Pakistan	10	12
South Africa	5	11
France	5	10
Italy	15	10

(A) Number of file downloads (view by country) of the UQ eSpace deposit GONZALEZ and CHANSON (2007), 8 months after deposit

	Abstracts	Downloads
Views	1821	2589

Views by country (derived from IP address of query) for all years

Country	Abstracts	Downloads
United States	287	260
Australia	374	222
Portugal	110	169
Iran, Islamic Republic of	74	158
Italy	95	144
?	64	134
India	52	125
Germany	68	108
France	37	101
China	28	87
United Kingdom	40	77
Brazil	35	69
Canada	48	69
Turkey	29	54
Netherlands	28	51
Algeria	11	42
Spain	48	42
Switzerland	29	42
Indonesia	16	35
Malaysia	15	34
Belgium	27	25
Russian Federation	2	24
Egypt	29	23
United Arab Emirates	16	23
Venezuela	2	23
Iraq	5	21

(B) Number of file downloads (view by country) of the UQ eSpace deposit MATOS and CHANSON (2006), 12 months after deposit

Fig. 3 - Statistical summary of two UQ eSpace deposits on 12 December 2007

The statistical information may be used by the researchers themselves to select a suitable journal. At the end of a Ph.D. project, the writer and his student were looking for a suitable place of publication for a journal contribution with a large professional readership. The file download statistics available at ePrintsUQ led to the selection of a refereed journal which is not listed in Web of Science™ and where the writer previously published. The new journal article was published in April 2007 (GONZALEZ and CHANSON 2007). Since it was downloaded more than 661 times (Fig. 3A) and it was ranked 27th in the "Top 50 Downloaded Papers" at UQ eSpace on 1 January 2008.

Another usage of the statistical information is the geographical interest for a deposit. In December 2006, the writer edited an international workshop proceedings on hydraulic structures (MATOS and CHANSON 2006). One year later, the proceedings deposit had been downloaded more than 2,500 times (Fig. 3B) and it was ranked 4th in the "Top 50

Downloaded Papers" at UQ eSpace on 1 January 2008. The retrieval statistics showed a strong interest from North-America, Western Europe, Australia, Iran and India (Fig. 3B). The findings were challenging considering that few new hydraulic structures were built in Europe and North-America in the last 40 years, and they showed a resurgence of interest in these countries in hydraulic engineering and hydraulic design. They also supported the decision to organise a second international workshop on hydraulic structures in Pisa, Italy in July 2008 (http://www2.ing.unipi.it/2nd-ijrewhs08).

New and fairer research indexes

In many countries, governmental bodies and funding agencies are developing some form of research assessment metrics to quantify the research quality and impact. But these "metrics" are often artificial and biased, and they lack objectivity. In addition, the metrics reference must be the single-authored paper since the contribution of a scholar is inversely proportional to the number of co-authors on the paper. Any measure of the researcher's scholarship should be objectively assessed in terms of weighted number of published papers and weighted number of citations. Herein a new combination of two individual research output metrics is proposed. One is defined as the weighted number of journal paper published per year, in which the weight of each contribution is the inverse of author number : e.g., 0.20 for a paper co-written by five people. Such an indicator is an equivalent number of single-authored article. A second indicator is the weighted number of citations where the weight of each article citation is inversely proportional to the number of co-writers of the paper that is cited.

Figures 4 and 5 illustrate a comparison between some conventional metrics and the new indexes for a group of civil and environmental researchers at the University of Queensland. Figure 4 shows both the total number of journal publication per year written/co-written by each researcher, and the weighted number of publications per annum with a weight equal to the inverse of the number of co-authors. The data cover a five-year period and are focused on journal publications only. Figure 5 presents the weighted numbers of citations per year in which the weight of each citation is inversely proportional to the number of co-writers of the cited paper, and the m-index which is the ratio of the h-index to the number of years that the researcher has been publishing papers (HIRSCH 2005). Note that the weighted citation rate was averaged over the same time span.

In Figures 4 and 5, the reader notes some anomalously high total publication numbers: e.g., researchers 2, 5 and 19. Their weighted number of publications is only about 1/4th of the total number of publications. These individuals co-wrote regularly with numerous co-authors to inflate their publication records. This is simply unethical : "*Ethical violations include* [...] *listing authors who did not significantly contribute to the technical work*" (AIAA Journal 2007). Figure 5 highlights some very-low citation numbers per year for some individuals with relatively high total publication numbers: e.g., researchers 5, 6, 9, 10, 19. These poor citations rates relative to the number of publications tend to highlight some low impact on the research community. A comparison between Figures 4 and 5 illustrate also a researcher who does not publish much but has had a strong impact on the research community for the last 20 years: i.e., researcher 14.

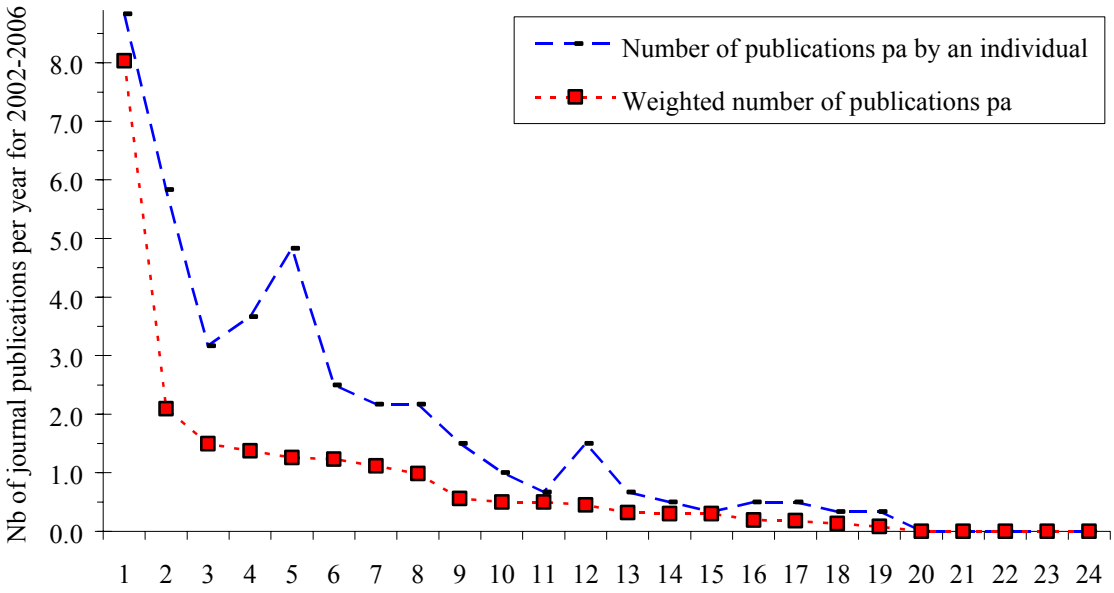

Fig. 4 - Number of journal publications per year published for the period 2002-2006 listed in ISI Web of Science™ by civil and environmental engineering researchers

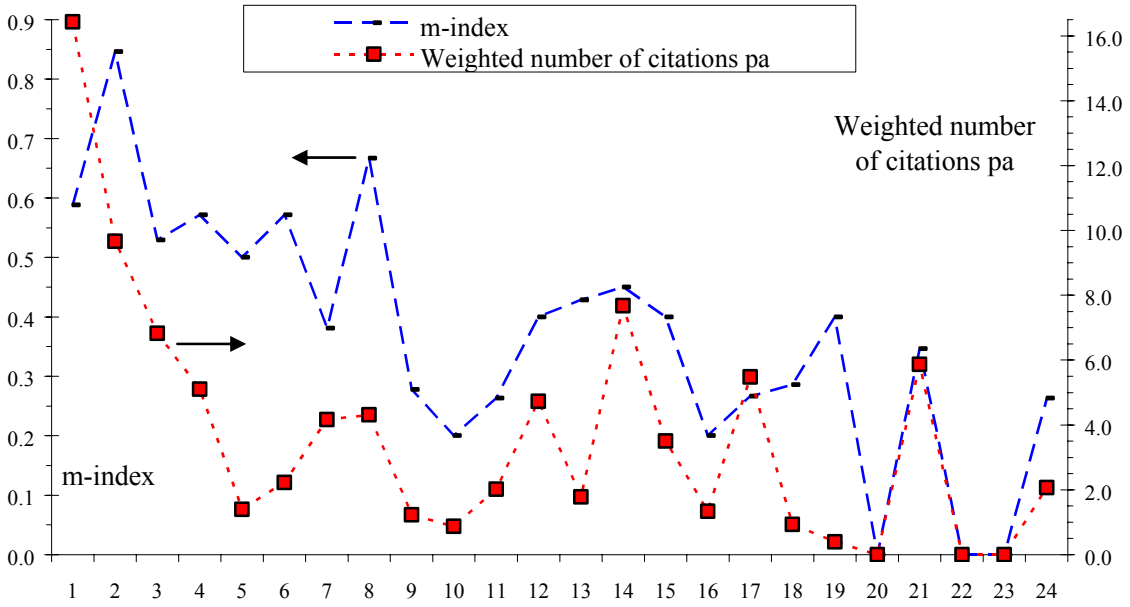

Fig. 5 - m-index and weighted number of citations per annum based upon journal papers listed in ISI Web of Science™ for the same group of civil and environmental engineering researchers and same period as in Figure 4

DISCUSSION

Will traditional book and journal publications disappear ? No, because digital databases and open access repositories do not replace scholarship. All the e-resources and digital aids cannot replace critical thinking. There is no substitute to smart thinking, innovation and scholarship. An American honours graduate summarised the situation : "*I became incredibly aware of the rapid rate at which science and mathematics develops after reading myriad articles and books on the subject of fluid dynamics and river flow. This was especially noticeable in the comparison of approaches and techniques used to solve the "dambreak" problem.* [One] *approach was complicated and laborious.* [Another] *approach, however, was*

elegant in its simplicity and conciseness" (POLWARTH 2005).
Engineers must be broad-minded and acknowledge that scholarship has no linguistic and geographical boundaries. Presently, digital materials are biased towards the American and English literature at the expense of other sources (e.g. VAUGHAN and THELWALL 2004). In the future, the digital literature might become biased towards simplified Chinese publications. The monopoly of some Internet resources is not an indicator of quality and scholarship. For example, in fluid mechanics, ARCHIMEDES, HERO of Alexandria, Blaise PASCAL, Daniel BERNOULLI, Leonhard EULER, Louis NAVIER, Henri DARCY, among others, did not use English nor Chinese ! Professionals, students and researchers must comprehend further that digital aids and e-resources databases do not replace conventional libraries. Traditional library resources may include a wide range of support including audio-visual, hard copies of older books and 3D animations that are not on-line. Internet "surfing" does not replace browsing the shelves of a good scientific library nor some field experience.
Importantly civil engineering is not a "virtual" science ! Civil engineering is a real-world science for a better environment; it is not an "electronic game". Engineers and researchers must gain first hand experience in real professional situations, and comprehend the complex interactions between engineering and non-engineering constraints (LIGGETT and ETTEMA 2001). Computer and Internet aids cannot replace personal individual observations and field experience (CHANSON 2004). In hydraulic engineering, they cannot convey the geometric scale of water systems, the broad range of relevant time scales, the variability of river flows from zero during droughts to gigantic floods, the complexity of basic fluid mechanics with governing equations characterised by non-linearity, natural fluid instabilities, interactions between water, solid, air and biological life, and Man's total dependence on water. The same e-resources cannot explain the present political instabilities centred around water systems and freshwater system issues, nor the broad and complex scope of the relevant problems : e.g., water quality, pollution, flooding, drought (Fig. 6). Figure 6A shows a road crossing an ephemeral stream and the situation is typical of more than 360 days per year. Figure 6B illustrates a sudden flash flood.

(A) Dry river bed in 2006

(B) Flood in Feb. 2000, flow from left to right (the road seen in Fig. 6A is completely submerged)

Fig. 6 - Real civil engineering: the Todd River through Alice Springs (NT, Australia) (Courtesy of Ms S. MACMINN)

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Internet resources

ePrintsUQ {http://eprint.uq.edu.au/}
UQ eSpace {http://espace.library.uq.edu.au/}