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Sixth Annual Report of the Centre for Computational Geostatistics

SEPTEMBER 2004

Introduction

The past year has been one of growth. The rise in the number of sponsor companies has been matched by a rise in faculty and support staff. Last year, we had 18 months to prepare Report Five and generated 42 papers; this year, we are back to the normal 12 month preparation period and we have 41 papers to show for our efforts. We believe with the increased productivity, you will also see an increase in the quality of contributions.

Effective August 1, 2004, Oy joined the academic ranks of the University of Alberta as a tenure-track Assistant Professor. This appointment is clear evidence of the University commitment to our growing programme in geostatistics. Oy's demonstrated abilities at teaching, research and facilitating productive teamwork will be core strengths that we will build on for the future. Retaining Oy provides a tremendous boost to the Department and to the stability and growth potential of the CCG.

Clayton received a second Chair position (Alberta Chamber of Resources Industry Chair in Mining Engineering) last year. We are not quite sure why he needs two, but it should help attract government funding and increase visibility within the University.

Our students have also celebrated many accomplishments including valuable scholarships, awards, internships and permanent jobs. Two students completed their degrees (Stefan (MSc) and Michael (PhD)), one MSc is about to graduate (Paula), and two PhD students joined the group (Sandra and Jason). Our communication of these accomplishments with CCG member companies will be facilitated by **Amanda Potts** who joined the group as a full time research administrative assistant; you will hear more from her during the coming year.

Our website has been on-line for over a year now (www.uofaweb.ualberta.ca/ccg). Newsletters and the latest CCG news are updated frequently. All member companies were assigned a login and password to access the software website (a link from the main site). All previous reports, some useful software, and some important CCG monographs are available. Note that you can search for a specific CCG paper or search for a certain subject of interest. Please feel free distribute your member access information to any interested colleagues within your organization.

In May 2004, an unprecedented research meeting on underground stope optimization was initiated by the mining industry members. This mini-forum was held prior to a national mining conference that was hosted in Edmonton. The forum was attended by representatives from five companies. Presentations given by CCG are available on-line for download by any interested CCG member company. We hope to increase the frequency of such special meetings for geostatistical modeling of particular geological settings and solving specialized optimization problems. We are pleased to collect our work in a yearly report, but it is our goal to engage each CCG member organization in our research work throughout the year. Please take the initiative and contact us with any ideas you have. Open dialogue with our member organizations helps us identify the most promising research avenues and leads to the most significant contributions to geostatistics theory and application.

Geostatistics is an applied science that has seen application in many industries, particularly in mining and petroleum. CCG research reflects this trend. Numerous case studies in both industries have been presented at various conferences throughout the year. Public dissemination of this work is important and beneficial to the industry and also to our industrial counterparts. Our objective remains, first and foremost, to develop solutions to problems associated with uncertainty modeling and management in the natural resources sector.

Let's review the contributions in Report Six by considering some of the main contributors. **Julián** is now an Assistant Professor at the University of Chile in Santiago. He has accepted a

position of Adjunct Assistant Professor at the University of Alberta and remains an integral part of our research group particularly in multiple point geostatistics and applications to Mining. **Michael** successfully defended his Ph.D. this summer. You will see many original and practically important contributions in surface-based and streamline-based simulation methods for deepwater and fluvial depositional systems. He recently moved to Houston where he will work with the first CCG sponsor company: ChevronTexaco. **Weishan** joined CCG with a background in petroleum engineering and has developed unparalleled expertise modeling heterogeneity and uncertainty in the McMurray formation. **Linan** has made meaningful contributions in the practical integration of production data. She has moved past the toy problems that have characterized this area of research for the last ten years; we are finally seeing practical application. **Paula** has completed one of the most original M.Sc. thesis that the CCG has seen. Her pioneering work in the geostatistical modeling of nonstationary boundaries will undoubtedly prove important in future applications. **Chad** continues to make numerous and important contributions in theory, software, applications, petroleum and mining. His diversity and mastery of geostatistics is commendable. **Stefan** completed his M.Sc. in the important area of implementation aspects of sequential simulation. Although he has begun a Ph.D. related to techniques for uncertainty quantification, he is flirting with the possibility of gaining some practical experience. **Jason** joins CCG as a graduate student this September. This will surprise most of you given his many contributions and papers in this report and in past reports. He has made invaluable contributions during his varied work terms with CCG and promises to continue that trend as a full-time CCG researcher. **Sandra** joined early this year and has been mastering the theory and practice of quantifying the relationship between disparate data where the differences arise from any combination of measurement type, measurement scale, and error. **John** and **Steve** gave their last eight month work term of their undergraduate degrees to CCG. You will see their names on more than one quarter of all the papers in this report. John focused on unstructured grids and related topics. Steve spent most of his time in Chile working with Julián and focusing on multiple point statistics. The future of CCG will be secure if we can continue attracting and retaining bright young students of this high caliber.

Many other researchers and company representatives have contributed to this sixth CCG report. **Dr. Luciane B. Cunha** has provided extensive support to the research efforts in Petroleum Geostatistics, particularly the supervision of Linan and Weishan. **Manu Schnetzler** has expended countless hours developing software and then supporting that software.

An important focus over the past year has been preparations for the Seventh International Geostatistics Congress in Banff. We are excited to be hosting the first congress in North America since 1983. We hope that you will be joining us in Banff after the CCG meeting.

CCG membership has stabilized at an incredible 17 companies over the last year and a half. Since our last meeting, the newest members to the CCG include ConocoPhillips, Sultan Qaboos University, Snowden Mining Industry Consultants, and Schlumberger Information Systems. This unprecedented growth has been matched by a growth in the CCG faculty and support staff. We believe members receive unquestionable value for their annual fees. The added resources of CCG will increase the quality and quantity of our research deliverables.

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CCG Staff / Researchers / Students

Following are people at the University of Alberta who are affiliated with the Centre for Computational Geostatistics. There are numerous contacts in member companies who contributed in significant ways to the results presented in this report. They are prominently acknowledged in the author lists of each paper.

- **Clayton V. Deutsch** (cdeutsch@ualberta.ca): Professor and Director of CCG
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- **Julián Ortiz C.** (jmo1@ualberta.ca): Adjunct Professor
- **Luciane B. Cunha** (luciane.cunha@ualberta.ca): Professor
- **Amanda Potts** (amanda.potts@ualberta.ca)**:** Research Administrative Assistant

- **Sandra Correa M.** (scorrea@ualberta.ca): new Ph.D. student working on geostatistical modeling of multiple data types of different scale and error.
- **Paula Larrondo** (larrondo@ualberta.ca): M.Sc. student working on rock type modeling and nonstationary modeling of geological boundaries.
- **Jason McLennan** (jam12@ualberta.ca): new M.Sc. student who has worked in many Mining and Petroleum related topics including the SAGD reservoir characterization guidebook.
- **Chad T. Neufeld** (neufeld@ualberta.ca): M.Sc. student who has worked in many Mining and Petroleum related topics including underground stope optimization for mine planning.
- **Karl P. Norrena** (karl_norrena@nexeninc.com): Ph.D. student working on decision making in the presence of uncertainty; now with Nexen Canada Ltd.
- **Bora Oz** (boz@ualberta.ca): Ph.D. student working on scaling relationships in presence of complex geologic structures; now with Shell in Calgary.
- **Michael J. Pyrcz** (mjpy@chevrontexaco.com): recent Ph.D. graduate who has developed many clever techniques for improved geological modeling; now with ChevronTexaco in Houston.
- **Weishan Ren** (wren@ualberta.ca): Ph.D. student working on integration of multiple point statistics for petroleum reservoir characterization.
- **Stefan Zanon** (szanon@ualberta.ca): recent M.Sc. graduate, worked on the integration of secondary data and improved Gaussian simulation techniques.
- **Linan Zhang** (linan@ualberta.ca): Ph.D. student working on the integration of production data in geostatistical reservoir models.
- **John Manchuk** (jmanchuk@ualberta.ca): undergraduate student, research assistant who worked on unstructured grids for direct simulation and underground stope optimization.
- **Steve Lyster** (lyster@ualberta.ca): undergraduate student, research assistant who worked on multiple point geostatistics and many other interesting subjects.