Third Annual DRI Workshop:

PROGRAM AND ABSTRACTS

Sheraton Suites Eau Claire
Calgary, AB
January 17th-19th, 2008

Third Drought Research Initiative Workshop
Sheraton Suites Eau Claire, Calgary AB
January 17-19, 2008

DRAFT AGENDA
(DRAFT as of January 15, 2008)

(This workshop agenda is intended to provide updates on DRI research and to provide sufficient time for discussion of key issues in the DRI workplan between January 2008 and July 2010 and beyond)

January 16, 2008

16:00 – 17:30: DRI BoD Meeting

January 17, 2008

08:00 - 08:30: Registration

0830 – 10:30: Session #1: Welcome and Introduction to Alberta, CFCAS and overview of DRI (Location: Wildrose Centre)

- Welcome to Alberta and the Significance of Drought in Alberta (Alberta Government Official)
- CFCAS and Drought (Jim Bruce, Tim Aston)
- DRI Progress and Overview of the 1999-2005. Drought (R. Stewart, John Pomeroy)
- Programmatic structure of DRI and workshop objectives (R. Lawford)
- Report from the Evapotranspiration workshop (John Pomeroy)
- Report from the Prediction Workshop (Charles Lin)

10:30 – 11:00: Break

11:00 – 1145: Session #2: International Drought Research

Siegfried Schubert: Drought Research Priorities in the United States
David Legler: US CLIVAR Activities Addressing Long-Term Drought
Kerstin Stahl: European Initiatives on Drought: Research Projects and Networks
Discussion

11:45 – 12:10: Session #3: Provincial Drought Activities

Ray Keller: Alberta Environment, Drought Issues and Water Management in Alberta
Bob Kochtubajda: Environment Canada Drought services on the Prairies Provinces
Discussion

12:15 – 13:15: Lunch

13:15 - 14:05 Session #4: Drought Characterization (including mapping, comparisons and impacts)

John Hanesiak

Alison Meinert, Barrie Bonsal and Elaine Wheaton: Characterizing the Climatological Nature of the 1999-2005 Drought in the Canadian Prairies: Data Sources and Issues

Paul Bullock

Suzan Lapp and Dave Sauchyn: Comparing GCM simulations of climate moisture variability to observed and dendroclimatic records

Kevin Shook: Testing the stationarity of historical meteorological data on the Canadian prairies

Discussion

14:05 – 15:00: Session #5 Regional water and energy cycling

Kit Szeto: Prairie water and energy cycling: Budget assessments, modeling and process diagnostics

Henry Leighton

Geoff Strong; Atmospheric Moisture and Thunderstorm Drought – Update January 2008

Ron Stewart: Storms, clouds and drought

Discussion

15:00 – 15:20: Break

15:20 – 16:30: Session #6: Partner and Potential Partner Presentations

Harvey Hill; PAC Update

Terry Rolfe: An Update of Drought Policy Activities at Agriculture and Agri-Food Canada – Partner Presentation

Bart Oegema: Saskatchewan Watershed Authority

Daniel Itenfisu: The Alberta Agriculture and Food Weather Stations Network and Drought Risk Management Program

Alberta Environment (Ray Keller?)

Others

Discussion

16:30 – 17:30: Session #7: Surface – Sub-surface - Atmosphere Exchanges

John Pomeroy: Canadian Hydrological Drought Processes and Modelling

Al Woodbury

Garth van der Kamp

Ken Snelgrove: Groundwater implications on Drought Research

Masaki Hayashi: Understanding the response of groundwater to drought and increasing demands

Discussion

17:45 – 20:00: Session #8 (early evening) Poster Session and Reception (Location: Wildrose South)

1. Rabah Aider, Jacques Derome, Charles Lin: Skill of Monthly Predictions over North America using GCM3

2. R.N. Armstrong, J.W. Pomeroy, L.W. Martz: Evaluation of Evaporation Estimation Methods during a Summer Drying Period
3. Eyad Atallah and John Gyakum: A Series of Unfortunate Events: Synoptic modulation of the drought
4. H. Bhuyian: Drought over Canadian Prairies: Canadian Regional Climate Model (CRCM) data validation during 1999 – 2004.
5. Julian Brimelow*, John Hanesiak*, Richard Raddatz* and Masaki Hayash† Verification of the prairie agro-meteorological model against in-situ soil moisture and eddy-covariance data: Model sensitivity to soil hydraulic parameters and minimum stomatal resistance
6. Catherine Champagne, Dr. Heather McNairn, Eric Gauthier, Dr. Jiali Shang and Anna Pacheco: Monitoring Soil Moisture Using Passive and Active Microwave Sensors to Assess Agricultural Risk
7. Xing Fang and John W. Pomeroy: Spatial Scale for Modelling Blowing Snow
8. Thian Yew Gan, Adam Kenea Gobena, Qiang Wang: Precipitation of Southwestern Canada - Wavelet, Scaling, Multifractal Analysis, and Teleconnection to Climate Anomalies
9. Mark Gervais and Paul Bullock: Calibration of the 2nd Generation Prairie Agrometeorological Model for Spring Wheat
10. Gobena, A. K., and Gan, T. Y.: Statistical ensemble seasonal streamflow forecasting in the South Saskatchewan River Basin by a modified nearest neighbors re-sampling
11. Heather Greene, Henry Leighton and Ronald Stewart: Preliminary Analysis of Cloud Characteristics During Drought
12. Harvey Hill: Linking the Agriculture and Agri-Food Canada Land Suitability Rating System to Climate Change Scenarios
13. Kevin Shook and John W. Pomeroy: Testing the stationarity of historical meteorological data on the Canadian prairies
14. R.N. Armstrong: Poster 2
15. Lei Wen: Poster
16. Aaron Berg: Canadian soil moisture observatories for calibration and validation of the Soil Moisture and Ocean Salinity (SMOS) mission
17. Agboma, C. and K.R. Snelgrove, Application of the VIC Model for Water Budget Studies in the Upper Assiniboine River Basin
18. S. Yirdaw-Zeleke and K.R. Snelgrove, Groundwater Responses During the Recent Canadian Prairie Drought : The Assiniboine Delta Aquifer of Manitoba as a Case Study.

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08:30- 09:30: Session #9: Large scale Atmospheric Circulation Controls

Thian Gan: Precipitation of Southwestern Canada - Wavelet, Scaling, Multifractal Analysis, and Teleconnection to Climate Anomalies

Barrie Bonsal and Amir Shabbar: Large-Scale SST Patterns and Teleconnections Associated with the 1999 to 2005 Canadian Prairie Drought

John Gyakum/ Eyad Atallah: A possible relationship between the Pineapple Express and Prairie Droughts

Amir Shabbar: Large-scale Teleconnections associated with Canadian Summer Drought

Ray Garnett: Canadian Prairie Drought: Climatology, Mechanism and Monitoring

Discussion

09:30 – 10:45: Session #10: Predictions and Simulations

George Boer: Seasonal Forecasting: current state and future directions

Charles Lin: Soil Moisture Analysis and the Seasonal Forecast of Drought

Al Pietroniro

Aaron Berg: Sensitivity of Seasonal Climate Forecasts to Realistic Initialization of Land Surface Hydrological States

Brenda Toth

Daniel Caya

Discussion

10:45- 11:00: Break

11;00 – 12:25: Session #11: Data Systems and Satellite Data Applications

Steve Williams: Data Management Planning

Patrice Constanza: A Data Access Interface (DAI) and Data Integration Facility using Google Earth

Ken Korporal

Al Howard

Alex Trishchenko: Vegetation and soil moisture response to drought conditions in Prairies derived from MODIS and AMSR-E satellite observations and modeling

Susan Skone: Atmospheric Moisture Data from Canadian GPS Stations

Discussion

12:25 – 13:30: Lunch

13:30 – 15:00: Session #12: Theme Overviews:

Theme #1: John Hanesiak

Theme #2: Masaki Hyashi

Theme #3: Charles Lin

Theme #4: Barrie Bonsal

Theme #5: Elaine Wheaton

Partner Advisory Committee: Harvey Hill

Charge to the Working Groups

Discussion

15:00 – 15:15: Break

15:15 – 16:30: Session #13: Working Group Discussions

Working Group #1: Theme #1

Working Group #2: Theme #2

Working Group #3: Theme #3

Partner Advisory Committee

16:30- 17:15: Reports from the Working Groups Discussions

January 19, 2008

08:30 – 09:00: Summary of previous day's discussions and guidance for final morning discussion

09:00 – 10:30: Session #14: Working Groups:
WG #1: After DRI – ideas for a new drought initiative
WG#2: Development of data products and other deliverables for the DRI Legacy – what needs to be done?

10:30 – 10:45: Break

10:45 – 11:15: Reports from the working groups and Discussion

11:15 – 12:00: General Discussion:

(Topics:
Gaps in scientific activities:
Interactions between DRI and other initiatives
Progress on issues from the last workshop on:
- What gaps exist in themes 1-3, and how should these gaps be addressed?
– What additional efforts should be made in Themes 4 and 5
How could/should DRI interact with NIDIS and other international drought efforts?
How should the ideas developed in DRI be moved forward to operational implementation and application?
What needs to be added to the Work plans for Year 4 and Year 5?

12:00- 12:30: Workshop Wrap-up
Summary of Decisions/ Actions
Adjournment

13:00 – 14:30:
Scientific Committee meeting (Location: Primrose Room)

POSTERS

A Series of Unfortunate Events: Synoptic modulation of the drought

Lead Author: Eyad Atallah/McGill University
Other authors: John Gyakum/McGill University
Contact: eyad.atallah@mail.mcgill.ca

While it is understood the feedback mechanisms such as evapotranspiration (or, in the case of drought, the lack thereof) can have a significant impact on the presence and/or severity of drought, synoptic-scale forcing, if of sufficient magnitude, can over-ride these feedback mechanisms and either instigate or alleviate drought conditions. Therefore, the primary focus of this work is to understand the relative importance of the synoptic-scale on the modulation of the drought. Towards this end, the large-scale moisture transport by the synoptic-scale flow is examined. Preliminary results indicate that this drought can not be characterized by a single pattern. At least three disparate flow regimes appear to contribute significantly to the most recent Prairies drought. Only one of these regimes consisted of stereotypical high amplitude ridging over northwestern Canada. Patterns which were accompanied by severe moisture deficits included flow regimes where the mean storm track was displaced both to the north and south of the Prairies region. This resulted in temperatures that, for the entirety of the drought, averaged near normal. Consequently traditional concepts of drought in western Canada being related to a positive phase of the Pacific North American pattern are only partially applicable**.**

Preliminary Analysis of Cloud Characteristics During Drought

Lead Author: Heather Greene
Other Authors: Henry Leighton & Ronald Stewart
Contact: Heathergreene62@gmail.com

Little is known about cloud climatology during droughts. Information on clouds is now readily available from satellite data as far back as the early 1980's. By focusing specifically on the Canadian Prairies and the drought of 1999-2005, the objective is to have a better understanding the role of clouds during drought and other moisture conditions. Surface Radiation Budget (SRB) satellite data is used to investigate mean cloud cover fraction of various types of clouds at several levels in the atmosphere as well as the overall amount. In addition, cloud base height, optical depth and the effect cloud cover has on shortwave radiation reaching the earth are being examined.

Preliminary analyses of cloud cover throughout the Canadian Prairies has shown that although cloud amounts do differ slightly from dry to wet conditions, it is only weakly correlated to the amount of precipitation received. Further analysis will include specific case studies over the Canadian Prairie Provinces including Regina, SK and Fort McMurray, AB.

Spatial Scale for Modelling Blowing Snow

Lead Author: Xing Fang/Centre for Hydrology, University of Saskatchewan
Other Authors: John W. Pomeroy/Centre for Hydrology, University of Saskatchewan
Contact: john.pomeroy@usask.ca

Blowing snow transports and sometimes sublimates much of the seasonal snowfall in the Prairies of western Canada. Snow redistribution is an important feature of Prairie hydrology as deep snowdrifts provide a source of meltwater to replenish ponds and generate streamflow in this dry region. The spatial distribution of snow water equivalent in the spring is therefore of great interest for Prairie hydrology. A test of the appropriate spatial scale for modelling blowing snow redistribution and sublimation was conducted at St Denis National Wildlife Area in the rolling, internally drained prairie pothole region east of Saskatoon, Saskatchewan, Canada. A LiDAR based DEM and aerial photograph based vegetation cover map were available for this region. A coupled complex windflow and blowing snow model was run with ~250,000 6 m x 6 m grid cells to produce spatially distributed estimates of seasonal blowing snow transport and sublimation. The calculation was then aggregated, using 7 landscape units that represented the major influences of surface roughness, topography and fetch on blowing snow transport and sublimation. Both the distributed and aggregated simulations described similar end of winter snow water equivalent with substantive redistribution of blowing snow from exposed sparsely vegetated sites across topographic drainage divides to the densely vegetated pothole wetlands. Both simulations also agreed well with snow survey observations. While the distributed calculations provide a fascinating and detailed visual image of the interaction of complex landscapes and blowing snow redistribution and sublimation, it is clear that blowing snow transport and sublimation calculations can be successfully aggregated to the spatial scale of the major landscape units in this environment.

Drought over Canadian Prairies: CRCM data validation during 1999 – 2004.

Lead Author: H. Bhuyian/ University of Manitoba
Other authors: John Hanesiak, Peter Rasmussen

The central theme in the definition of drought is the concept of a water deficit. Precipitation deficit over time is related to the surface-runoff, the soil-moisture, the stream-flow, and the groundwater components of the hydrologic cycle. Considering this fact, precipitation can be identified as a drought signal. The climate describes the long-term characteristics of this signal.

The objective of the study is to inter-compare and analyze the 1999 – 2004 atmospheric and surface characteristics from different data sources. Two recent Canadian Regional Climate Model (CRCM) runs, one with a simple land surface scheme and another with the Canadian Land Surface Scheme (CLASS) is considered for inter-comparison. Canadian homogenized historical gridded data (CANGRID) is used to validate the CRCM simulations. Inter-comparison of two model outputs with CANGRID demonstrated that CLASS improves model estimation. We used spatial distribution of annual and seasonal (1999-2004) precipitation from the CRCM (CLASS coupled) experiment to compare with CANGRID. Time series of spatial averages show good agreement with CANGRID. The CRCM (CLASS coupled) experiment was used to calculate precipitation normals for 1971-2000. Precipitation anomalies are calculated, and only one year (2004) is presented.

Skill of Monthly Predictions over North America using GCM3

Lead Author: Rabah Aider

Other Authors: Jacques Derome, Charles Lin(1)
McGill University
(1) On leave at Environment Canada (2007-08)

Abstract

The goal of this study is to examine the skill in mean-monthly forecasts by the GCM3 model, based on the Historical Forecasting Project (HFP2), for the period 1969- 2003 over North America. GCM3 is coupled to the land surface scheme CLASS. The variables examined are the 500 hpa geopotential heights (Z500), air surface temperature (SAT), precipitation and soil moisture. The ensemble mean predictions are compared with NCEP re-analysis over the period of 35 years using a correlation analysis as a measure of skill. The monthly forecasts of Z500 and SAT are found to have the highest skill throughout the year compared with precipitation and soil moisture. The skill is concentrated in the first month of the prediction period and diminishes as the lead time is increased, due to the dominant role of the initial conditions. There is more skill in the cold compared to the warm season. Preliminary results show the skill is low for the forecast of the 2001- 2002 summer drought over the Canadian Prairies.

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Testing the stationarity of historical meteorological data on the Canadian prairies

Kevin Shook/Centre for Hydrology, University of Saskatchewan, 117 Science Place, Saskatoon, Saskatchewan, Canada, S7N 5C8
Other authors: John W. Pomeroy/ Centre for Hydrology, University of Saskatchewan
kevin.shook@usask.ca

Although the prairie regions of western Canada are important as a source of agricultural production, the region is marginal for agriculture. Thus there is great interest in the existence of climate change in historical climate data, and the effects of climate change in the future. Historical values of daily minimum, maximum, and mean air temperatures and daily rainfall, snowfall, and total precipitations were analyzed to determine their stationarity, i.e. if each dataset could be represented by constant values of mean and variance. Data were selected for six locations: Calgary, Medicine Hat, Saskatoon, Regina, Indian Head and Brandon which had data preceding the 20th century, and because their data measurement locations did not change throughout the period of record.

The data were analyzed using the KPSS test. In all cases, the null hypothesis of stationarity could not be rejected for the daily rainfall, maximum and mean air temperature values. Although several of the daily snowfall and precipitation data sets initially appeared to be non-stationary, this effect disappeared when the snowfall datasets were corrected for the effects of wind. The only dataset for which the null hypothesis of stationarity was rejected was the Indian Head minimum daily air temperature values. The implications of these findings are discussed.

Verification of the prairie agro-meteorological model against in-situ soil moisture and eddy-covariance data: Model sensitivity to soil hydraulic parameters and minimum stomatal resistance

Lead Author: Julian Brimelow
Other Authors: John Hanesiak, Richard Raddatz and Masaki Hayashi
Contact: umbrimel@cc.umanitoba.ca

Although the Prairie agro-meteorological model (PAM-II) has been used extensively by the agriculture and research communities in Canada and the USA, it has yet to be verified against in-situ observations over an entire growing season. To this end, the objective of this study was to establish the model's ability to reproduce root-zone soil moisture below native grasses and a barley field at four sites in Alberta in 2004 and 2005. In addition, at the barley site, model output of daily ET was verified against daily ET estimates from an eddy-covariance system.

The model was found to perform well, although sensitivity tests indicated that the model output and performance were strongly modulated by the input soil hydraulic properties and minimum stomatal resistance. Further, it was determined from the literature that there is a wide range of water retention characteristics for each soil textural class depending which pedo-transfer function (PTF) one uses. We hypothesized that this model sensitivity to the hydraulic parameters could, in part, be addressed by adopting a multi-model ensemble approach. In all, 20 PTFs were identified in the scientific literature for the purpose of specifying the water retention characteristics at the three grassland sites. It was found that while no single PTF consistently produced superior results at all three sites, when PAM-II was run using the mean water retention characteristics of the 20 PTFs it consistently produced superior results than the control.

Following an extensive literature review and model sensitivity tests, new reference values for minimum stomatal resistance for grassland and cereal crops were proposed. Using these new reference values markedly improved the model's performance at both the grassland and cereal sites. For the first time, the multi-model ensemble approach and minimum stomatal resistance sensitivity tests allowed us to quantify the uncertainty associated with the model's output.

Linking the Agriculture and Agri-Food Canada Land Suitability Rating System to Climate Change Scenarios

Harvey Hill
Prairie Farm Rehabilitation Administration (PFRA)

Building on the work of Nyrifa and Harron this work examines the expected impact on precipitation, temperature, and land suitability for small grains on the Agricultural landscape under three scenarios and two GCM models.

Statistical ensemble seasonal streamflow forecasting in the South Saskatchewan River Basin by a modified nearest neighbors re-sampling

Lead Author: Gobena, A. K.
Other Author: Gan, T. Y.
Department of Civil and Environmental Engineering, University of Alberta,
Contact: tgan@ualberta.ca

An ensemble seasonal streamflow forecasting model is developed for two watersheds in the South Saskatchewan River basin of southern Alberta, Canada. The ensembles are generated from a mean forecast by using a modified K-nearest neighbor algorithm. The mean forecasts are produced by a robust M-regression model that uses snow water equivalent and large-scale climate information as predictors where the best combination of predictors is automatically selected by the generalized cross-validation criterion. It is shown that skillful forecasts of the April-September flow can be obtained as early as the beginning of December preceding the runoff year, thus extending the current forecast lead time by two months. An assessment of the potential economic value of the forecasts shows that ensemble forecasts offer superior economic value for a wide range of end users as compared to deterministic forecasts using the same set of predictors.

Evaluation of Evaporation Estimation Methods during a Summer Drying Period

R.N. Armstrong, J.W. Pomeroy, L.W. Martz
Centre for Hydrology, Dept. of Geography, University of Saskatchewan, 117 Science Place, Saskatoon, Canada, robert.armstrong@usask.ca

Spatially variable topography, vegetation and available water are inherent in natural landscapes. Complex interactions within the soil-vegetation-atmosphere system present difficulties for determining reliable estimates of evaporative fluxes between the land surface and atmosphere. Methods available for estimating evaporation (includes both water losses via evaporation from soil and exposed water, and transpiration from plants) can vary widely as a result of different theoretical approaches and data requirements. Three useful approaches to estimating 'actual' evaporation are evaluated during a summer drying period (2006) for a mixed-grass site located in the St. Denis National Wildlife Area within south-central Saskatchewan.

A Penman-Monteith (P-M) type combination approach explicitly takes into consideration the influence of resistances and energy balances on evaporation from non-saturated surfaces. A Dalton-type bulk transfer (BT) approach typical of land surface schemes considers turbulent transfer along with the humidity gradient between the surface and atmosphere by incorporating land surface temperature observations. Granger and Gray developed an extension of the Penman equation to the case of non-saturated surfaces using a feedback approach (G-D) that considers the relative evaporation, G or the ratio of actual to potential evaporation and the relative drying power of the air, D.

The models are evaluated for several temporal scales; seasonal, daily and 15 min intervals. Results suggest that all three approaches have 'reasonable' applicability for estimating seasonal and multi-day evaporation within the Prairie environment. However, for periods of daily or less evaporation estimates varied considerably between methods and from observed values. Evaporative losses were also examined during the 1999-2004 drought period for a short mixed grass prairie (Lethbridge, Ameriflux site, 2001) and a native prairie site (Kernen Research Farm, 2000) located just east of Saskatoon, Saskatchewan. Results for a simple coupled water balance approach in a hydrological model show the difficulties in characterizing the soil column and initial state conditions for adequately modeling evaporation.

Calibration of the 2nd Generation Prairie Agrometeorological Model for Spring Wheat

Mark Gervais and Paul Bullock
Department of Soil Science, University of Manitoba, Winnipeg, Manitoba.

Evapotranspiration (ET) from crops provides a significant source of atmospheric water which is integral to the water cycle of the Canadian prairies. Unfortunately, the methodology of direct measurements of ET is often problematic and requires significant resources. As a result, ET models have been used frequently for ET determination.

The 2nd Generation Prairie Agrometeorological Model (PAM2nd) is a model in which soil water, crop development and atmospheric demand for water vapor is modeled in order to derive an evapotranspiration estimate for agricultural crops. At the time of development, the model was validated for spring wheat using data collected from Kenaston, Outlook and Saskatoon, Saskatchewan. However for PAM2nd to be used for the Canadian Prairies the model should be calibrated under the various soil and climatic conditions present throughout the Prairies.

The objectives of this study are to calibrate the soil water and crop component of PAM2nd for spring wheat on the Canadian Prairies and to test the accuracy of the ET estimates by comparing them to a measured soil water balance. Model calibration is being done with detailed soil water and crop development measurements collected from spring wheat test plots at Melfort, Swift Current, Regina, Winnipeg and Carman during the growing seasons of 2003 to 2006.

Preliminary results indicate the model overestimates soil water for the second half of the growing season. Our hypothesis is the crop growth component of the model is maturing spring wheat too quickly resulting in increased canopy resistance too early in the growing season, thus restricting transpiration. We are currently investigating different methods to model spring wheat development in order to improve the accuracy of both crop maturation rate and canopy resistance throughout the growing season.

Monitoring Soil Moisture Using Passive and Active Microwave Sensors to Assess Agricultural Risk

Catherine Champagne
Agriculture and Agri-Food Canada
champagneca@agr.gc.ca
Dr. Heather McNairn, Eric Gauthier, Dr. Jiali Shang and Anna Pacheco (all of Agriculture and Agri-Food Canada)

Information to support risk management, program targeting and monitoring must be accurate, dependable and timely. Valuable data sources already exist, including Census information, insurance databases, field surveys, in-situ sensors and meteorological data. These data, however, are limited because of the inadequate temporal frequency, the inconsistency and the lack of spatial detail with which observations are collected across the country and/or the inability to link observations to landscapes. Data collected from orbiting satellites can provide temporally frequent and spatially detailed data, thus providing potential solutions to the spatial-scale problems associated with drought monitoring and modelling in Canada. Soil moisture is a critical variable for assessing emerging drought conditions, but it is not measured routinely at in-situ stations, and is one of the most difficult to evaluate using hydrological models. Remote sensing approaches are promising, but the models to extract soil moisture and relate this to risk conditions need to be developed further for them to be used operationally. Research is currently underway at Agriculture and Agri-Food Canada to examine remote sensing of soil moisture using active and passive sensors with a vision towards establishing a monitoring system for soil moisture extremes. This project will develop, test and evaluate methods to quantify surface (0-15 cm) soil moisture using active synthetic aperture radar (SAR) satellite sensors; develop a method to flag regions experiencing extreme soil moisture conditions using assimilated passive microwave data, in order to cue collection of spatially detailed SAR data; and demonstrate the assessment of risk due to extreme soil moisture conditions using integrated active and passive microwave soil moisture products, over sites in the Prairies.

ORAL PRESENTATIONS

Drought Research Priorities in the United States

Siegfried Schubert/NASA
Siegfried.d.schubert@nasa.gov
Max Suarez, Philip Pegion, Randal Koster, Julio Bacmeister/NASA

This talk will review the recommendations for U.S. drought research priorities that came out of a 2005 workshop on "Observational and Modeling Requirements for Predicting Drought on Seasonal-to-Decadal Time Scales". The focus will be on recent progress on implementing aspects of the recommendations within the framework of the USCLIVAR program. In particular, results will be presented from a coordinated effort involving modeling groups from NASA/GMAO, NCEP, GFDL, NCAR and Lamont-Doherty to examine the SST forcing of drought, with an emphasis on assessing the dynamical mechanisms linking remote SST forcing to regional drought over North America.

US CLIVAR Activities Addressing Long-Term Drought

David Legler/U.S. CLIVAR Office
legler@usclivar.org

US CLIVAR has identified long-term drought and its predictability as a critical research challenge. Two projects addressing the predictive understanding and analysis of long-term drought have been initiated. The first, DRought In COupled Models Project (DRICOMP) aims to increase community-wide diagnostic research into the physical mechanisms of drought and to evaluate its simulation in current models. Several small research grants were provided to investigators for evaluating a variety of *existing* model products such as the CMIP3 coupled climate models runs (forced and control runs), regional climate simulations, and reanalyses. A key goal of DRICOMP is to identify the role of deep soil moisture, the nature of long-term SST variability, the impact of global change, as well as fundamental issues about predictability of drought on multi-year time scales. Most of the selected investigations address drought in North America; however, some explore other drought-prone regions of the world.

The second activity is a short-term Working Group that is serving as a central coordinating body for long-term drought prediction research in the US. They are developing working definitions of drought and related model-predictands, designing and carrying out coordinated model experiments using all the major US climate models in order to assess drought dependence on "forcing" (eg ocean temperature variability, land-atmosphere feedbacks, global warming, etc), and other related research and coordination activities. These model experiments are well underway, and a workshop to review the results, and those from DRICOMP, is being planned for late 2008.

European Initiatives on Drought: Research Projects and Networks

Dept of Geosciences, University of Oslo, Norway
Kerstin.stahl@geo.uio.no

The presentation will provide an overview of drought issues across Europe, aspects of previous research on hydrological drought, current research projects, and emerging research networks. It has been recognized for many years that drought events cross national borders in Europe, and hence the issue has been on the agenda of the European Environment Agency; the European Union's research and technical development programme has called for proposals; and drought has been a topic of interest for many climatologists and hydrologists working on large-scale analyses and modeling. Past research has mainly dealt with the comparison of methods, spatial analysis of rainfall and streamflow data, and drought frequency analysis. Current projects are strongly motivated by integrated climate change impact assessment. The new project WATCH (http://www.eu-watch.org/), for example, includes a specific research component on properties and uncertainties of drought as simulated by climate models and their land surface schemes. As the continent spans a range of climatic regions, however, perceptions and needs for drought assessment, planning, and research vary strongly between different European countries. It is therefore important to have continuing platforms for information, discussion, and initiation of joint research. The European Drought Centre (www.geog.uio.no/edc/) is an emerging virtual centre that aims to provide such a platform to promote collaboration and capacity building between scientists and the user community and to enhance European co-operation in order to mitigate the impacts of droughts on society, economy and the environment.

Characterizing the Climatological Nature of the 1999-2005 Drought in the Canadian Prairies: Data Sources and Issues

Alison Meinert/University of Saskatchewan
alison.meinert@usask.ca OR alison.meinert@ec.gc.ca
Barrie Bonsal/ EC and Elaine Wheaton/SRC

Between 1999 and 2005, the Canadian Prairies experienced a period of severe drought varying in intensity, duration and spatial coverage. This drought is recognized as having had a major impact on the economy, environment and society in the region. This presentation outlines preliminary results from this study whose main objective is to quantify the extent and severity of the 1999-2005 Canadian Prairie drought at a variety of spatial and temporal scales. The proposed research will compare different methodologies to calculate drought indices over the prairie region and develop methods to analyze the migration of the drought to assess how it evolved, persisted, and terminated. The research plan includes calculating and comparing various drought indices to determine those that best reflect the drought in terms of documented agricultural and hydrological impacts. The list of potential indices to be used in drought studies is exhaustive. However, because of the large spatial scale of this study, applicable drought indices are those that are limited to monthly or daily temperature and precipitation data. Monthly gridded datasets of temperature and precipitation are readily available and provide good spatial coverage over the Canadian prairies and in some cases all of North America. The availability of these global and North American datasets has opened up the possibility of calculating drought indices beyond the study area with the intention of examining how conditions in the United States may have influenced the extent, severity and migration patterns of the drought on the Canadian Prairies. Drought indices considered for this study include the Palmer Drought Severity Index, the Standard Precipitation Index, the Climate Moisture Index and the Crop Moisture Index. Other important datasets will include evaporation and soil moisture data. Progress towards the above objectives began with an in depth evaluation of the gridded datasets to determine how the temperature and precipitation values corresponded with recorded station values. The reliability of the gridded datasets was assessed through a comparison of temperature and precipitation values from 6 prairie climate stations with 6 corresponding grid locations. This presentation will highlight some of the preliminary results from this comparison. Once a full set of drought indices have been calculated our next goal will be to relate these indices with observed drought impacts including but not limited to crop yields, pasture growth, water levels (dugouts) and aerosols (dust storms). These comparisons will provide an indication of the usefulness/applicability of drought indices. This research supports Theme 1 in that it aids in the description and quantification of the physical features of the drought across the Canadian Prairies between 1999 and 2005. In addition, this research will make a contribution to the understanding of the wide range of impacts associated with the drought and how these impacts relate to the intensity, timing and duration of the drought.

Comparing GCM simulations of climate moisture variability to observed and dendroclimatic records

Suzan Lapp, PARC, University of Regina
lapp200s@uregina.ca
Dave Sauchyn, PARC, University of Regina

The capacity to validate decadal, multi-decadal and lower frequency climate variability from GCM outputs is constrained by the scarcity of long observational records. Proxy data from tree-ring analyses carried out in western North America has proven valuable to quantify natural climate variation over centuries to millennia; therefore, providing a unique opportunity to validate GCM experiments. Drought events of the 20th century have been linked to natural climate variability modes such as ENSO, PDO, PNA and AMO. Reconstructions of annual and seasonal climate moisture from tree-rings for the past 500 years for sites in Montana, Alberta, Saskatchewan and NWT show drought events in previous centuries that are more extreme in magnitude, frequency and duration than recorded during the instrumental period. These drought events may be associated with various natural climate forcings. The key objectives of this work are to: 1) develop links between modes of climate variability and periodicities in moisture reconstructions derived from tree-ring data; 2) compare climate variability modes identified in GCM control runs to observed and proxy climate variability; and 3) derive a composite time series of future climate moisture natural variability for the study area.

Prairie water and energy cycling: Budget assessments, modeling and process diagnostics

Kit Szeto / Climate Search Division, Environment Canada Toronto ON.
Kit.Szeto@ec.gc.ca

The regional climate system is operated through the exchange of water and energy between the region and its ambient environment and the cycling of these quantities within the region. A comprehensive assessment of water and energy budgets for the Canadian Prairies is thus the first step in enhancing our knowledge of drought in the region. Baseline climatologies of atmospheric and surface water and energy budgets for the Prairies are developed by using various quasi-independent source datasets. Budget results evaluated by using the different datasets are inter-compared to examine their variability among the different commonly-used climate datasets and to provide recommendations to the suitability of their application to studies of Prairie drought. In addition, how well the Prairie water and energy cycle, particularly its aberration during a drought episode, can be simulated with current regional climate models are examined by comparing results from a simulation of the 1999-2004 Prairie drought with several different models. The large-scale and regional processes that govern the variability of the budgets are also studied to better understand the development of hydroclimatic extremes such as drought in the region.

Atmospheric Moisture and Thunderstorm Drought – Update January 2008

Geoff Strong
University of Alberta, Edmonton

We have previously shown that during normal or above-normal soil moisture conditions, the surface atmospheric moisture (mixing ratio) undergoes cycling with periods of 10-16 days, in addition to the normal diurnal cycle. Cycling peaks can be linked directly to convective outbreak periods, emphasizing the importance of local evapotranspiration (as opposed to long-distance moisture advection) to convective storm processes.

During drought conditions, when soil moisture drops below the *wilting point*, when plants can draw no more water from the soil, the diurnal evapotranspiration cycle is interrupted so that moisture cycling, as well as convective storm processes, tend to stop. However, we do find some extreme drought conditions when these processes do not terminate, and neither does the occurrence of severe convective storms. Cases for cycling and non-cycling conditions are reviewed. To understand the exceptions, that is, when moisture cycling does occur during drought conditions, we need to investigate the main source of the atmospheric moisture, transpiration from the vegetation itself. Some results from a fixed 180-metre transect across wheat/grass during moist soil conditions, a special dataset collected from St. Denis, Saskatchewan in July 1992, provide some preliminary answers to the extent of the diurnal signal, and of the moisture gradient between wheat and prairie grass.

As time permits, an update on the related study of Alberta *drylines* will also be reviewed, together with an update on the use of GPS moisture for monitoring daily evapotranspiration and drought.

Storms, clouds and drought

Ron Stewart:
Other Authors: Erin Evans, William Henson, Kit Szeto
Contact: ronald.stewart@mcgill.ca

This study will focus on the flow of water through clouds and precipitating systems to the surface within and adjacent to drought regions. In particular, it will focus on thresholds that must be exceeded before precipitation can reach the surface and on episodic events that produced heavy, widespread precipitation. The presentation will mainly though concentrate on the occurrence of light precipitation and virga. Such small precipitation events still sometimes occurred in the midst of the drought and these instances were produced through both stratiform and convective processes. In addition, virga was also common so that the precipitation aloft evaporated and/or sublimated before reaching the surface. The common occurrence of cloud bases at temperatures colder than freezing may have contributed to the occurrence of virga since slowly falling snow can sublimate more rapidly than fast-falling rain can evaporate. Model information such as that from NARR captures some of these features but there are shortcomings as well.

The Partners Advisory Committee (PAC)

Harvey Hill
Agriculture and Agri-Food Canada, Prairie Farm Rehabilitation Administration

The presentation will cover two topics:

1) The needs of Agriculture and Agri-food Canada's National Agroclimate Information Service (NAIS) for DRI information.
2) it will provide a brief overview of the key findings of the PAC committee and one possible way these needs can be addressed.

An Update of Drought Policy Activities at Agriculture and Agri-Food Canada – Partner Presentation

Irene Hanuta, Agriculture and Agri-Food Canada, Prairie Farm Rehabilitation Administration / Terry Rolfe, Agricultural Consultant (Presenter)
hanutai@agr.gc.ca tsrolfe@aol.com

Agriculture and Agri-Food Canada (AAFC) is in the process of developing a longer-term drought strategy for the Department. The goal of the strategy is to help the Department and the sector become better prepared to deal with drought, and to identify policies and activities that will help agriculture remain sustainable, competitive and be more resilient to drought impacts.

A framework is being updated incorporating input from a stakeholder meeting held in May 2007. This framework will serve to guide AAFC in developing an action plan identifying priority proactive measures for the Department and sector to put into practice.

The Alberta Agriculture and Food Weather Stations Network and Drought Risk Management Program

Daniel Itenfisu, Alberta Agriculture and Food
Daniel.itenfisu@gov.ab.ca

High quality, near real time (NRT) weather data of adequate spatial and temporal resolution is a vital component of modern agricultural production and environmental protection programs. To meet the need for NRT weather data, Alberta Agriculture in collaboration with other organizations has expanded its standard automated weather station network to 115 stations. All of the stations in the network monitor all season precipitation, air temperature, relative humidity, wind speed and direction. Moreover, 48 stations monitor windspeed and direction at 10 m, 50 solar radiation, and 30 soil moisture and temperature and 3 snow depth. Data from some stations are transmitted via satellite using the GOES/NESDIS system to central archive where data quality control and assurance procedures are implemented. In addition to its own station network, Alberta Agriculture also makes use of historical and NRT weather data collected by other agencies across the province and adjacent to its boarders. This larger network of weather stations is the basis for the drought risk, crop insurance and irrigation water management programs in the province.

Canadian Hydrological Drought Processes and Modelling

John Pomeroy, Kevin Shook, Robert Armstrong, Xing Fang, Lawrence Martz
Centre for Hydrology, University of Saskatchewan, Saskatoon

Hydrological drought in the Prairies is characterized by cold, arid winters and dry, warm summers. In the winter period, suppression of blowing snow by reduced snowfall results in reduced sublimation losses and vastly reduced blowing snow transport to potential snow drift locations. The restricted redistribution of snow in drought winters acts to reduce snowmelt water supply in poplar bluffs, ponds, wetlands and stream channels but has little effect on snow retention on cultivated fields. The result is greatly reduced recharge of ponds and wetlands and greatly reduced streamflow. It is speculated that this has a follow-on effect on restricting groundwater recharge. Meteorological drought recovery in a winter period (return to normal or greater snowfall) does not assure the end of hydrological drought the subsequent spring, as dry soil moisture from the preceding autumn will act to restrict spring runoff generation and favour unlimited infiltration to frozen soils. Evaporation in the summer is strongly controlled by soil moisture but in a deeper soil column than previously thought. Pasture grasses in drought draw upon relatively deep soil moisture reserves and so can continue to transpire after the top 40 cm of soil moisture is depleted to the wilting point. The spatial variability of volumetric soil moisture in the top 20 cm is smallest in drought conditions and greatest in moderately wet conditions. This change in spatial distribution may affect the areal estimates of evaporation and result in mean areas evaporation values that do not correspond with the evaporation estimated using mean inputs (soil moisture, radiation, wind speed, etc).

An evaluation of a blowing snow model at spatial scales from very fine (6 m) to relatively coarse landscape-based spatial units showed that snow redistribution in a prairie landscape may be accurately calculated using either fine or coarse spatial resolution and so lends itself to tiled land surface schemes. An evaluation of various evaporation calculation routines showed that the Penman-Monteith, Granger-Gray and Dalton types of routines performed similarly well in a drying period when compared to eddy correlation observations of evaporation. The reduced parameterization requirements of the Granger-Gray routine make it preferable for application in hydrological models. Hydrological models for small prairie stream and prairie wetland basins were created using the Cold Regions Hydrological Modelling platform (CRHM). The CRHM models performed well when evaluated against field observations of snow accumulation and streamflow at Bad Lake in SW Saskatchewan; snow accumulation and pond recharge at St Denis in east-central Saskatchewan and soil moisture during summer at Lethbridge. A comparison of the NCEP-NARR dataset for solar radiation to observations has shown that a simple correction makes this product suitable for hydrological modelling using these CRHM models. The next steps are to use these models to estimate the spatial and temporal development of various components of the hydrological cycle (runoff, soil moisture, evaporation, snow accumulation, snow redistribution) across the Prairies for the recent drought using a combination of NCEP and surface observations.

Precipitation of Southwestern Canada - Wavelet, Scaling, Multifractal Analysis, and Teleconnection to Climate Anomalies

Lead Auhtor: Thian Yew Gan
Other authors: Adam Kenea Gobena, Qiang Wang
Department of Civil and Environmental Engineering, NREF 3-033
University of Alberta

Low frequency fluctuations at decadal and higher time scales could give rise to extreme floods & droughts that bring severe damages & economic losses. Western North America experiences low-frequency climate variability partly because Pacific Ocean has sufficient storage for long-term memory. We (1) Identified the dominant oscillations of precipitation data from southwestern (SW) Canada and their temporal variations using wavelet; (2) Related detected precipitation signals to some large-scale teleconnection patterns found over the Pacific by frequency and time domain analyses; (3) Identified the scaling and multifractal properties of precipitation data; and (4) Addressed issues such as whether different precipitation time scales correspond to different teleconnection patterns, whether decadal or higher-level precipitation variations arise from climate dynamics that are separate from interannual or lower-level variations, & feasibility of precipitation predictions by teleconnection with climate indices.

A possible relationship between the Pineapple Express and Prairie Droughts

John Gyakum/McGill University
john.gyakum@mcgill.ca
Eyad Atallah and Alain Roberge/McGill University

Several varying flow regimes can result in dry conditions over the Canadian Prairies. Perhaps counter-intuitively, one such flow regime involves the significant transport of moisture from tropical to high latitudes along the North American West Coast, often referred to as Pineapple Express (PE) events. These events can often be accompanied by very warm and dry conditions in the Canadian Prairies as moisture is condensed over the Canadian Rockies due to adiabatic cooling resulting from the forced ascent of air. The resulting latent heat release acts to warm the air which subsequently descends onto the Canadian Prairies in a significantly warmer and drier condition then during its initial encounter with topography.

Large-Scale SST Patterns and Teleconnections Associated with the 1999 to 2005 Canadian Prairie Drought

Barrie Bonsal; Environment Canada/ University of Saskatchewan
Barrie.Bonsal@ec.gc.ca
Amir Shabbar, Environment Canada

Several studies have determined significant relationships between hemispheric to global-scale atmospheric and oceanic oscillations and climate anomalies over the Canadian Prairies. The main teleconnections that have been shown to affect Prairie climate include El Niño/Southern Oscillation (ENSO), the Pacific Decadal Oscillation (PDO), and the Pacific North American (PNA) pattern. Strongest links occur during the cold season and are generally less robust during summer. However, some analyses have indicated that persistence of a North Pacific sea-surface temperature (SST) pattern consisting of anomalously cold water in the east-central North Pacific and anomalously warm water along the west coast of North America often leads to extended summer dry spells on the Canadian Prairies. This SST pattern is consistent with the PDO-related inter-decadal mode of variability. In addition, a significant lagged relationship between winter ENSO and the Atlantic Multi-decadal Oscillation (AMO) and summer PDSI values over the Prairies has been determined. This presentation summarizes current knowledge regarding relationships between teleconnections and drought-related climate on the Prairies. Large-scale characteristics associated with the 1999 to 2005 Canadian Prairie drought including global SST anomalies, North American soil moisture anomalies, and major teleconnection indices (ENSO, PDO, PNA, NAO, AO, AMO) are then presented. The talk concludes with an outline of directions for future research to better quantify relationships between large-scale teleconnections and the Canadian Prairie drought of 1999 to 2005.

Large-scale Teleconnections associated with Canadian Summer Drought

Amir Shabbar, Environment Canada
Amir.Shabbar@ec.gc.ca
Walter Skinner, Environment Canada

Canadian summer Palmer Drought Severity Index variations and winter global sea surface temperature (SST) variations are examined for the 63-year period 1940 to 2002. Extreme wet, and extreme dry Canadian summers are related to anomalies in the global SST pattern in the preceding winter season. Large-scale relationships between summer PDSI patterns in Canada and previous winter global SST patterns are then analysed using singular value decomposition (SVD) analysis. The robustness of the relationship is established by the Monte Carlo technique, in which the time expansion of the primary EOF analysis is shuffled 1000 times.
It is found that the interannual El Niño-Southern Oscillation (ENSO), the Pacific Decadal Oscillation (PDO), and the interrelationship between the two play a significant role in the determination of the summer moisture availability in Canada. These Pacific ocean processes are reflected in the second and third SVD modes and together explain approximately 48% of the squared covariance. The first SVD mode strongly relates to the trend in global SSTs and multidecadal variation of the Atlantic SST, explaining approximately one-third of the squared covariance. It is reflective of both the warming trend in the global southern oceans and the influences of the Atlantic Multidecadal Oscillation (AMO) variability. The six-month lag relationship between the PDSI and large scale SSTs provides a basis for developing long-range forecasting schemes for drought in Canada

Canadian Prairie Drought: Climatology, Mechanism and Monitoring

E.R. Garnett Agro-Climatic Consulting, Winnipeg, Mb.
ergarnett@shaw.ca
C.E. Haque[2], M.L. Khandekar[3]
[2] Natural Resources Institute, University of Manitoba,
Winnipeg, Manitoba.
[3] Consulting Meteorologist
Toronto, Ontario

Large-scale atmospheric circulation patterns, primarily driven by the sea surface temperature (SST) distribution over the equatorial Pacific as well as over the central and eastern North Pacific appear to be the most important driving forces behind drought over the Canadian prairies. The cold (La Niña) phase of the El Niño/Southern Oscillation phenomenon appears to be the most important precursor. Single year droughts such as 1961 and 1988 may have been influenced, in part, by remote forcing from the Asian monsoon system. Studies have delineated a western versus eastern split over the Canadian prairies in which the eastern prairies appear less impacted by SSTs than the western prairies. The Dust Bowl years are a case in point.

A recent study by Garnett *et al* in 2006 reveals that high sunspot activity, an easterly phase of the Quasi-Biennial Wind Oscillation (QBO) and heavier than normal North American snow cover in seasons leading up to the summer months also contribute to low summer rainfall.

Appropriate monitoring of various large-scale atmospheric/oceanic indices can provide useful guidance for forecasting future drought with a lead-time of two to four months. An empirical procedure of accumulating monthly values of ENSO, PNA, and other indices has proven useful in skillfully forecasting summer weather over the Canadian prairies. (e.g. PNA acc. vs. June-July temperature, r = .49 significant at the 0.1% level). As initiated by Garnett *et al* in 1998, including various teleconnection indices and other factors into a regression scheme could improve the prediction of May-July precipitation, temperature and hence grain yield over the Canadian prairies.

References

Garnett, E.R., Khandekar, M.L. and Babb, J.C. 1998. On the Utility of ENSO and PNA Indices for Long Lead Forecasting of Summer Weather over the Crop-Growing region of the Canadian Prairies. *Theoretical and Applied Climatology* 60: 37-45.

Garnett, E.R., Nirupama, N., Haque, C.E. and Murty, T.S. 2006 Correlates of Canadian Prairie summer rainfall: implications for crop yields. *Climate Research* Vol. 32: 25-33

Khandekar, M.L. 2004 Canadian Prairie Drought: A Climatological Assessment
A report for Alberta Environment.

Understanding the response of groundwater to drought and increasing demands

Masaki Hayashi
University of Calgary

Groundwater level in aquifers tends to decrease during prolonged droughts and increase afterwards, and is also affected by anthropogenic effects such as pumping and landuse change. However, very few studies have been conducted in the Canadian Prairies to investigate the mechanistic linkage between atmospheric drought and groundwater. We propose to use a coupled model of land-surface exchange processes and groundwater to tackle this problem. In the West Nose Creek watershed near Calgary, we have set up a densely spaced network of groundwater monitoring wells and two instrumented sites for water and energy flux measurements. We will use the data from these study sites to examine the feedback between meteorological drought and groundwater drought, as part of our efforts to understand the sustainability of groundwater under wet-dry cycles of climate and increasing water use.

Seasonal Forecasting: current state and future directions

George Boer, CCCma
Environment Canada
George.Boer@ec.gc.ca

The current Canadian operational seasonal forecasting system has grown out of a modest collaborative effort involving climate and weather models and researchers in government and the universities. The result is purely objective, 2-tier, multi-model, 1-season deterministic and probabilistic 3-category forecasts for Canada with accompanying skill measures. The forecast system is based on the Canadian CLIVAR HFP2, the second Historical Forecasting Project, consisting of a suite of 10-member retrospective forecasts for the 35-year period 1969-2003 produced with each of four different models. HFP2 data for selected variables is available on the CCCma website.

The predictive skill of the results and the possibility of enhancing skill through various post-processing approaches is being studied. In general, seasonal temperature anomalies may be predicted with some skill but skill in predicting precipitation is low and approaches to drought prediction based on seasonal forecasts must take this asymmetry into account.

The future direction of this research is part of the Global Ocean-Atmosphere Analysis and Prediction (GOAAP) project involving coupled ocean and atmosphere analysis and prediction for weather and climate. Part of this effort is a "CHFP", analogous to HFP2, but using a coupled atmosphere/ocean model and making multi-seasonal predictions.

Soil Moisture Analysis and the Seasonal Forecast of Drought

Charles Lin / McGill University and Environment Canada
charles.lin@ec.gc.ca
Lei Wen, Rabah Aider, Jacques Derome / McGill University

We use two land surface models (VIC, CLASS) in stand alone mode to simulate land surface properties, including soil moisture. The studies are first conducted over China, where data for forcing the model and verification of results are available. Having verified the modelling methodology and simulation results over China, we apply VIC over the Liard Basin in the Mackenzie River Basin, and the three Canadian Prairie provinces. Over the Liard Basin, VIC calibration (1994-99) and validation (1975-2001) are performed using observed hydrographs at Fort Simpson. We have also set up VIC over the Prairie provinces, at a resolution of 0.25° by 0.25° latitude/longitude. Allowance for non-contributing areas is made by stopping the simulated interflow from contributing to runoff in these regions. Calibration and validation are done over 11 catchments. The Nash scores obtained are good. A Soil Moisture Anomaly Percentage Index (SMAPI) has been calculated over the Prairies for the period January 1950 to December 2005, and the results are available on the DRI website (www.meteo.mcgill.ca/~leiwen/vic/prairie). We have also started to examine the seasonal forecasts from the Historical Forecast Project (HFP) over North America; HFP is a CLIVAR project and is led by Jacques Derome of McGill University and George Boer of CCCma. We investigate the skill in mean monthly forecasts of GCM3 (coupled to CLASS) of HFP2 (phase 2 of HFP) for the period 1969-2003 over North America, focusing on the 500 hpa geopotential height, precipitation and soil moisture. Temporal correlations are calculated for each month's forecast, with observational values taken from the NCEP global reanalyses for verification. Preliminary results will be presented.

Sensitivity of Seasonal Climate Forecasts to Realistic Initialization of Land Surface Hydrological States

Aaron Berg. Dept. of Geography, University of Guelph
aberg@uoguelph.ca
Gordon Drewitt, Dept. of Geography, University of Guelph

This presentation will give a brief overview of a funded proposal to the Global Ocean-Atmosphere Prediction and Predictability (GOAPP) working group. This project will examine the sensitivity of the CCCma GCM to initialization of the land surface hydrological states. A central theme of the proposed work will explore the importance of soil moisture as a boundary condition in the CCCma coupled climate model. Of interest to the DRI will be a case study to examine the importance of land surface initialization during the 2001-2002 drought. This experiment will compare precipitation and 2-metre air temperature forecasts archived in the Historical Forecast Project (HFP2) to simulations of the CCCma GCM conducted using realistic representations of the initial land surface state.

Data Management Planning

Steve Williams
Earth Observing Laboratory (EOL)
National Center for Atmospheric Research (NCAR)
Boulder, CO USA

The NOAA Climate Prediction Program for the Americas (CPPA) mission is to improve operational intra-seasonal to inter-annual hydroclimatic predictions for the Americas with quantified uncertainties sufficient for making informed decisions. One of the CPPA projects focuses specifically on drought research, particularly, to identify the contributions of anomalous boundary forcing and climate anomalies to the initiation, intensification, and demise of persistent droughts over North America. The EOL provides data management support to the CPPA and works closely with CPPA scientists to identify data requirements for meeting scientific objectives. A brief description of these data services and drought research activities (both in CPPA and other U.S. Agencies) will be summarized.

The development and maintenance of a comprehensive and accurate data archive is the legacy and a critical step in meeting the scientific objectives of a project. The overall guiding philosophy for any data management strategy is to make the completed data sets easily available to the scientific community as soon as possible following the project's analysis phase. There are critical data management steps (i.e. considerations) necessary in the planning and execution of a project and these will be described to help in the development in the follow-on DRI data planning process. Data management examples from various field projects (and lessons learned) will be presented.

A Data Access Interface (DAI) and Data Integration Facility using Google Earth
McGill - GEC3

Patrice Constanza, McGill University
constanza.patrice@ouranos.ca

We describe a web-based Data Access Interface (DAI) developed through a partnership among the Global Environmental and Climate Change Centre based at McGill University, the Climate Change Scenarios Network of Environment Canada, DRI, and the Ouranos consortium on regional climate change and impacts based in Montreal, Canada. Weather and climate data from different sources (e.g., the North American Regional Reanalysis, different global and regional climate models, weather stations for Canada and northeast US) are available for members. Most of the data are downloaded and stored at a central facility located at Ouranos with tape and robot access capability. Access to the data by members of the partner organizations is through an electronic registration procedure, and an additional data protection step in case of proprietary data. We have also implemented Google Earth as a data integration and visualization facility where environmental data from different sources are geo-referenced and overlaid with the local geography. Support will be offered to members to use this tool. The DAI facility provides an integrated and standardized framework to access weather and climate data for research and teaching

Vegetation and soil moisture response to drought conditions in Prairies derived from MODIS and AMSR-E satellite observations and modeling

A.P.Trishchenko, CCRS, NRCan
trichtch@ccrs.nrcan.gc.ca
S.Wang, A.Komarov, Y. Luo, K.Khlopenkov, W.M.Park, CCRS/NRCan

The CCRS team is producing the surface reflectance and NDVI from MODIS land bands B1-B7 at 250m spatial resolution and 10-day intervals since 2000. An update on the development of satellite time series of surface properties from MODIS for 2007 will be presented. New elements include fusion of 250m and 500m channels to improve spatial resolution, better cloud and shadow detection, new approach for compositing – two-value compositing scheme, and new bi-directional reflectance model. Analysis of vegetation index and precipitation indicated that 2007 was rather dry year for the Prairie region relative to 2005 and 2006. The beginning of regular operations with MERIS full-resolution (275m) data at CCRS Prince Albert and Gatineau receiving stations opens a good new opportunity for near-real time monitoring of vegetation conditions in Prairie region.
Analysis of modeling results and AMSR-E/AQUA satellite retrievals of soil moisture has been conducted. Modeling results from the CCRS EALCO model and the North American Regional Reanalysis indicate that the soil moisture in the surface upper layer (e.g., top 5-cm) is general poorly correlated with soil moisture in the deeper root-zone layers. This challenges the direct applicability of satellite soil moisture observations using the high frequency measurements from AMSR-E, because a small penetration depth and vegetation impact. New satellite systems such as European Space Agency's Soil Moisture and Ocean Salinity (SMOS) to be launched in 2008 and future NASA planned mission Soil Moisture from Active Passive (SMAP) measurements will provide an improved capabilities for soil moisture mapping from space, as they will operate at longer wavelengths and better spatial resolution.

Atmospheric Moisture Data from Canadian GPS Stations

Susan Skone (University of Calgary
L. Hill and N. Nicholson (University of Calgary)
sskone@geomatics.ucalgary.ca

The Global Positioning System (GPS) signals experience delays in the neutral atmosphere, with the resulting range errors being dependent on the atmospheric water vapour. This ranging error can be translated into a measure of precipitable water vapour (PWV) overlying a given GPS receiver, and high resolution estimates of PWV can be derived from a network of GPS sites. In this presentation, GPS data from a network in southern Alberta are examined and long-term signatures associated with climate are identified. Comparisons with local numerical weather predictions are also shown, and current initiatives to derive a near real-time database for Canada are discussed – with potential application in drought research and monitoring.