Opportunities for new global insights on groundwater – ecosystem (or land use – hydrology) interactions

San Luis – Friday Nov 16 2007

General Goal
Achieve a common view of major challenges and opportunities on GW-ecosystem interactions

Specific aims
- Introduce people and their driving questions, study systems, and research tools
- Identify major knowledge gaps and interesting opportunities for progress in our general (global) knowledge of GW-ecosystem interactions
- Define possible lines of actions on a 2 year time frame

Meeting Report

Attendees
Roxana Aragón, Gervasio Piñeiro, Sergio Contreras, Marcelo Nosetto, Carla Rueda, Germán Baldi, John Kim, Rob Jackson, Esteban Jobbágy

Brief Presentations
Jobbagy – Intro
Contreras – GW contributions in the desert
Santoni (by Jobbágy)– Deep drainage and salt transport in dry forest / agriculture
Nosetto – GW-veg interactions in (sub)humid plains
Aragon – Regional GW/surface water dynamics in the pampas-remote sensing tools
Kim – Encroachment: vadose moisture & Cl in NA and SAfr, plans for Argentina
Jackson – Ecohydrology for science and society: opportunities
Brief presentations by the rest of the GEAs (Marchesini, Rueda, Baldi)

Discussion topics (potential projects)

TOPIC 1
Groundwater contributions to ecosystem productivity: Global assessment of its magnitude in natural and irrigated situation.

Proposed Goals: Assess GW availability globally, explore its influence on NPP and vulnerability of production to climate change

Approaches
A. Baseline NPP(NDVI) – MAP relationship from which residuals are derived. These residuals indicate extra water supply. Instead of NPP based on NDVI we could use ET estimates and explore balance shifts directly. Other tools along this line: atmospheric vapour from MODIS.
B. Identify areas that given their landscape, topography, parent material, etc. are likely to display strong GW effects. These areas should show both sources and sinks of GW. A way to explore this is to map areas that full the conditions for sources and sinks and have hydrological connectivity

C. Leave the idea of a full coverage of the globe and focus on a good collection of comparative gradients like the one in Telteca replicated in other continents. These would get better if we have both irrigated and natural GW-fed situations
D. Grace may help to find areas where GW is being consumed fast (long term negative trends). Other expected signals? We had discussion of Roxana´s findings comparing a GW coupled zone of the Pampas with one that has deep water tables (Inner + Flooding Pampas vs. Rolling Pampas).

Interesting things to address:
NPP enhancement, GW use efficiency,
Discrimination of natural vs. irrigated systems

GW of endogenous vs. exogenous origin was compared (e.g. Pampas vs. Telteca). The role of the first as a buffer and not so much a net subsidy was highlighted. Endogenous GW is likely to impact on temporal NPP variability (cuts it) and spatial (enhances it) in opposite ways.

Fossil GW was considered as a special case with impact only in irrigated systems but not in natural ones

TOPIC 2
Exploration of large scale impacts of land use change through the "reality" filter of economic models

Goal: Explore large scale impacts of LUCs such as afforestation or ag expansion based on plausible scenarios of their coverage in the continent (This scale of analysis may show up unexpected and "cool" feedbacks). Plausible scenarios are driven by economic models such as FASOM

Discussion on how well coupled are LUCs to the market (varying degrees of coupling to the market may exist). Possible decoupling due to public investment / infrastructure lags. Social structure (self sufficient farming vs. agribussines). Land tenure issues such as land rental and "pooles de siembra". Role of technological "accidents" such as RR soybean show-up. Even considering all these limitations, the market-driven model could provide a valuable scenario that is more plausible than one that has an arbitrary allocation of land uses.

Bruce McCarl could start this type of exploration in the plata basin

TOPIC 3
Feedbacks in the Pampas system (Flooding – Use & ET – Rainfall)

Biological feedback on flooding: regulation and acceleration of flooding and the effects of plant, ecosystem, and land use "traits"

Feedbacks on rainfall. Convective storms and the effects of lakes, forestry, and defforestation

TOPIC 4

Limitations to GW consumption at depth

Actual limits – Why forests in telteca resemble a “miserable” dry forest of 300 mm/yr instead of “vigorous” rain forest of 1200 mm/yr?

Should we review the max depth of GW uptake? Something happens when GW is below 5-10 m…. (but oaks can get GW at 18 m in the caves….)

Hypotheses for GW uptake limitaiton

- Rigid root allocation
- Nutrient limitation
- High VPD
- Establishment (trade-off between drought tolerance and high water use)
- Oxygen limitation
- Gravitational potential
- Freequent disturbance