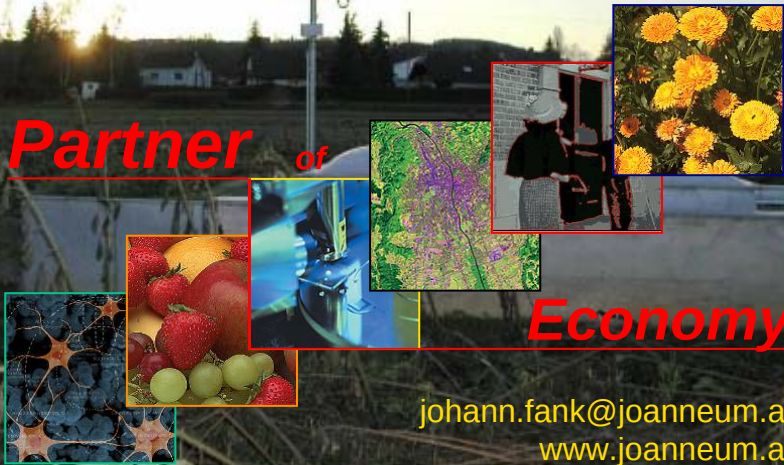




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Diffuse Inputs into the Groundwater Monitoring – Modelling – Management

Agriculture and Water Management in the Light of Future Challenges

Requirements on Soil- and Groundwater Hydrology Research to Satisfy Future Challenges on Agriculture and Groundwater Protection

Johann FANK

January, 31st 2007

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Water Resources Management
Hydrogeology and Geophysics

Diffuse inputs into the groundwater:

Monitoring - Modelling - Management

Agriculture and water management in the scope of future challenges

from January 29 to 31, 2007
in Graz, Austria

The long-term protection of the groundwater - and therefore our potable water - can only take place in interaction of agriculture, water management, ecology and economy. The basis for the decision-making in planning are numerical models for the investigation of water movement and nutrient transport; these models are calibrated using specific regional data.

Topics

- Diffuse inputs into the groundwater and their quantitative prediction
- Economical, sustainable and groundwater protective agricultural management systems
- Outlook of measuring and modelling parameters of the hydrologic cycle
- Excursion to southern and eastern Styria (research station Wagna, water supply Grenzland Süd-Ost)

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We are endepted to our partners for their cooperation and our sponsors

- JOANNEUM RESEARCH Forschungsgesellschaft
- Competence Network Water Resources Waterpool (Austria)
- Wasserversorgung (Water Supply) Grenzland Süd-Ost (Styria, Austria)
- Styrian Chamber of Agriculture (Austria)
- UMS GmbH Munich - measure to know (Germany)
- Styrian Government (Austria)
- Kulturvermittlung Steiermark (Styria, Austria)

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Future Requirements

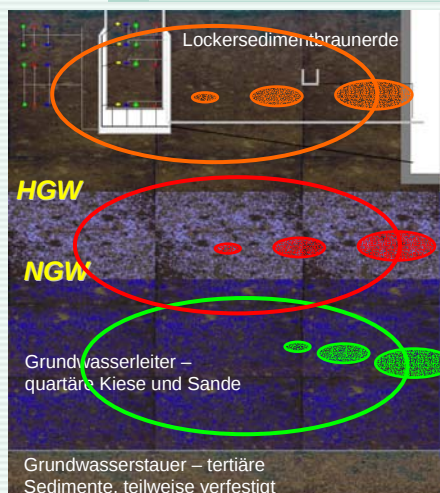
- **Process Research** to predict the distribution of solutes from diffuse sources in the groundwater using
- **Coupled Models** taking into account Atmosphere, Soil, Unsaturated Zone and Groundwater
- **Global Change** and the impact on the Water Cycle
- **Agricultural activities on Energy Production** and their effects on groundwater quantity and quality
- **Development of model based tools (DSS)**
 - ➔ To optimize the use of fertilizers taking into account different soil properties, meteorologic conditions, and economic needs
 - ➔ As well as needs on groundwater protection to ensure drinking water supply

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Process Research



Intensive Investigations on the processes in the soil over the last decennies

There is research need on the processes in the capillary fringe and the groundwater amplitude

Long term investigation of the groundwater system led to a high standard of knowledge

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Tillage on two lysimeter plots (2000 – 2005)

	Parzelle 14 (FF)		Parzelle 18 (MM)	
	Kultur	N - Gabe [kg/ha]	Kultur	N - Gabe [kg/ha]
2000	Gerste	113	Mais	93
2001	Kürbis	83	Mais	120
2002	Mais	102	Mais	102
2003	Mais	120	Mais	117
2004	Getreide	0	Lein	38
2005	Kürbis	0	Kürbis	56

- Since 2002 identic.
N – Fertilizer on Plot 14 lower (2004/2005)
- Differences in cropping systems 2000/2001
high amount of N - fertilizer at barley and pumpkin

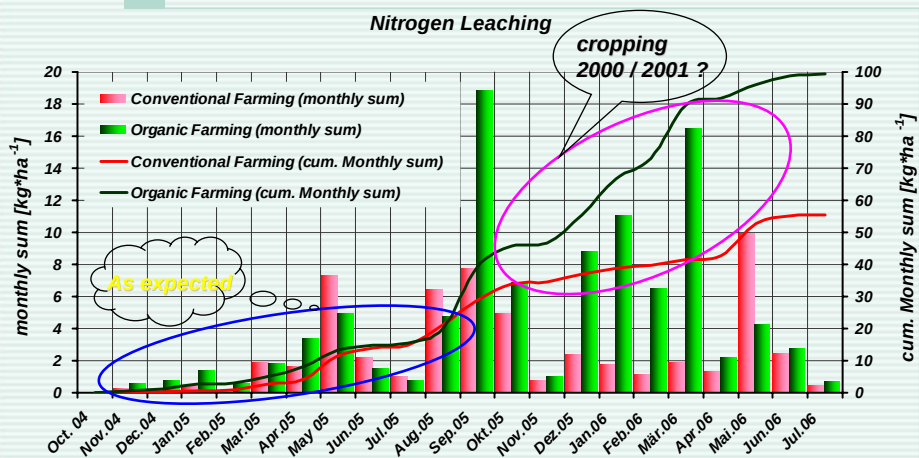
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Nitrogen leaching to groundwater



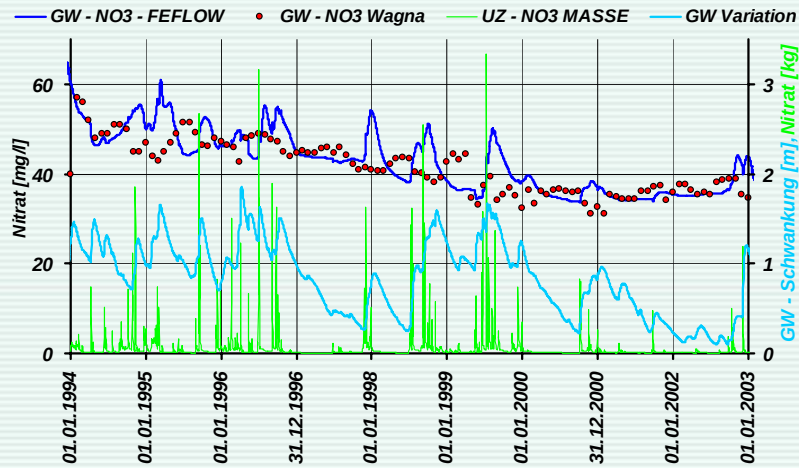
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Model coupling



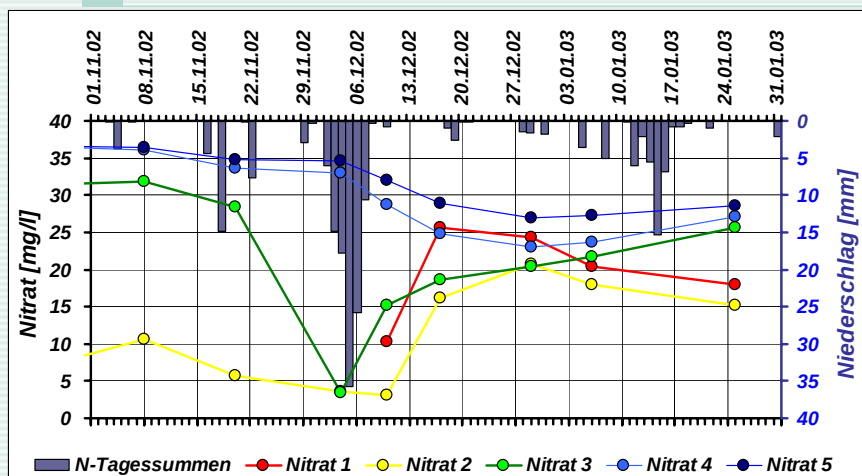
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Nitratkonzentration (Tiefenverteilung) im Verlauf eines Neubildungsereignisses (Dez. 2002)



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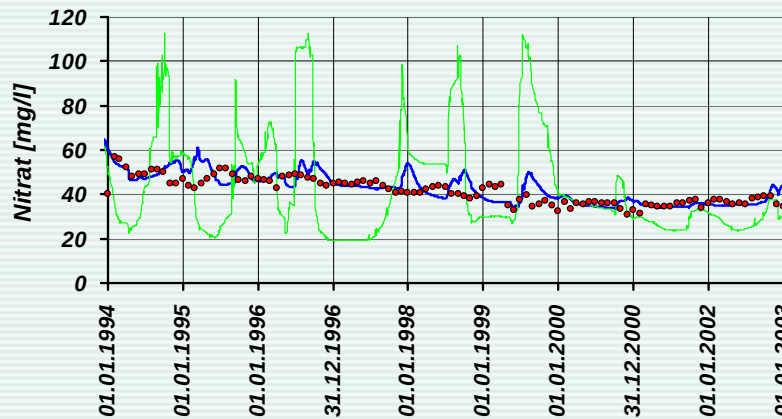
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Interpretation of Concentration Data

— GW - NO₃ - FEFLOW • GW - NO₃ Wagna — UZ - NO₃ KONZ.



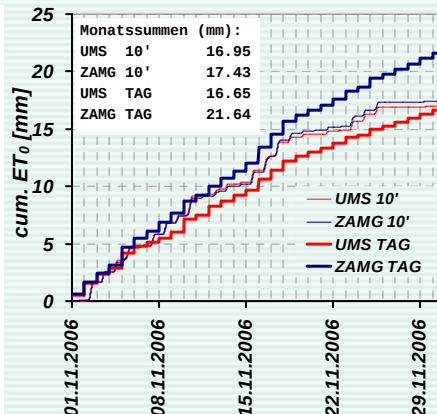
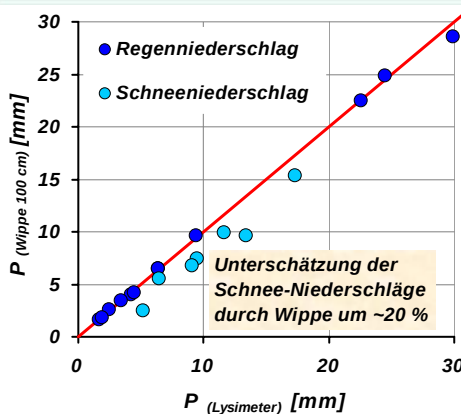
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Global Change and the impact on the Water Cycle



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Agricultural activities on Energy Production

Probe Material	KON Probe 1 Maiskolben u. Blätter	KON Probe 2 Maiskörner	Summe Mais
Trockengewicht [kg]	1.338	0.815	2.153
Ernte- (Nass)gewicht [kg]	3.577	1.245	4.822
Wassergehalt [kg]	2.239	0.429	2.669
Stickstoff (Kjehldahl) [g/100g]	1.090	1.690	2.780
[kg/kg]	0.011	0.017	0.028
[kg/ha]	145.832	137.782	283.614
Phosphor [g/100g]	0.170	0.330	0.500
[kg/kg]	0.002	0.003	0.005
[kg/ha]	22.744	26.904	49.649
Kalium [g/100g]	1.110	0.360	1.470
[kg/kg]	0.011	0.004	0.015
[kg/ha]	148.508	29.350	177.858
Calcium [g/100g]	0.450	0.010	0.460
[kg/kg]	0.005	0.000	0.005
[kg/ha]	60.206	0.815	61.021
Kohlenstoff (Asche) [g/100g]	94.400	98.500	192.900
[kg/kg]	0.944	0.985	1.929
[kg/ha]	12629.872	8030.493	20660.366

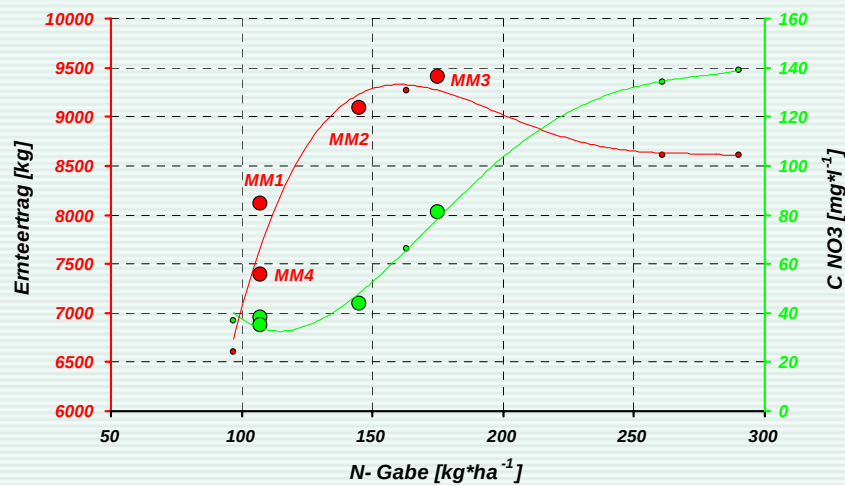
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Development of model based tools (DSS)



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