IWAS

Internationale WasserforschungsAllianz Sachsen

Präzise Quantifizierung der Grundwasserneubildung als Schlüsselgröße des Ressourcen-Managements in ariden Gebieten

C. Siebert, T. Rödiger, J. Friesen,
C. Schüth, A. Kallioras

2. IWAS- Statuskolloquium

KUBUS – Leipzig, 15. April 2011

TECHNISCHE UNIVERSITÄT DRESDEN

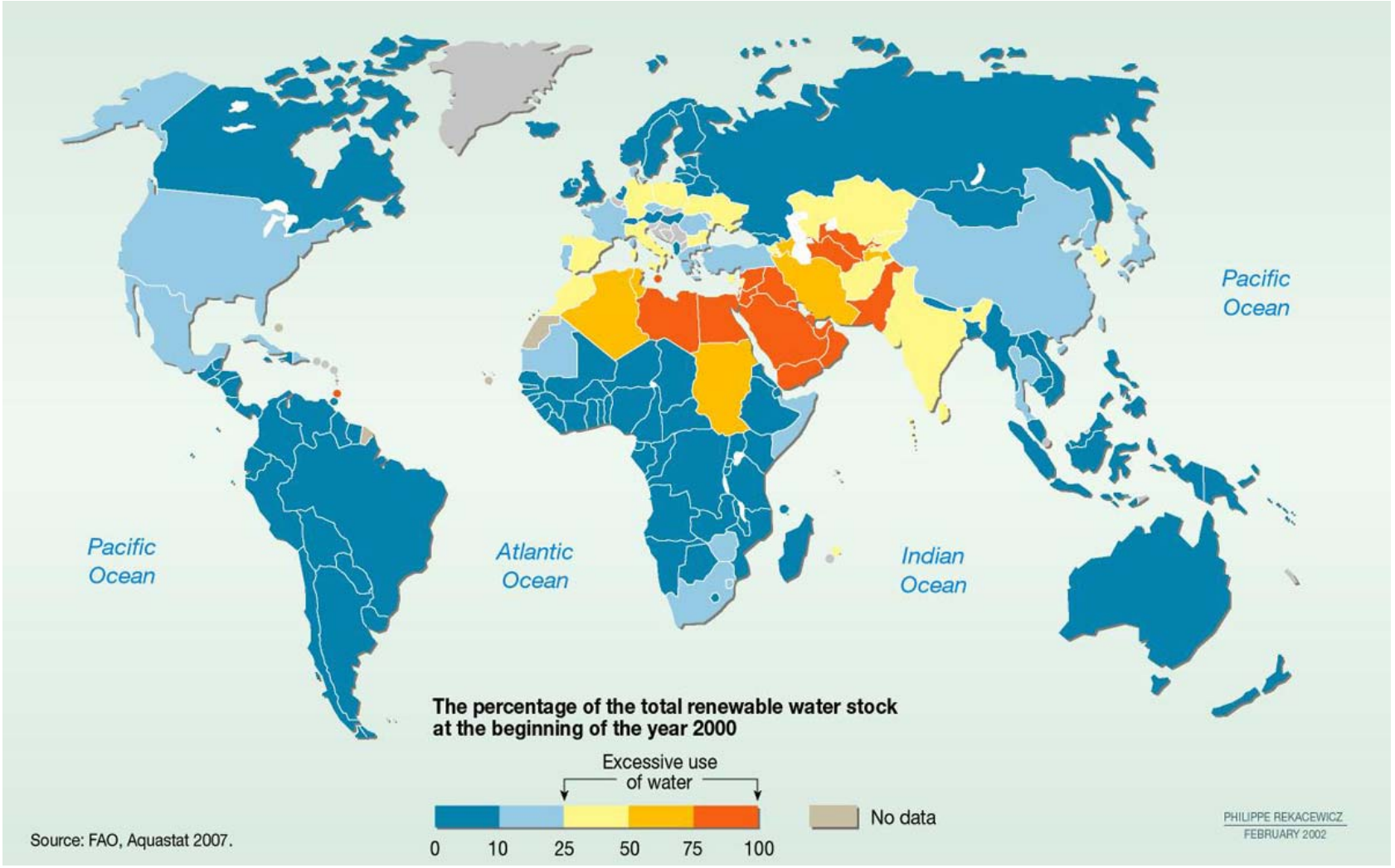
HELMHOLTZ ZENTRUM FÜR UMWELTFORSCHUNG UFZ

Stadtentwässerung Dresden
WIR KLÄREN DAS FÜR SIE

DREBERIS

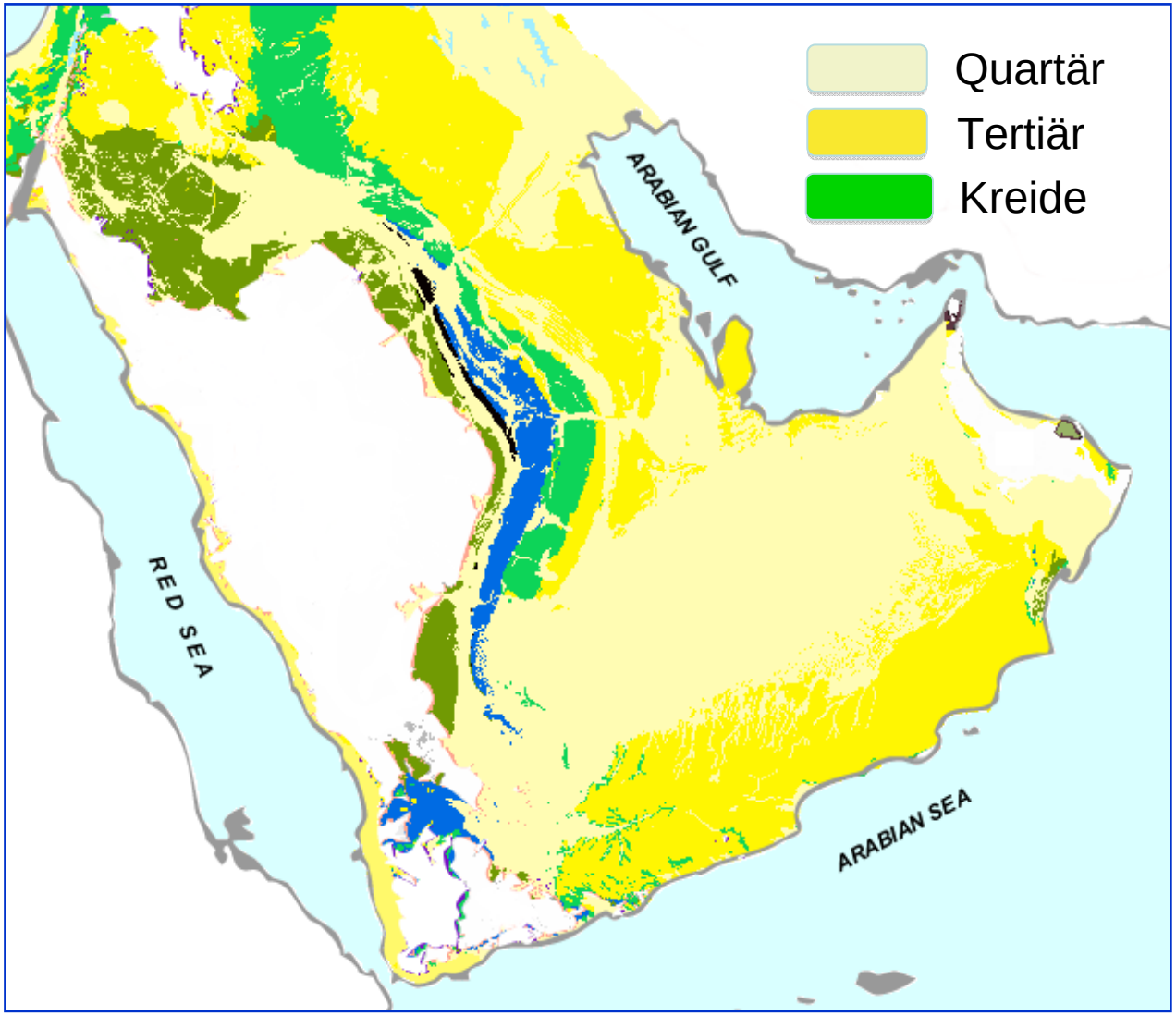
Gefördert vom
Bundesministerium für Bildung und Forschung

Wie erneuerbar sind erneuerbare Ressourcen?



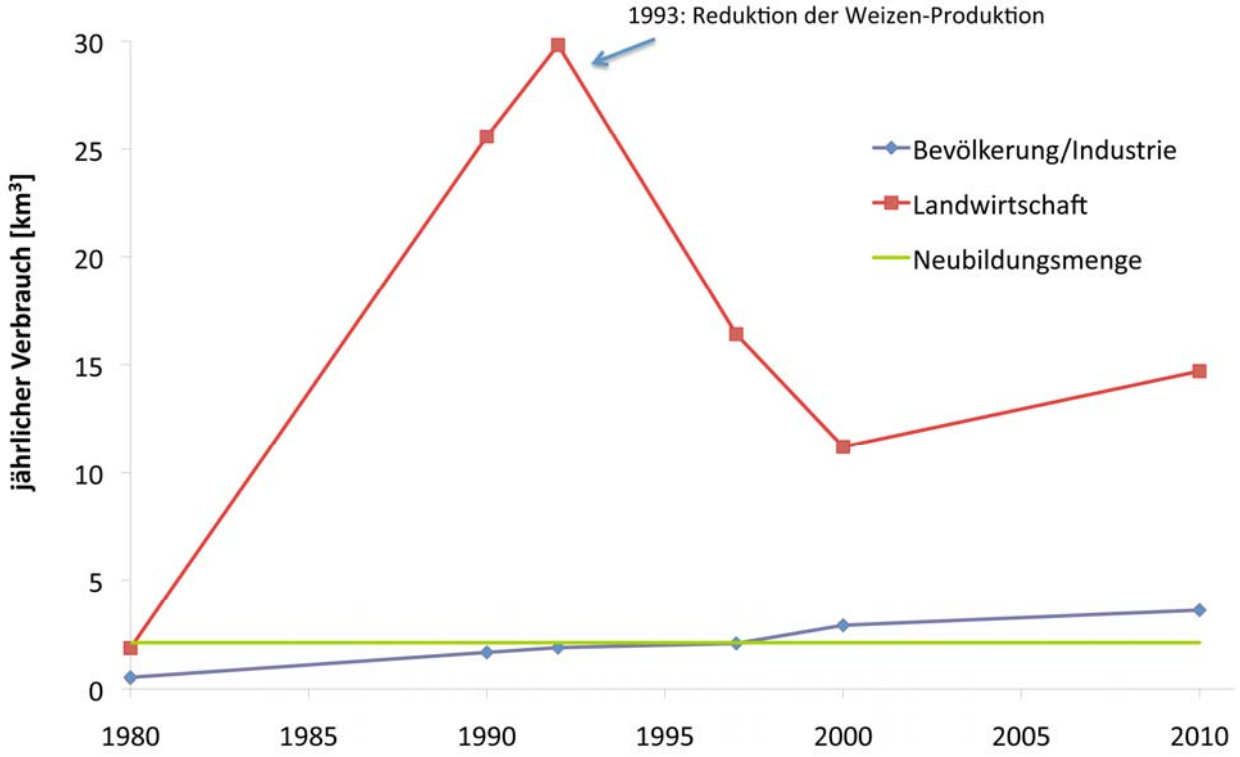
IWAS

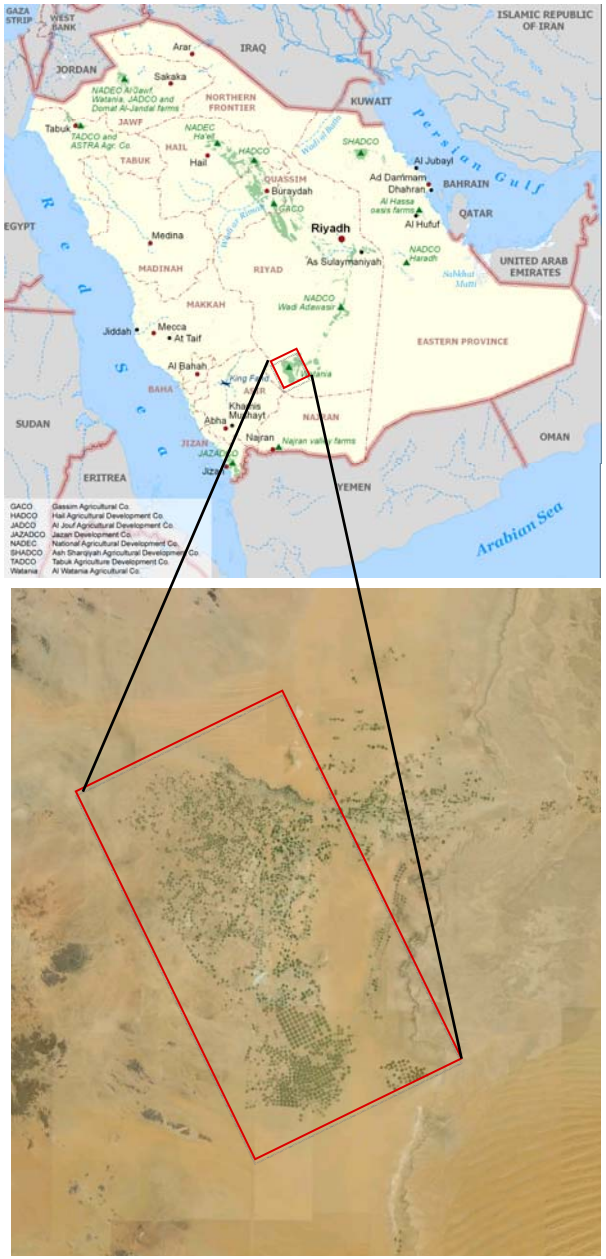
Upper-Mega-Aquifer: 500-2500 km³ Wasser



IWAS

Verbrauch: nur 10 % erneuerbar?





Modellierung der Grundwasserneubildung

Rainfall

Space-Time Precipitation Simulator (BARDÒSSY 2005) using ground based precipitation gauges, climatology and satellite information

SCS Unit-Hydrograph (HEC-HMS)

Runoff

Evapotranspiration

Calculated PENMAN ET_{POT} (UNEP 2002) using measured meteorological point-data and minimum curvature regionalization-method

Infiltration

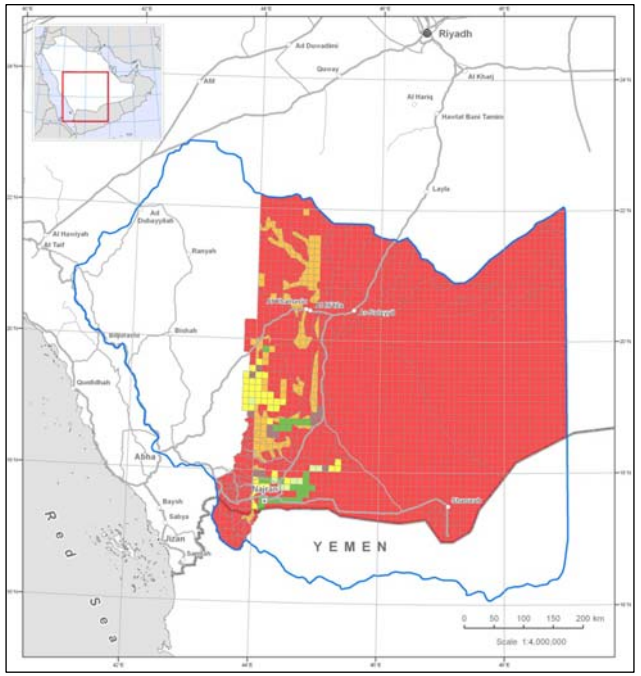
Soil-Moisture-Accounting (HEC-HMS)

Bed Infiltration

Infiltration loss depending on discharge (HEC-HMS)

Open Channel Flow

MUSKINGUM-CUNGE approach for channels (HEC-HMS)



Recharge [mm/a]

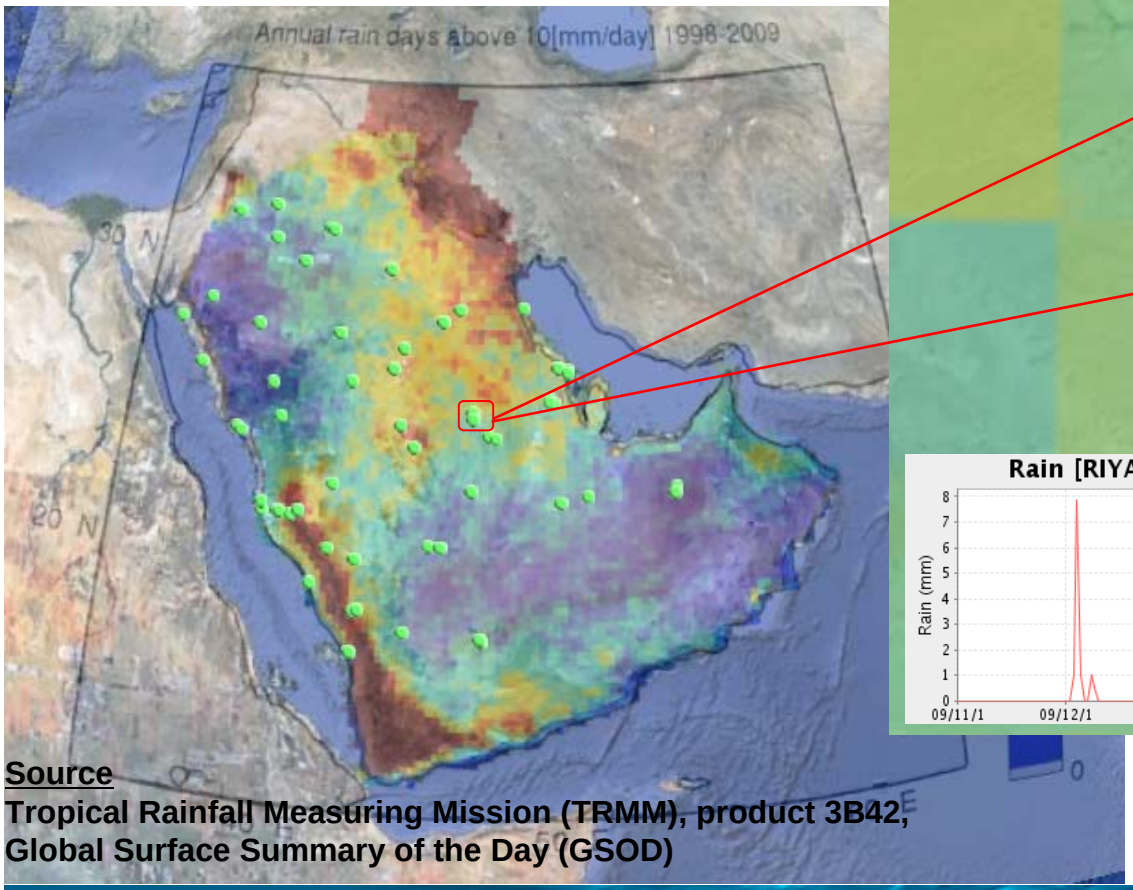
- 0 - 2,5
- 2,5 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- > 20

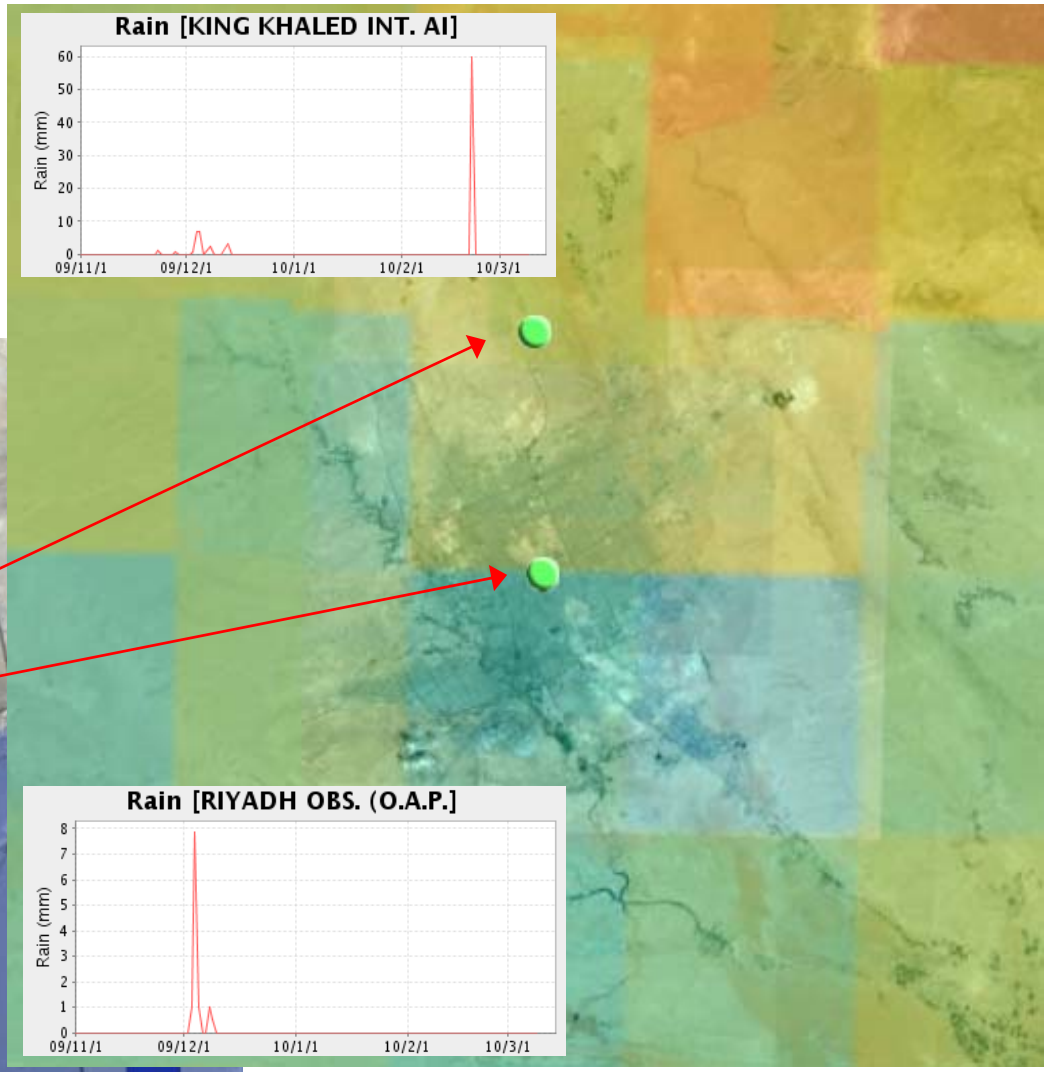
IWAS

Klima-Observation

Observationsdaten:

- Netz aus Stationen zu grob
- hoher Messfehler
- hohe räumliche Variabilität

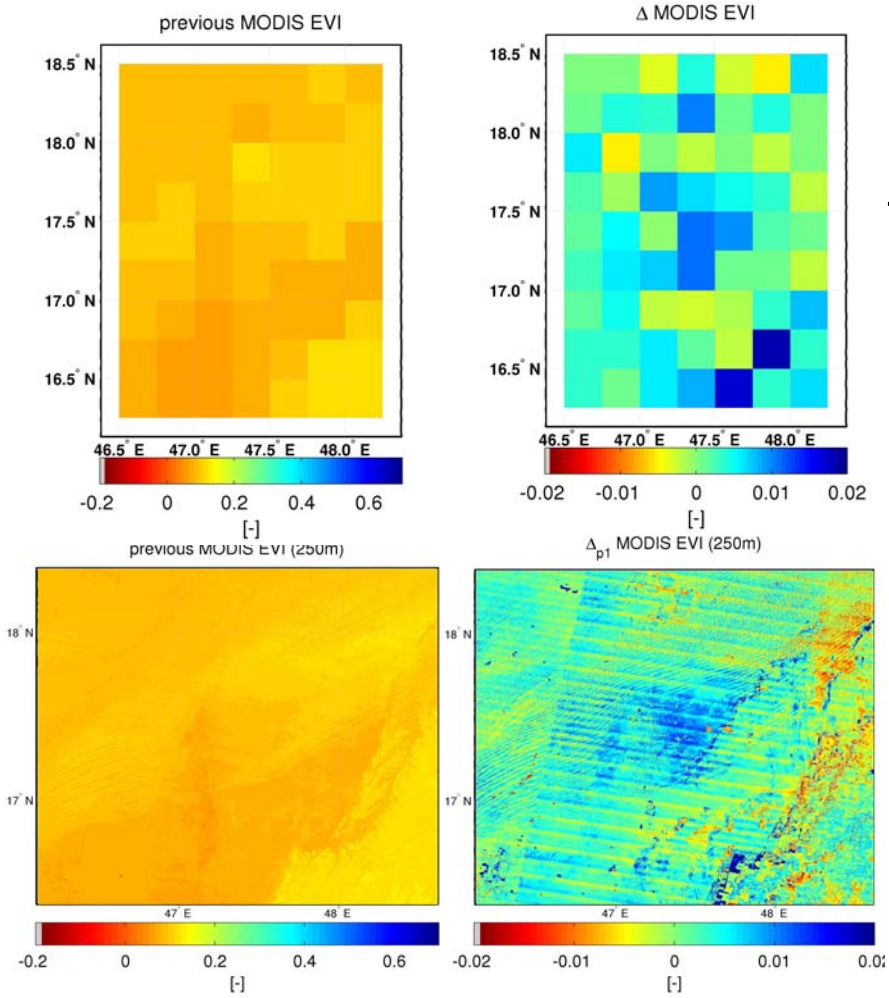




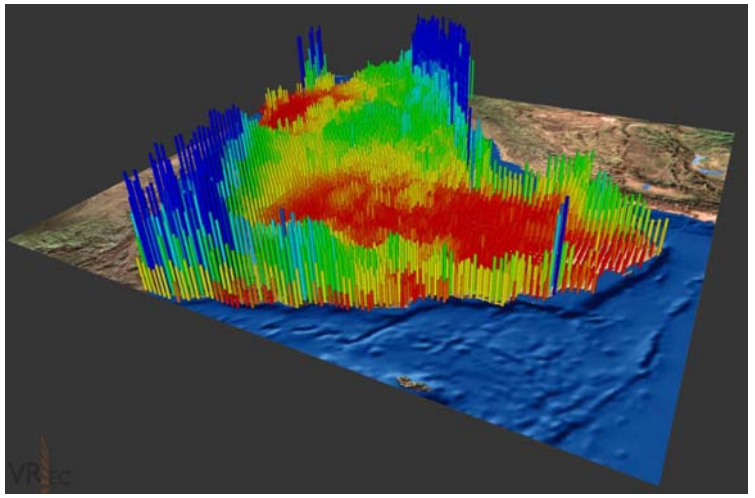
Source
Tropical Rainfall Measuring Mission (TRMM), product 3B42,
Global Surface Summary of the Day (GSOD)

IWAS

Validierung: Veränderung der Landoberfläche



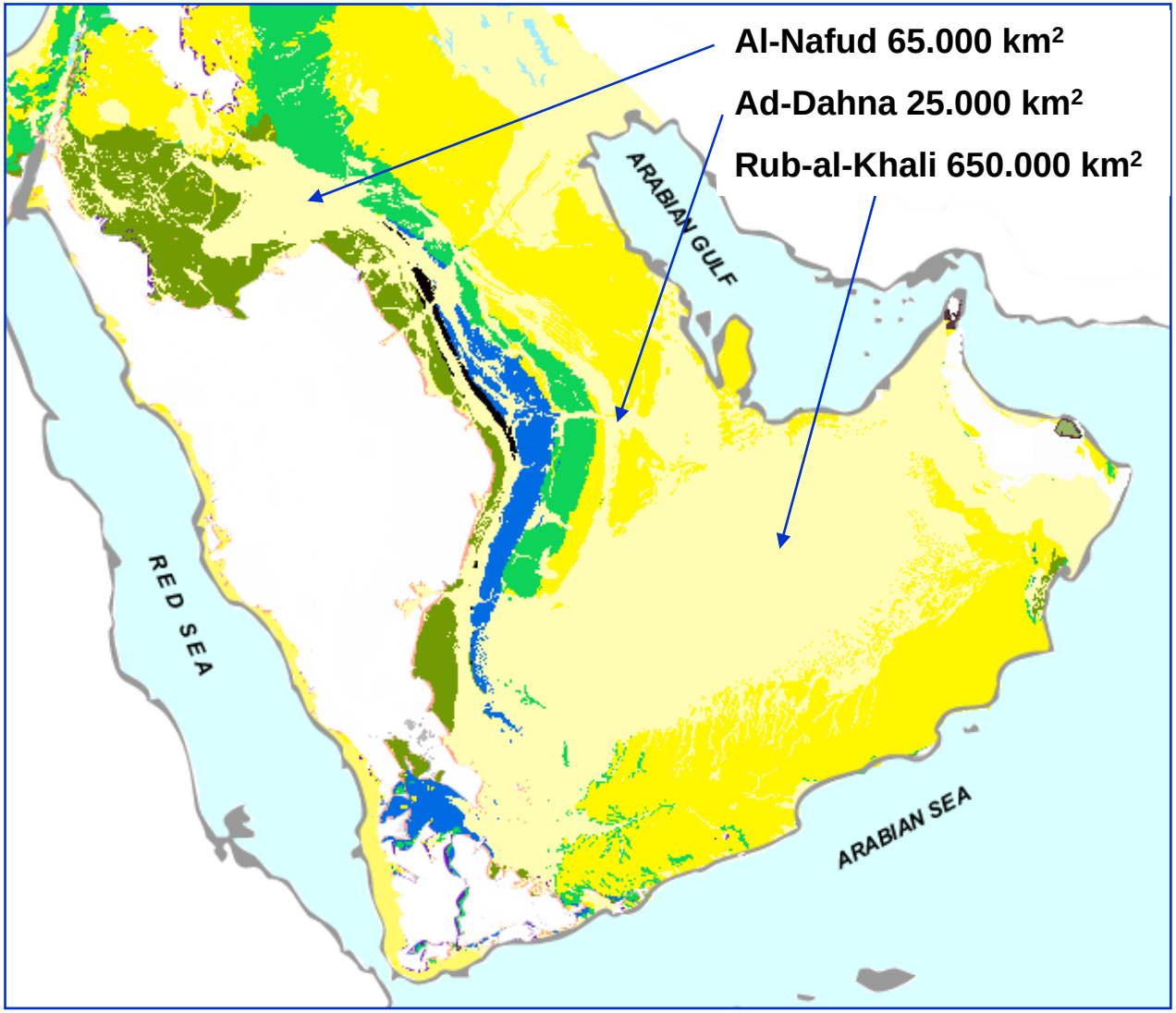
25 km
TRMM resolution

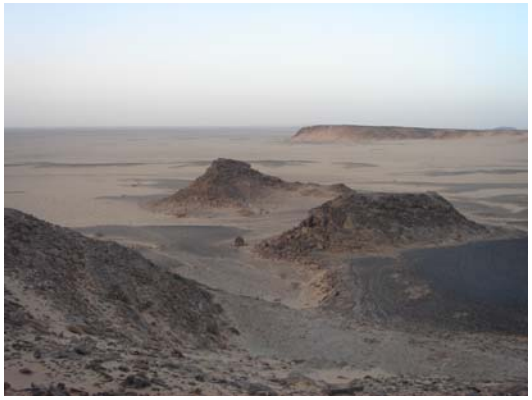


250 m
MODIS resolution

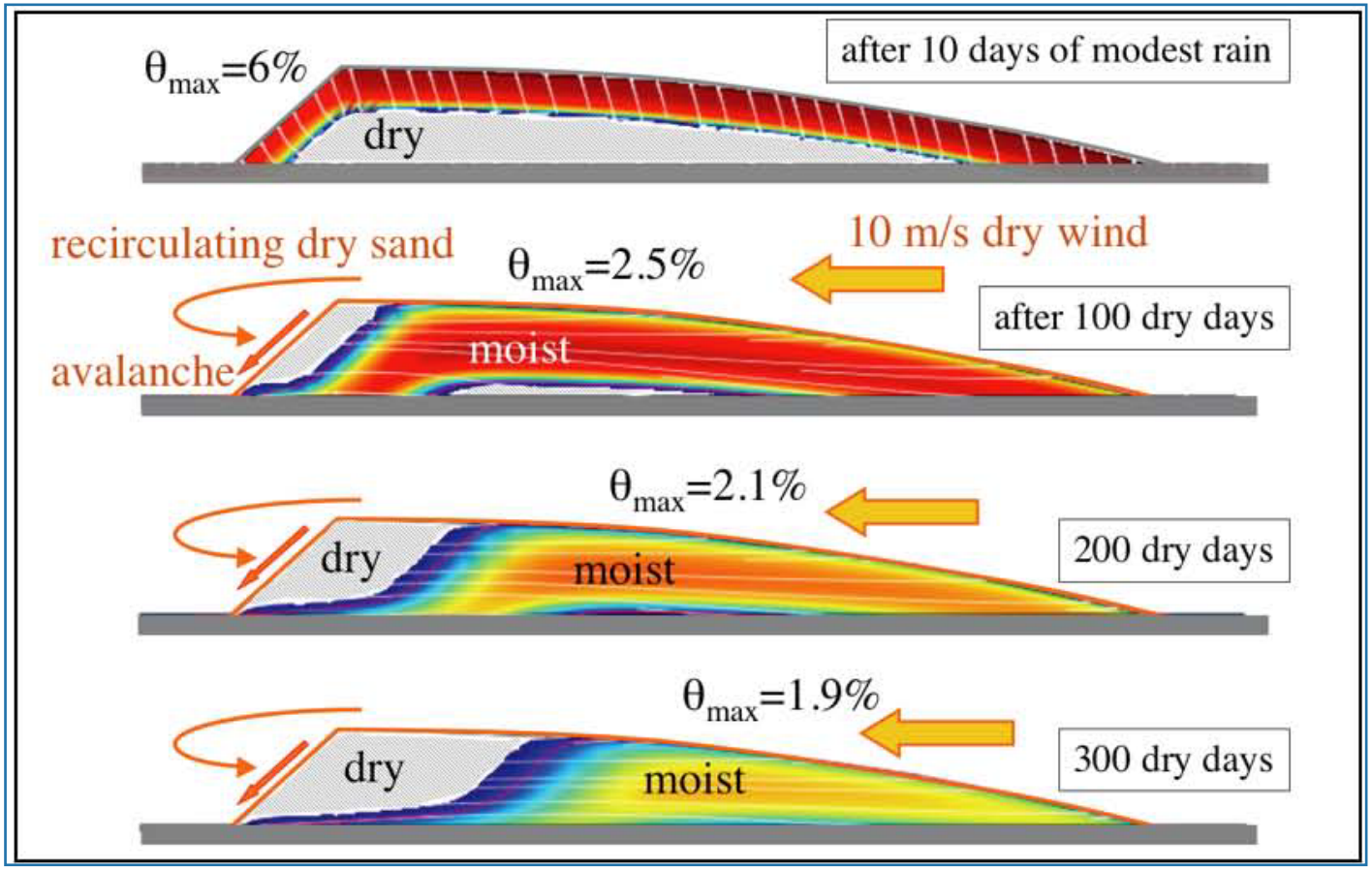
Source
Tropical Rainfall Measuring Mission (TRMM), product 3B42,
Moderate Resolution Imaging Spectroradiometer (MODIS), product 13Q1

Neubildung in 740.000 km² Sand



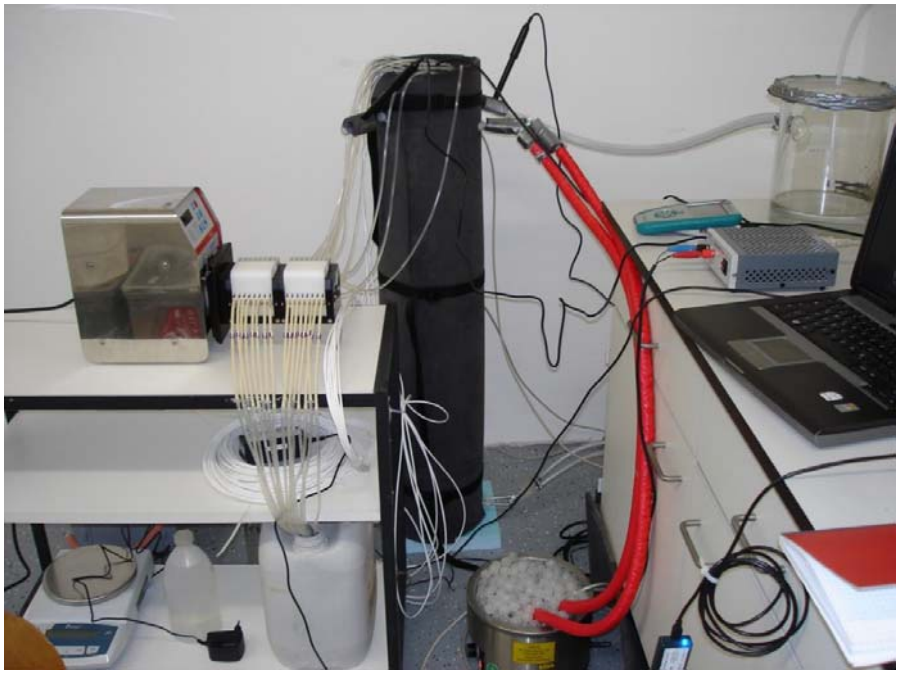


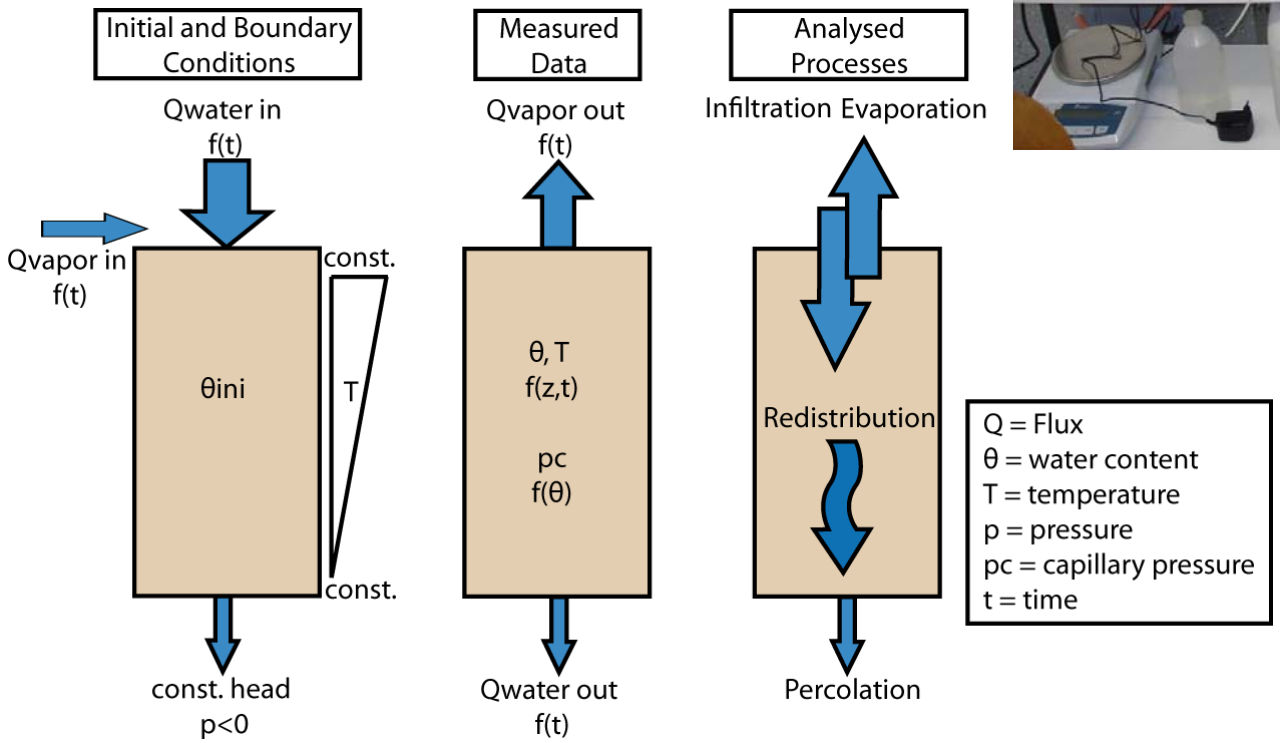
Findet Neubildung unter ariden Bedingungen statt?



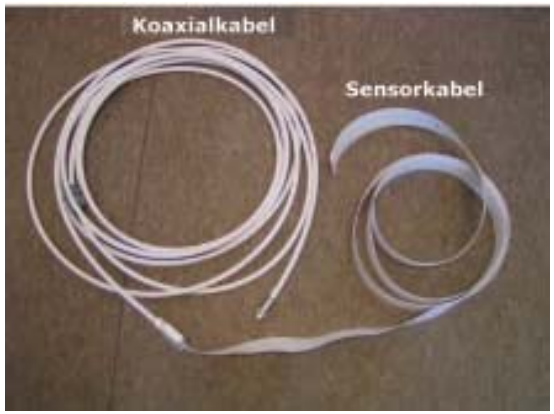
Cornell Univ. 2011

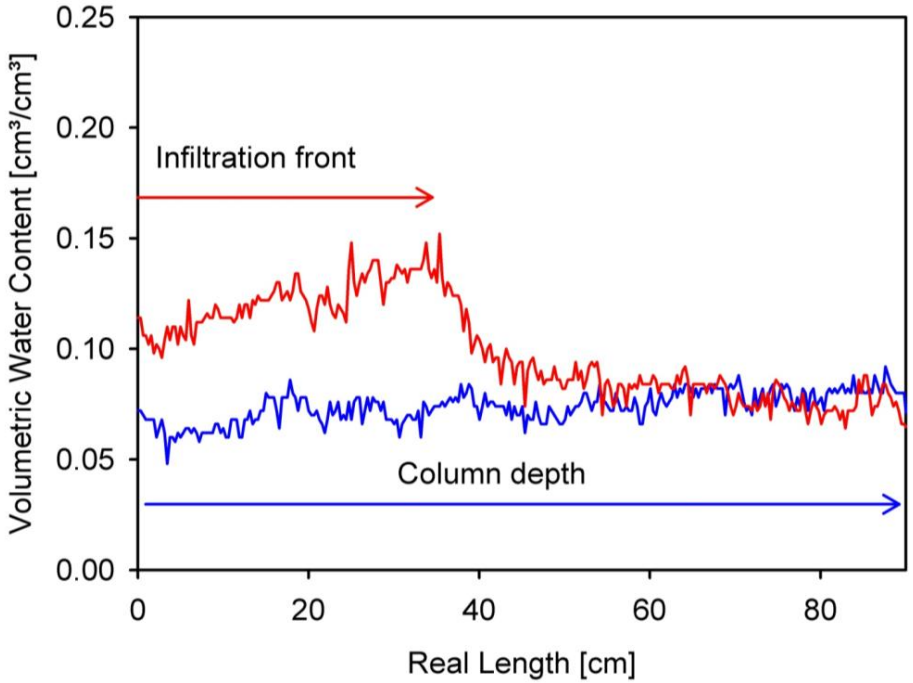
Laborskala

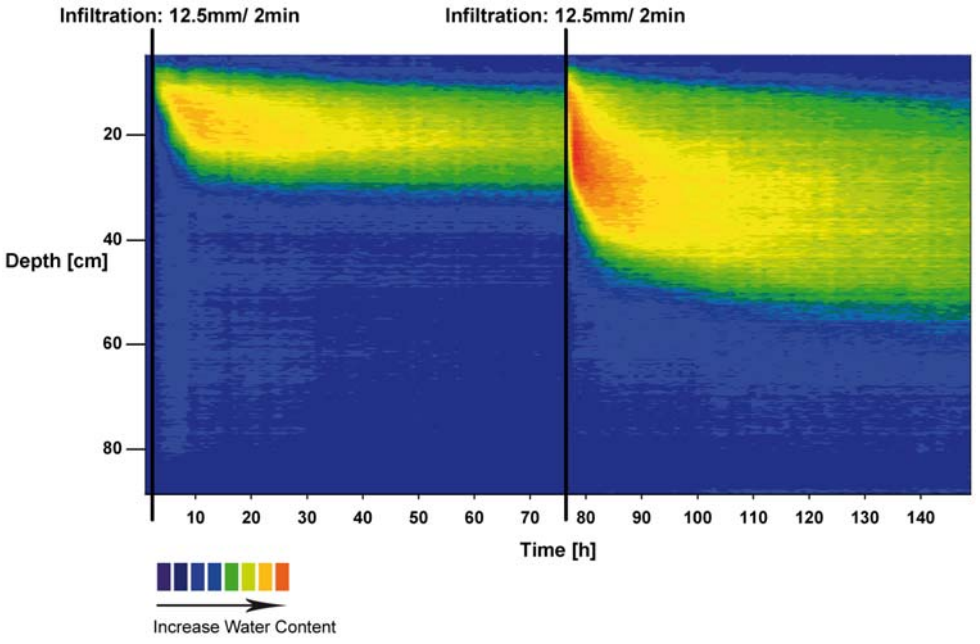



Initial and Boundary Conditions
Measured Data
Analysed Processes
Qwater in f(t)
Qvapor out f(t)
Infiltration Evaporation
Qvapor in f(t)
const.
θini
T
const.
θ, T f(z,t)
pc f(θ)
Redistribution
Q = Flux
θ = water content
T = temperature
p = pressure
pc = capillary pressure
t = time
const. head p<0
Qwater out f(t)
Percolation

TDR-Sensorik

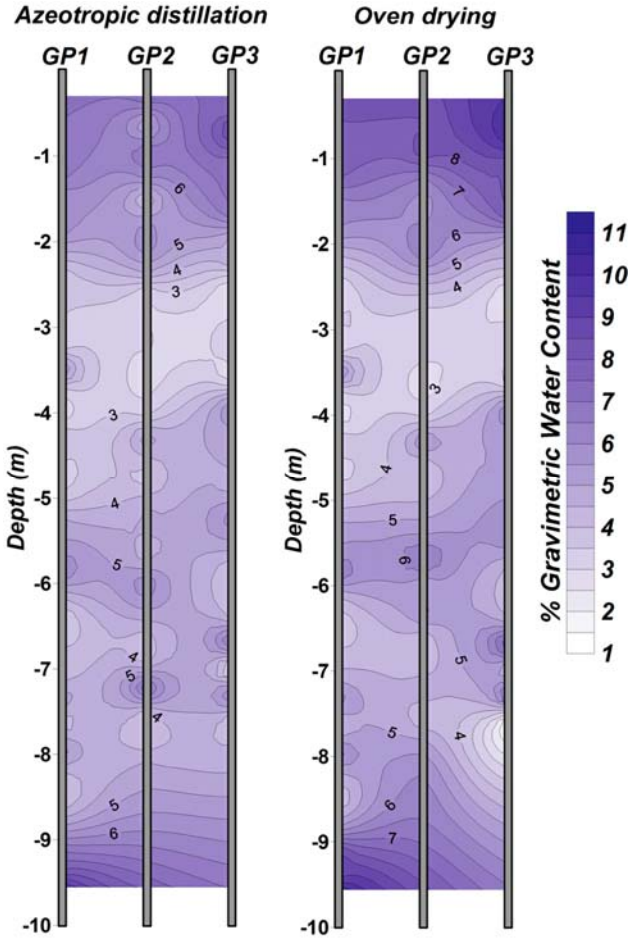






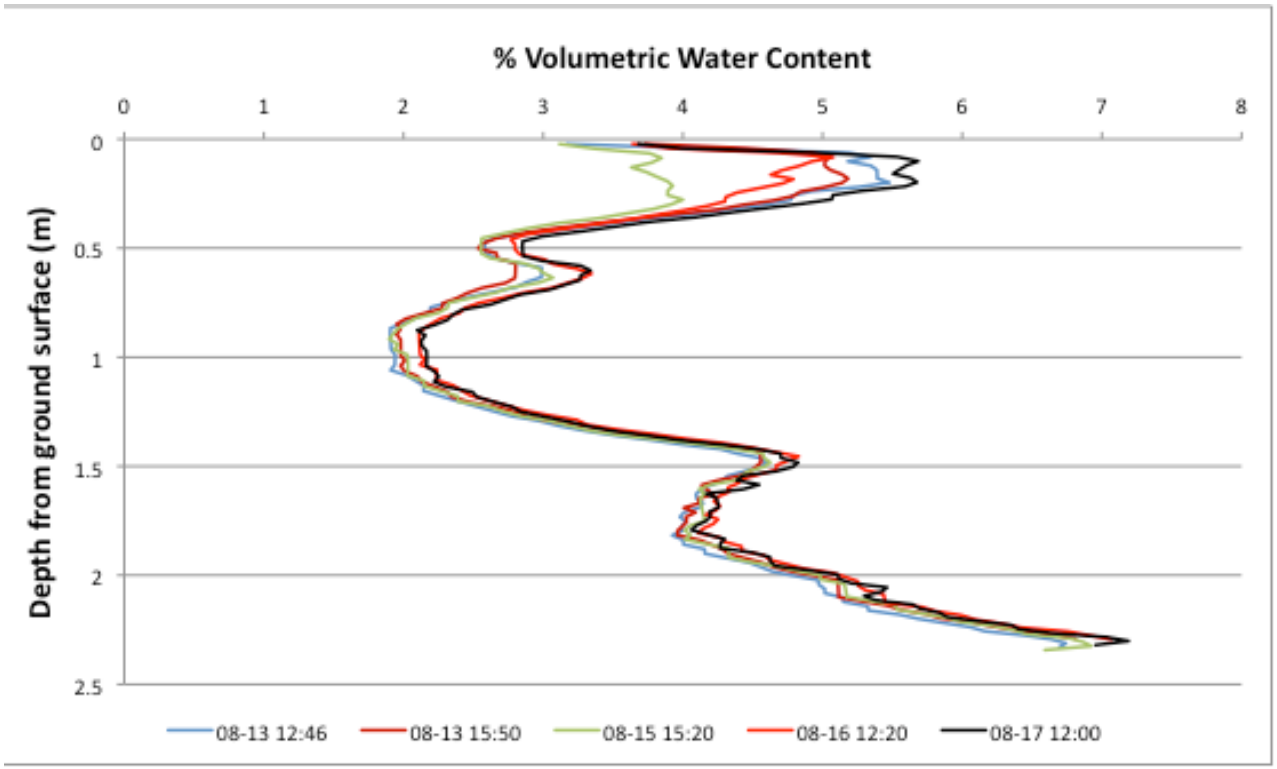
IWAS

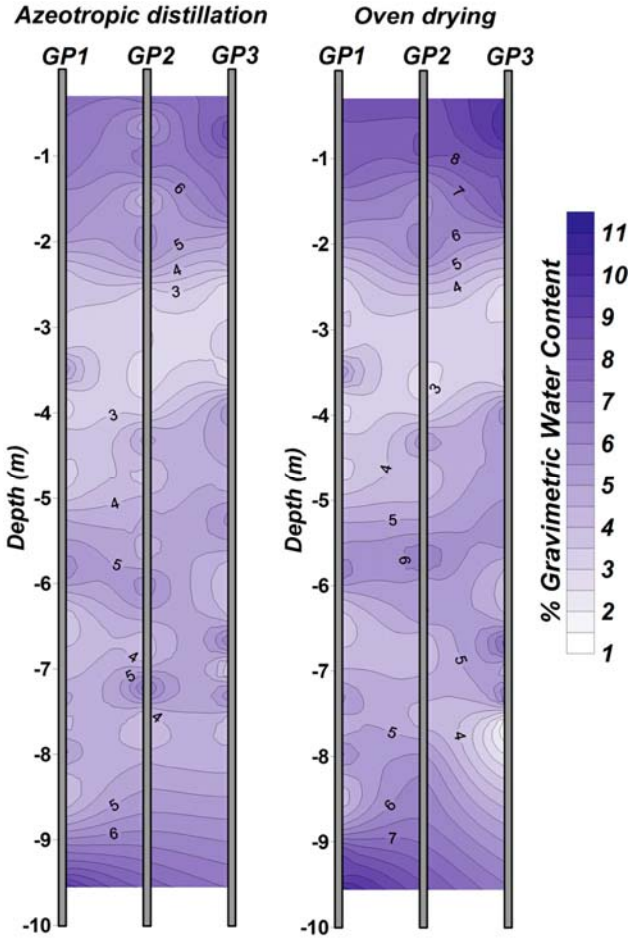
Feldskala: Test



Feldskala: Kalibration

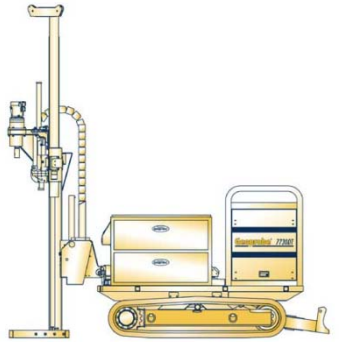
TDR-Signal umgerechnet auf Vol-% Wasser-Gehalt





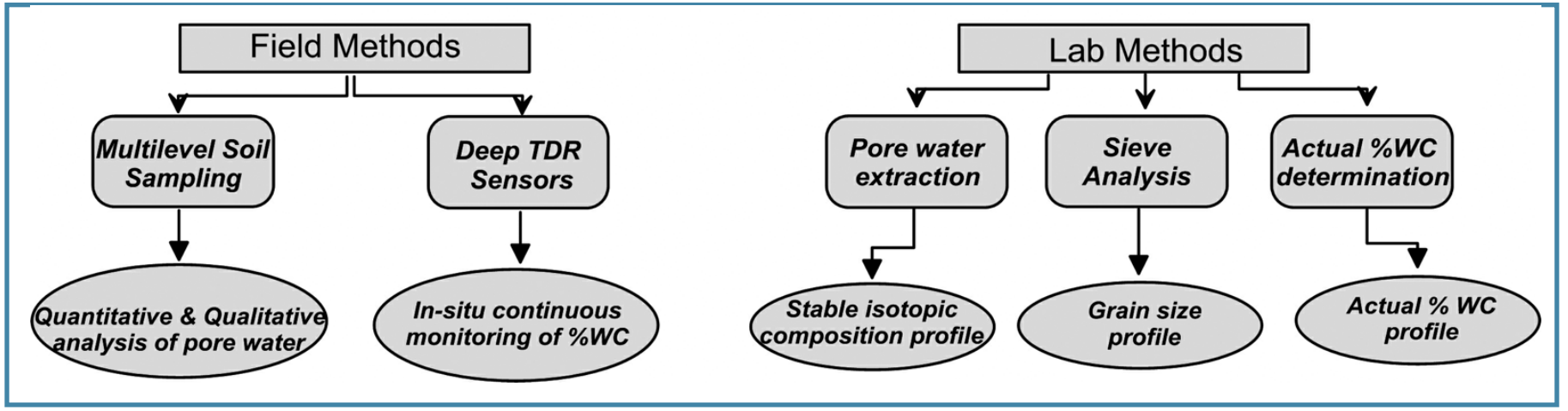
Feldskala: Arabische Halbinsel

Untersuchungen in der ungesättigten Zone

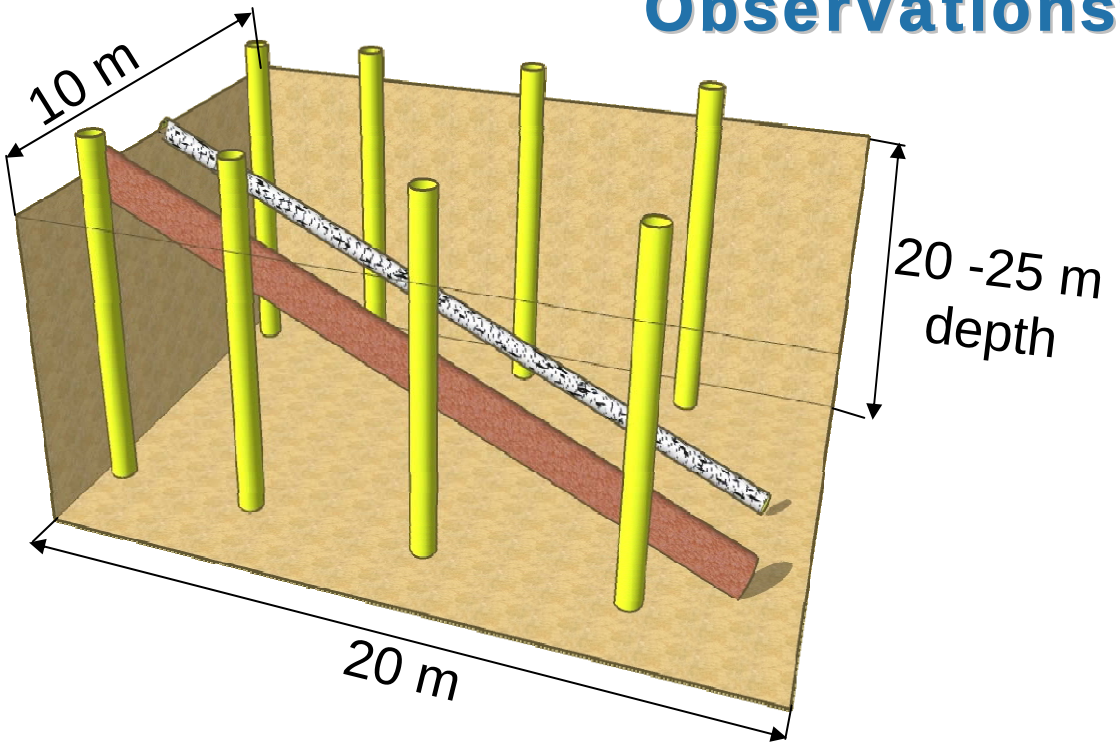


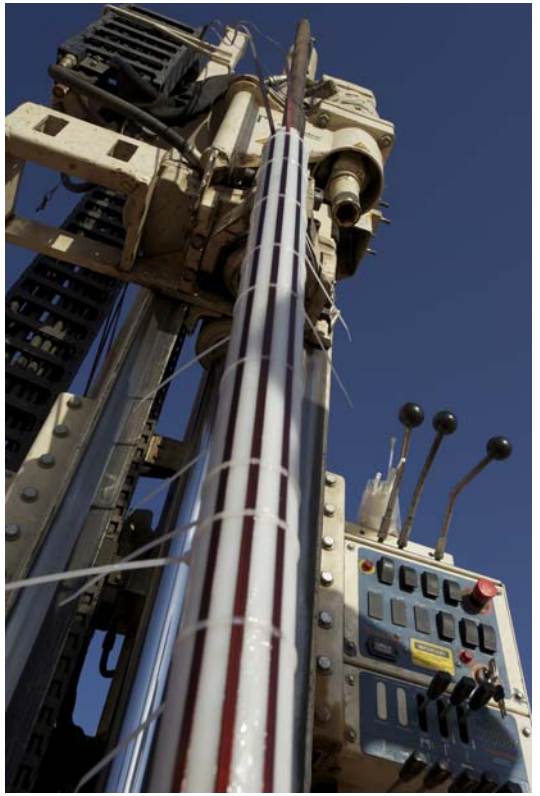
- hoch auflösende, ungestörte Bodenproben
- Bestimmung der Wasserchemie und des Wassergehaltes
- Installation der Sensoren und Geräte für die Langzeit-Beobachtung und Beprobung de Porenwassers

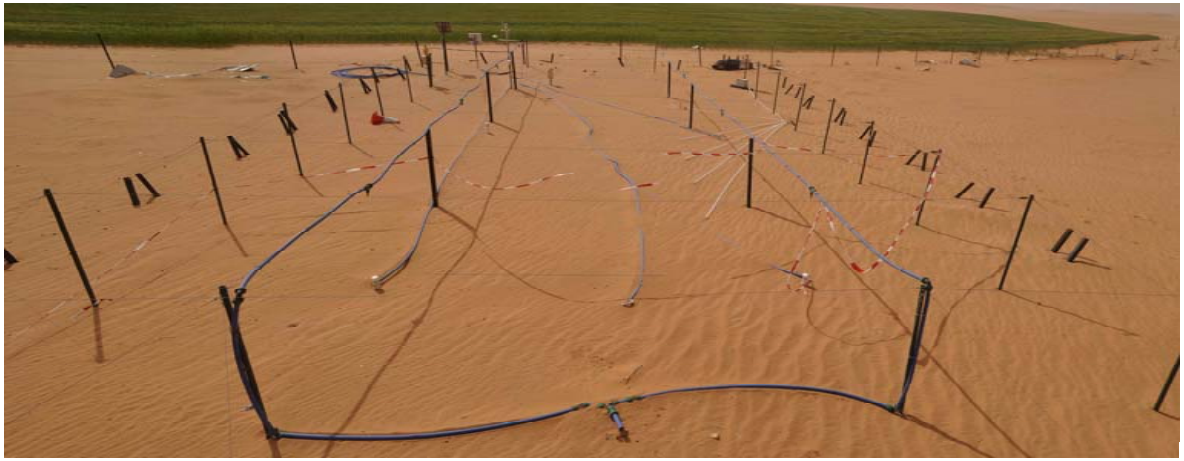
in ausgewählten Testgebieten der Arabischen Halbinsel mit typischem Neubildungs-Mustern wie: Wadis, Sandflächen, lokale Depressionen wie Fleys

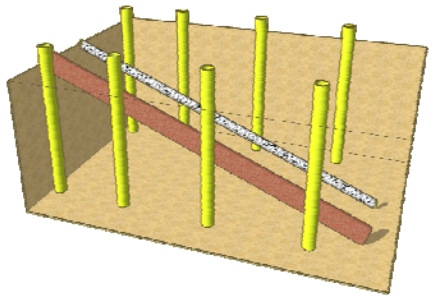


Observationsfeld

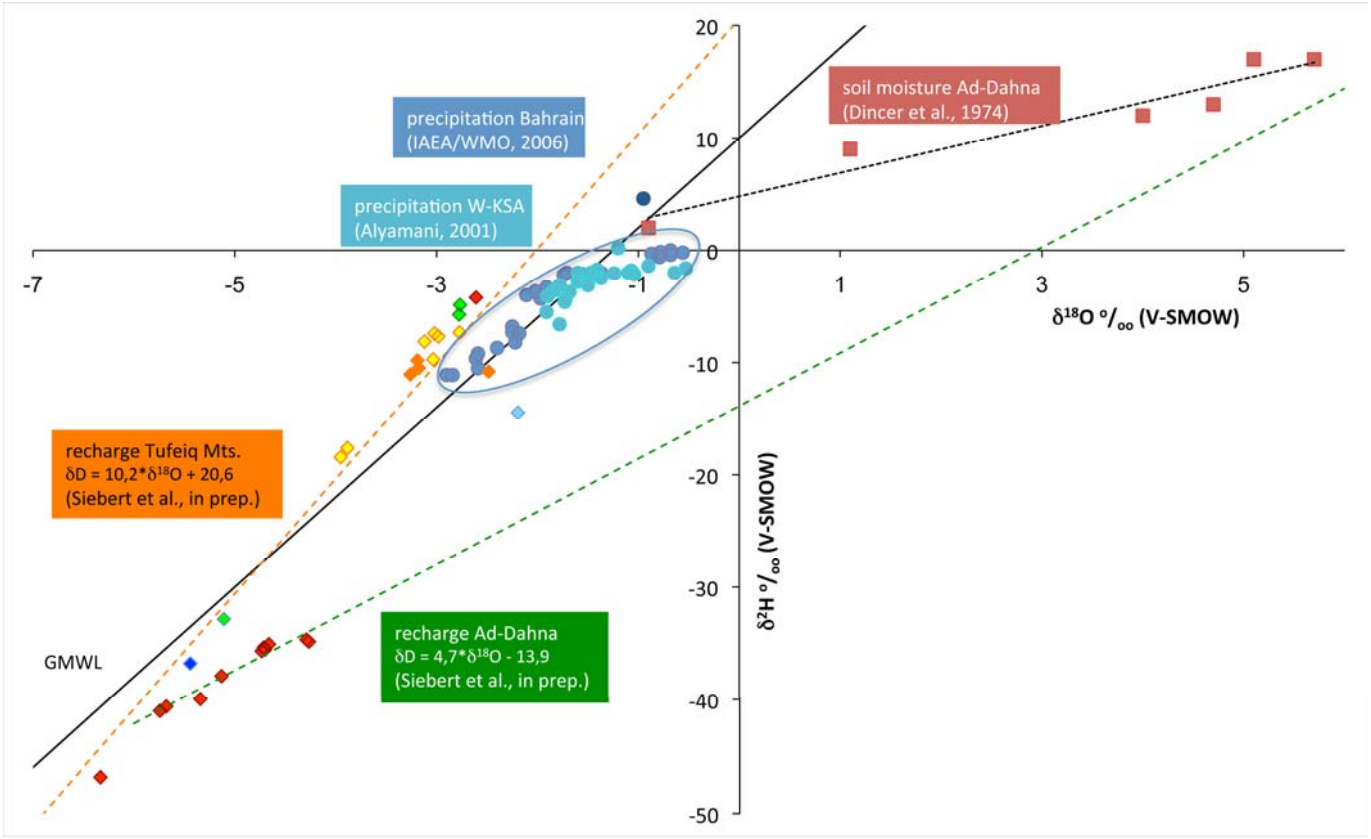




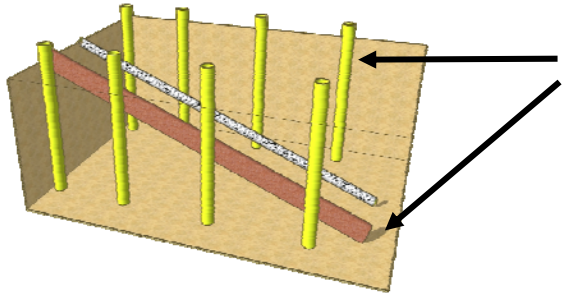




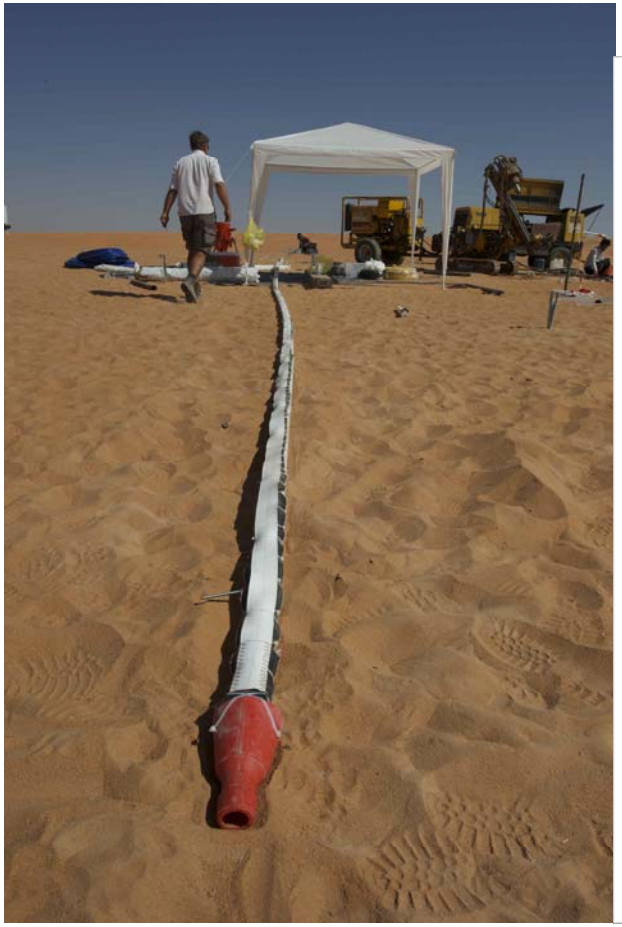
Porenwasser

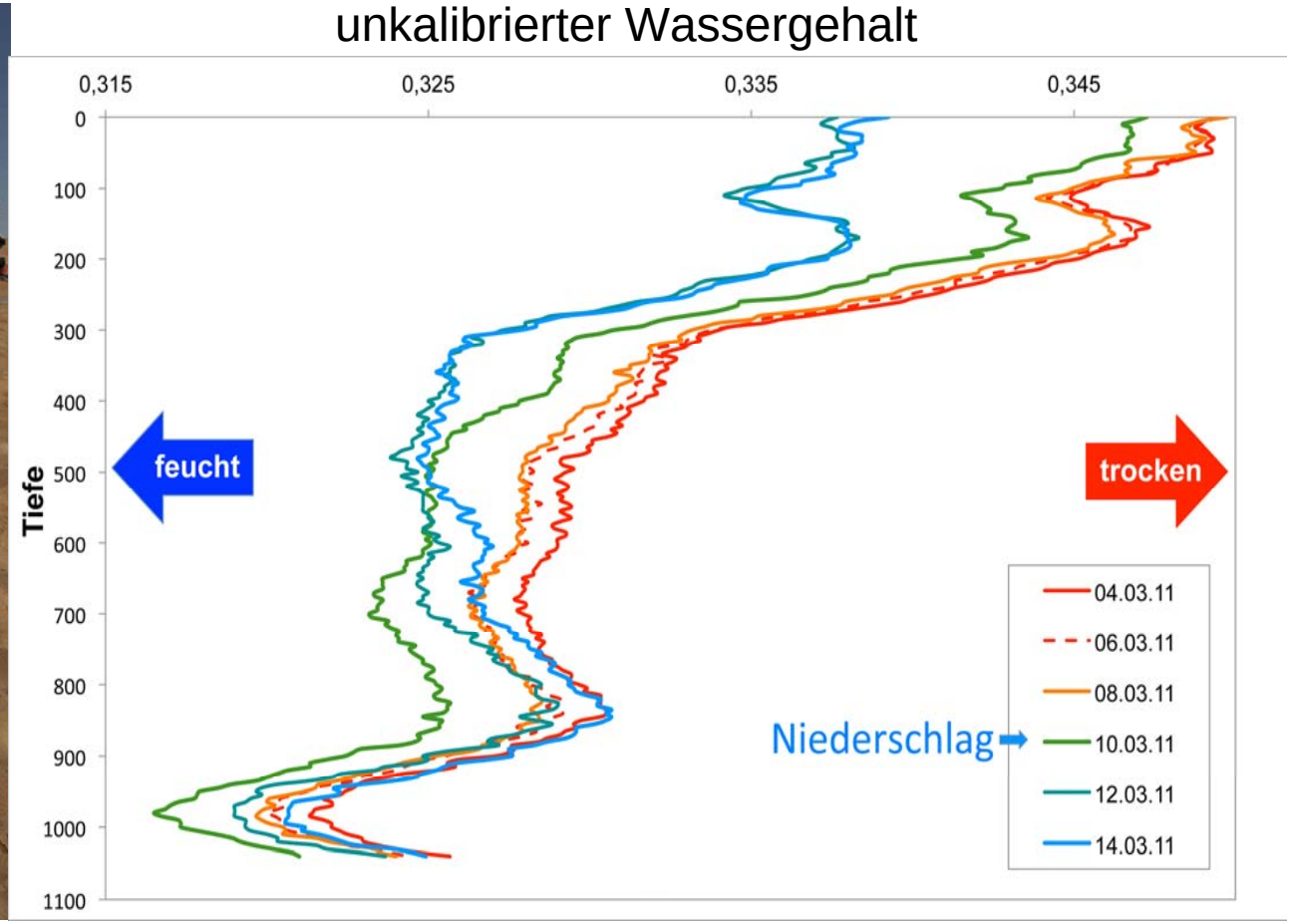


IWAS

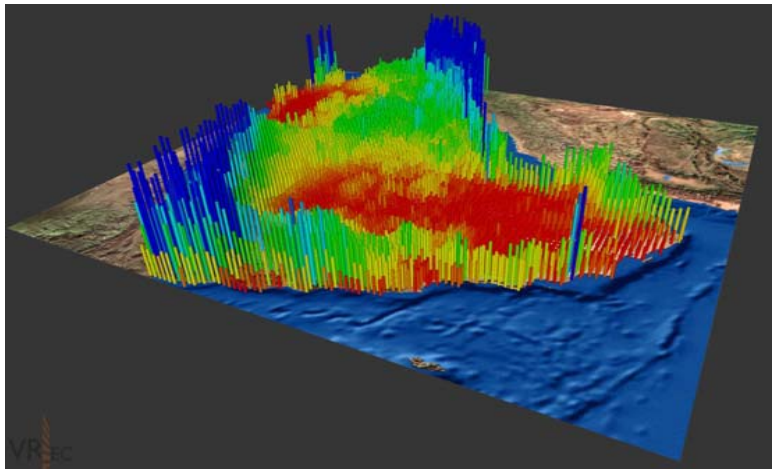


Vertikale und geneigte TDR-Bohrungen



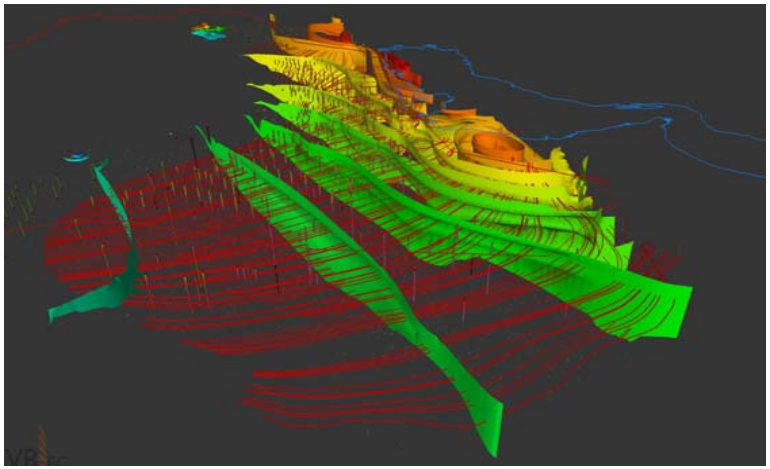


Definition der limitierten Wasser-Ressource

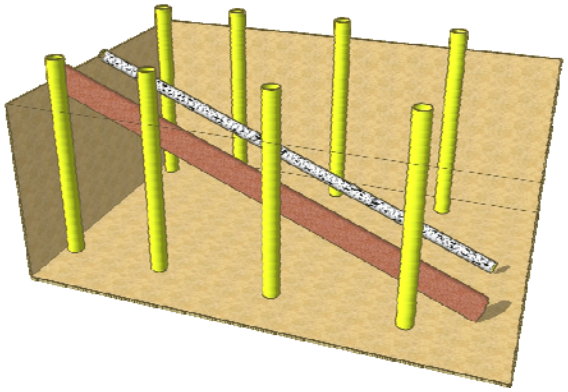


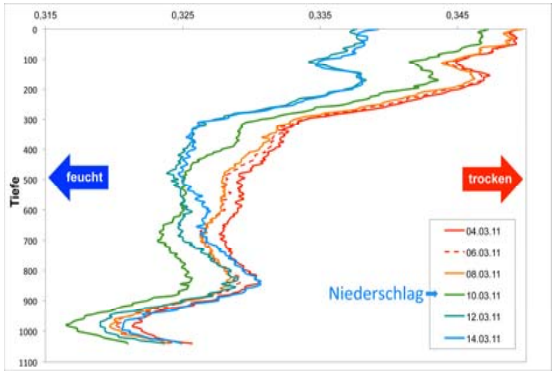
Klimatische Grenzen

Ressourcenmodell



Infiltration & Neubildung





IWAS

SPITZENFORSCHUNG & INNOVATION
IN DEN NEUEN LÄNDERN

Wir bedanken uns bei:

MET

GIZ

MOWE

administrative Belegschaft im UFZ

Bundesministerium
für Bildung
und Forschung

Förderkz: 02WM1165

IWAS

giz

وزارة المياه و الكهرباء
MINISTRY OF WATER & ELECTRICITY

C MM
Competence Center for Material Moisture

KIT
Karlsruhe Institute of Technology