

Review of SR-Site
Dose Assessment Methods
~ Preliminary Findings
Initial phase

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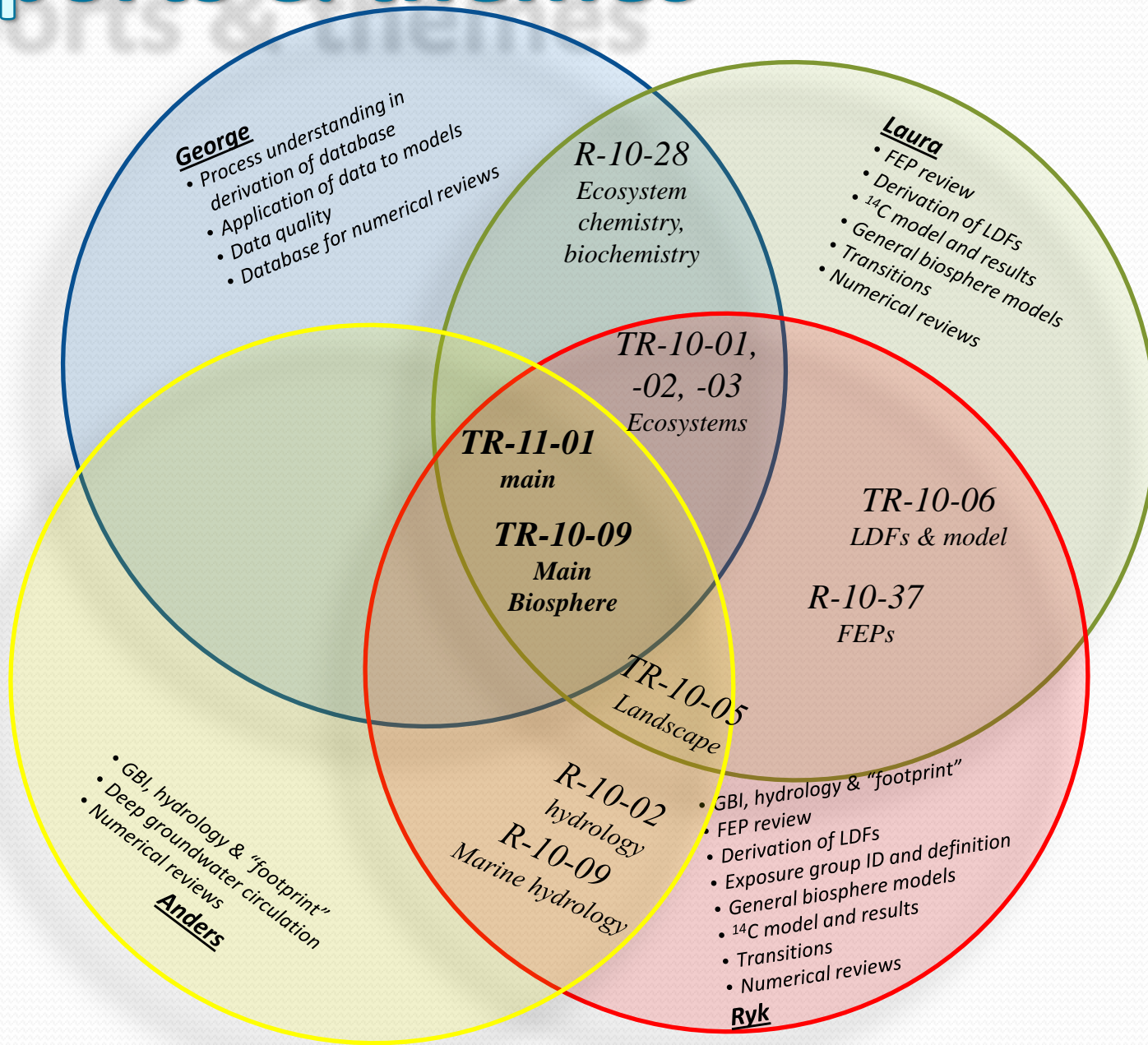
KTH, Stockholm

SSM Review Workshop , 2012-05-21 - 23

Scope ~ Dose Assessment Methods

- *The Golden Rule*
 - *Most processes in the biosphere are dispersive*
 - “... most biosphere FEP’s will tend to mitigate rather than augment assessed doses” (TR-11-01)
 - ***To evaluate the radiological impact of accumulation processes***
- Requirement of the initial review phase
 - *Have SKB made a compelling case in which they have accounted for all probable accumulation processes?*
 - Develop further questions
 - For SKB
 - For further documentary and numerical review

Reports & themes



Areas of concern I

- The new biosphere model
 - Model derivation
 - Definition of conceptual model (IM)
 - Translation to a practical assessment model
 - Processes representation ...
 - In the geosphere-biosphere interface
 - Low run-off in the Forsmark region
- Selection of biosphere objects
 - Delineation of objects and surface footprint
 - Implications for the *exposed group*
- Timing of key transitions in the surface system
 - Human action
 - *Other* accumulation processes

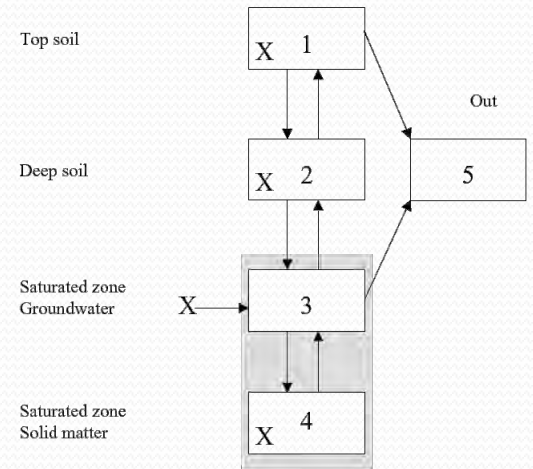
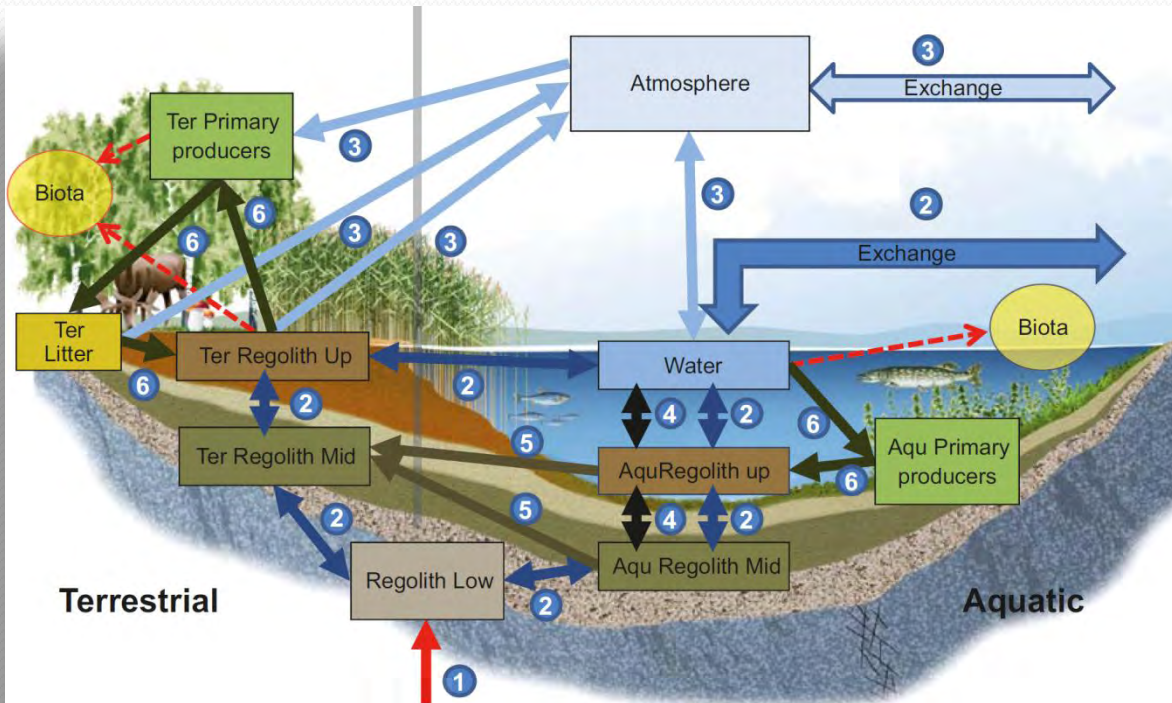
Areas of concern II

- Over reliance on the landscape model
 - Treated as “*The Future*” defining scenarios
 - Limits the scope of the *radiological assessment*
- Obscurities
 - Documentation can be “self-shielding”
 - Piecemeal set of biosphere assessment tools
 - Landscape model → RN model
 - Agriland exposure model, Irrigation model, ...
 - Release history
 - What the results are
 - Scenarios evaluated
 - Summary of the TR-11-01 summary

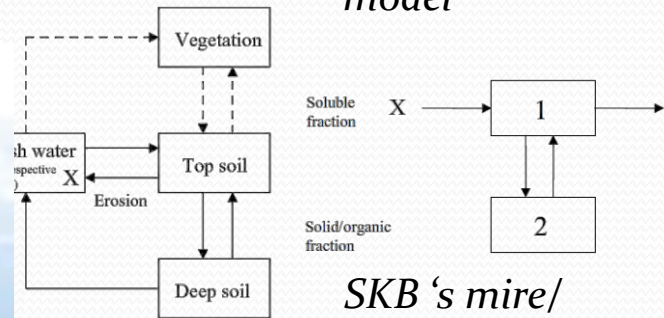
The biosphere model

transport & accumulation

- Completely revised for SR-Site
 - From multiple models ...
 - ... to one size fits all

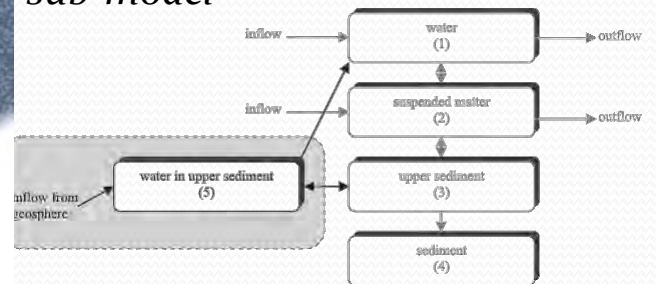


Agricultural land model



SKB 's mire/ forest model

Irrigation sub-model



Coastal & lake model

The geosphere-biosphere interface model

- *It is important that transport and retention processes in the lower regolith compartment are addressed properly in the model. (TR-10-06, p 33).*

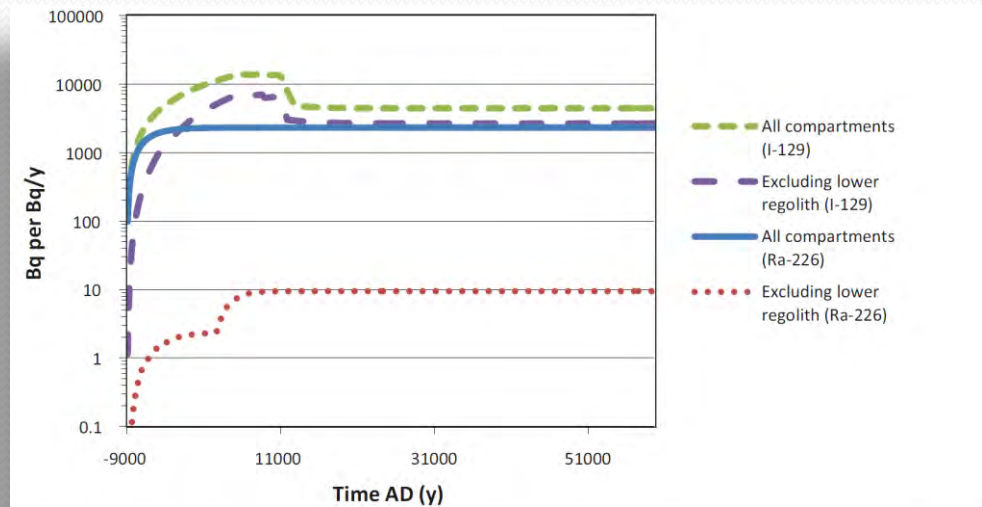
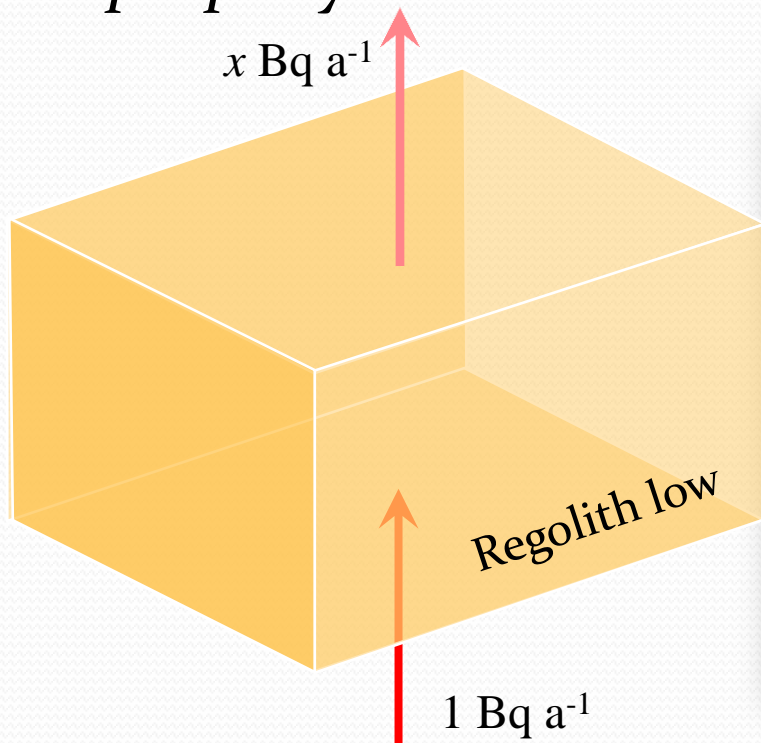
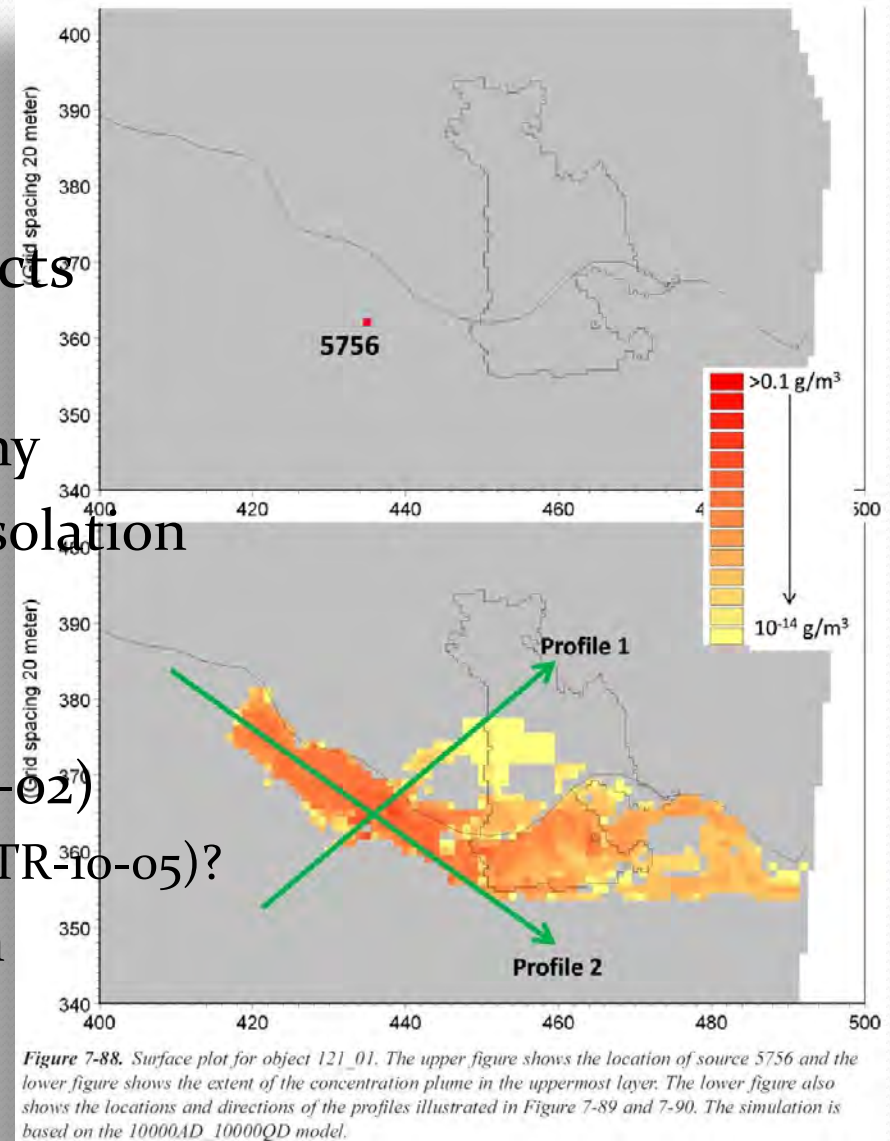


Figure 3-4. Ra-226 and I-129 inventories in all model compartments including and excluding the lower regolith compartment. Maximum values across all biosphere objects are shown. The values were obtained from deterministic simulations with a constant unit release rate during the interglacial period.

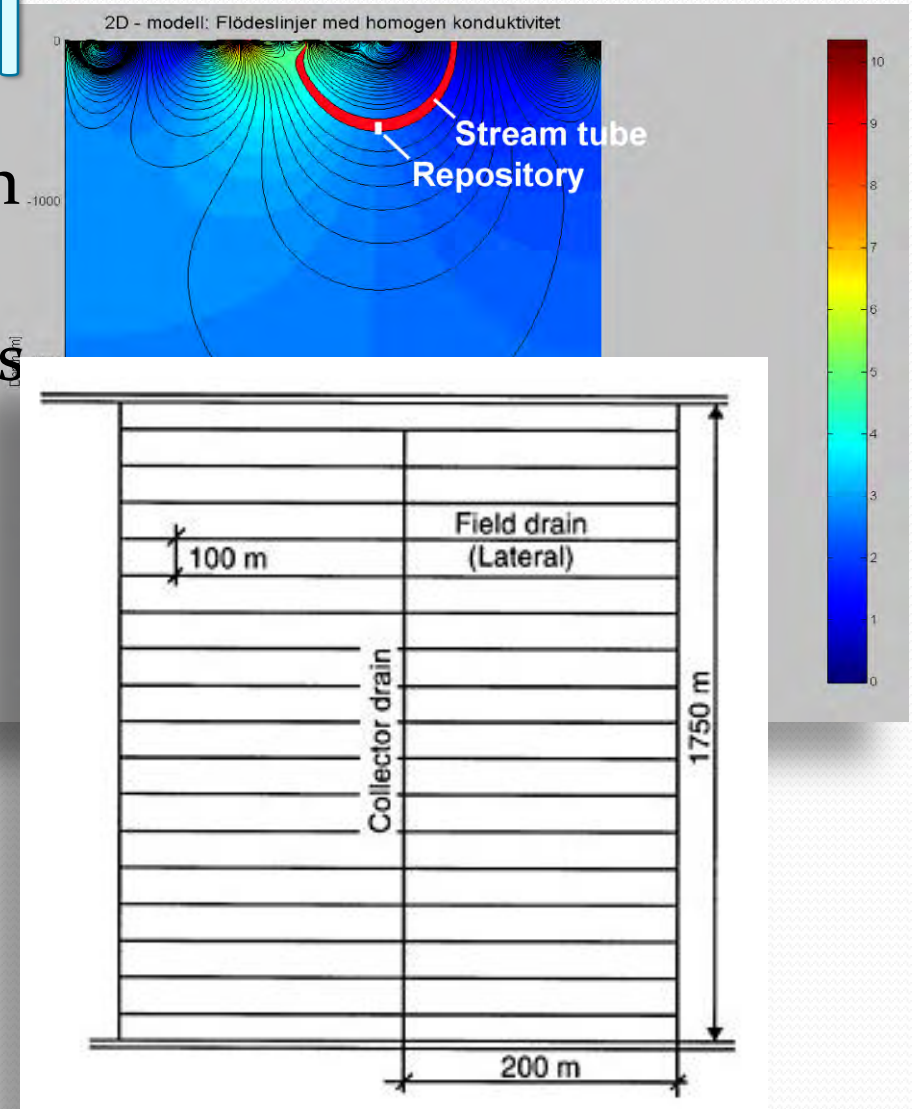
Homogeneity I

- Spatial resolution within objects
- Object definition
 - Basins defined by hypsography
 - Objects by shoreline at lake isolation
 - \geq km scale)
- Spatial dilution
 - Footprint at the surface (R-10-02)
 - As small as $100 \times 100 \text{ m}^2$ scale (TR-10-05)?
 - Exposed group interpretation
- Variation on discretisation
 - Only vertical resolution
 - Not sufficient



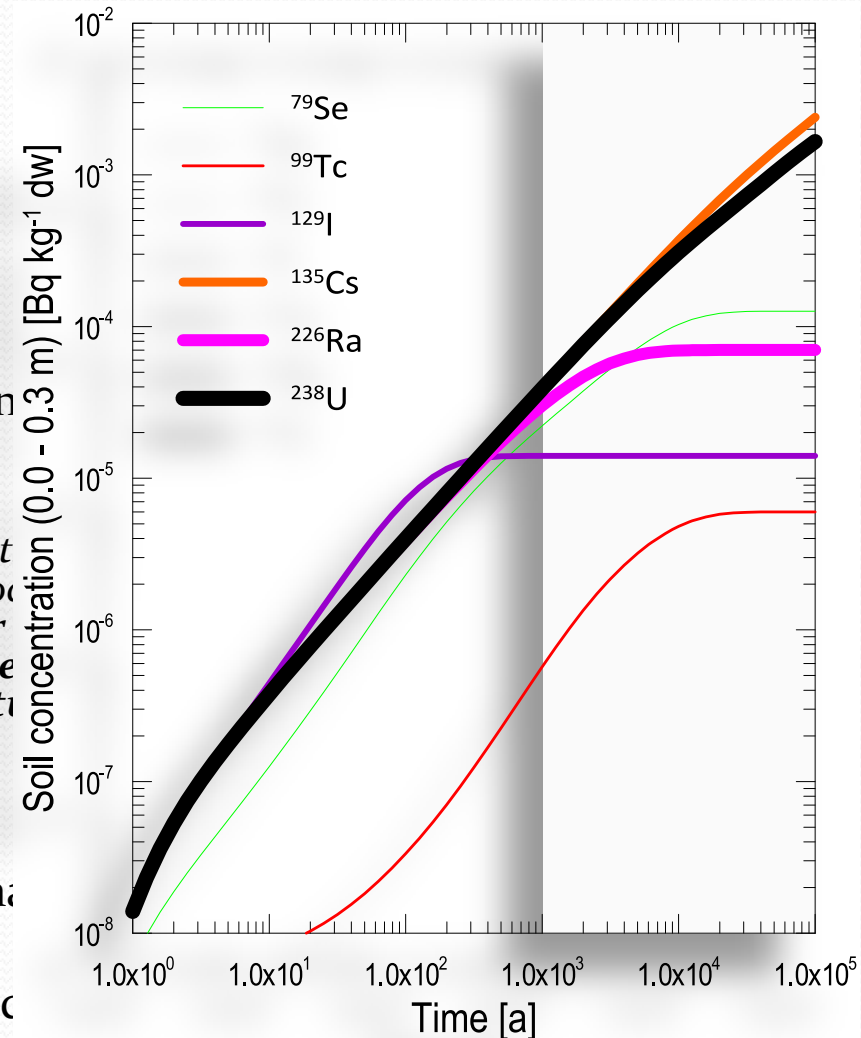
Homogeneity II

- The MIKE-SHE continuum
 - DFN → continuum
- Alternative representations
 - Topography controlled circulation
- *Natural* evolution
- Human intervention
 - Drainage system
 - Water body need not coincide with lowest bedrock topography



Timing I

- *Accumulation & Exposure ecosystems*
 - Only *cultivation* matters for exposure
 - Radionuclide transport and accumulation for natural systems
 - Decaying model for agriland
 - *It has been assumed that human inhabitant drain and subsequently use wetlands for pro crops and livestock fodder. This is done for simulation time point, starting from the when the use of the wetland for agricult purposes is possible.*
 - No further input
 - Transient system – 50 – 100 years
- How long does accumulation (wetland) pha
 - Alternative climate scenarios
- How long do ecosystems take to reach steac when calculating long-term LDFs?
 - To what extent are they 'out of equilibrium' when calculating LDFs for spike releases?



Timing II

- We have no clear idea of the release history
 - TR-11-01
- Points associated with canisters?
 - “Linger time” within objects?
 - Movement between objects
- Needed to assess the suitability of the usage of the LDF approach

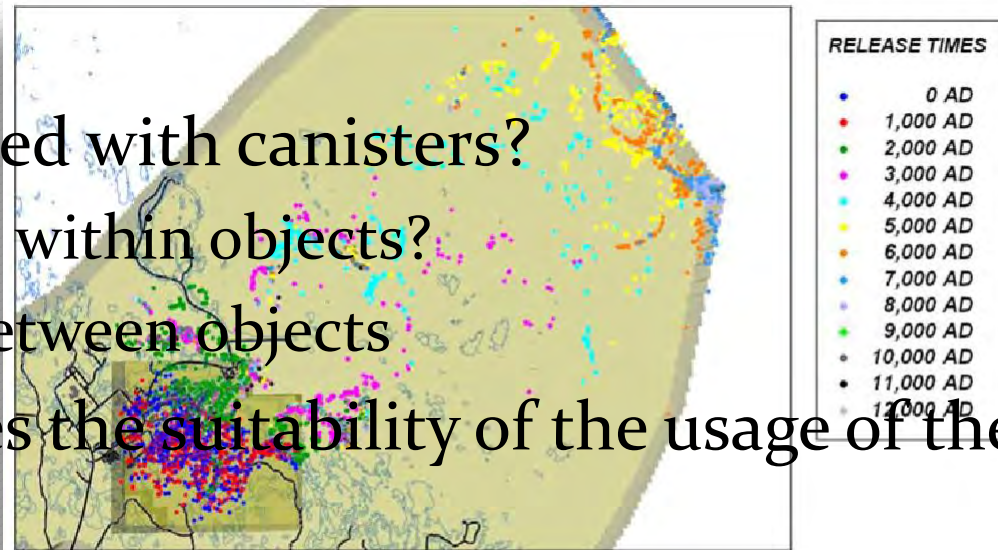


Figure 10-27. Discharge locations for particles (Q2 path) successfully reaching the top boundary of the site-scale hydrogeological base case model (89%–97%) for releases every 1,000 years from 0 AD to 12,000 AD. The model domain is shown in beige.

Open questions

- Need a clear summary of scenarios evaluated and results thereof
- How have the transport properties of the lower regolith been validated?
- The biosphere model for radionuclide transport is new
 - What steps have been taken to validate it against known distributions of elements in the present day system?
- The “dynamic plant” model is a new feature
 - Has applicability of this approach been tested against published data for plant uptake of the elements being modelled in SR-Site?
- How can the large spatial extent of the biosphere objects be justified?
- Can SKB provide a justification the modelling from a *radiological protection* perspective?
 - Landscape scale → *human* scale
- Can the assumptions for well usage be justified?

Preliminary conclusions I

- Lack of transparency in the LDF approach
- Scenario analysis for the biosphere is not complete and appears to be too benign
 - Lack of systematic analysis
 - Situations leading to exposure
 - Possibilities within the landscape
 - Alternative interpretations could lead to higher doses
 - contamination footprint
 - identification of critical group lifestyle
 - Mitigated by simplicity of new geosphere-biosphere interface
 - Alternative, more realistic, descriptions might reduce or delay the activity reaching the surface

Preliminary conclusions II

- The Landscape Model is only one possible interpretation
 - Alternative interpretation → deeper review
 - Not presently possible to say that all *necessary* accumulation processes are adequately addressed in LDF derivation → *forensic* review
 - Sensitivity studies seem to have been designed to bolster the standard model, not challenge it → numerical review
 - Increased range of uncertainty relative to calculated LDFs
- Systemic confusion about the degree of conservatism in the models at different stages
 - Not quantified
 - Best Estimate parameters – are representative of the real system or chosen to pessimistic