EMRAS II Plenary Meeting
WG3: Waste Disposal Working Group

Progress, work plan and reporting

28 January 2011

WG3: Waste Working Group

WG objectives:

- Approaches for developing reference biosphere models.
- Approaches should take into account changes of the exposure (environmental change).
- To derive a set of models that covers a wide range of environmental situations.

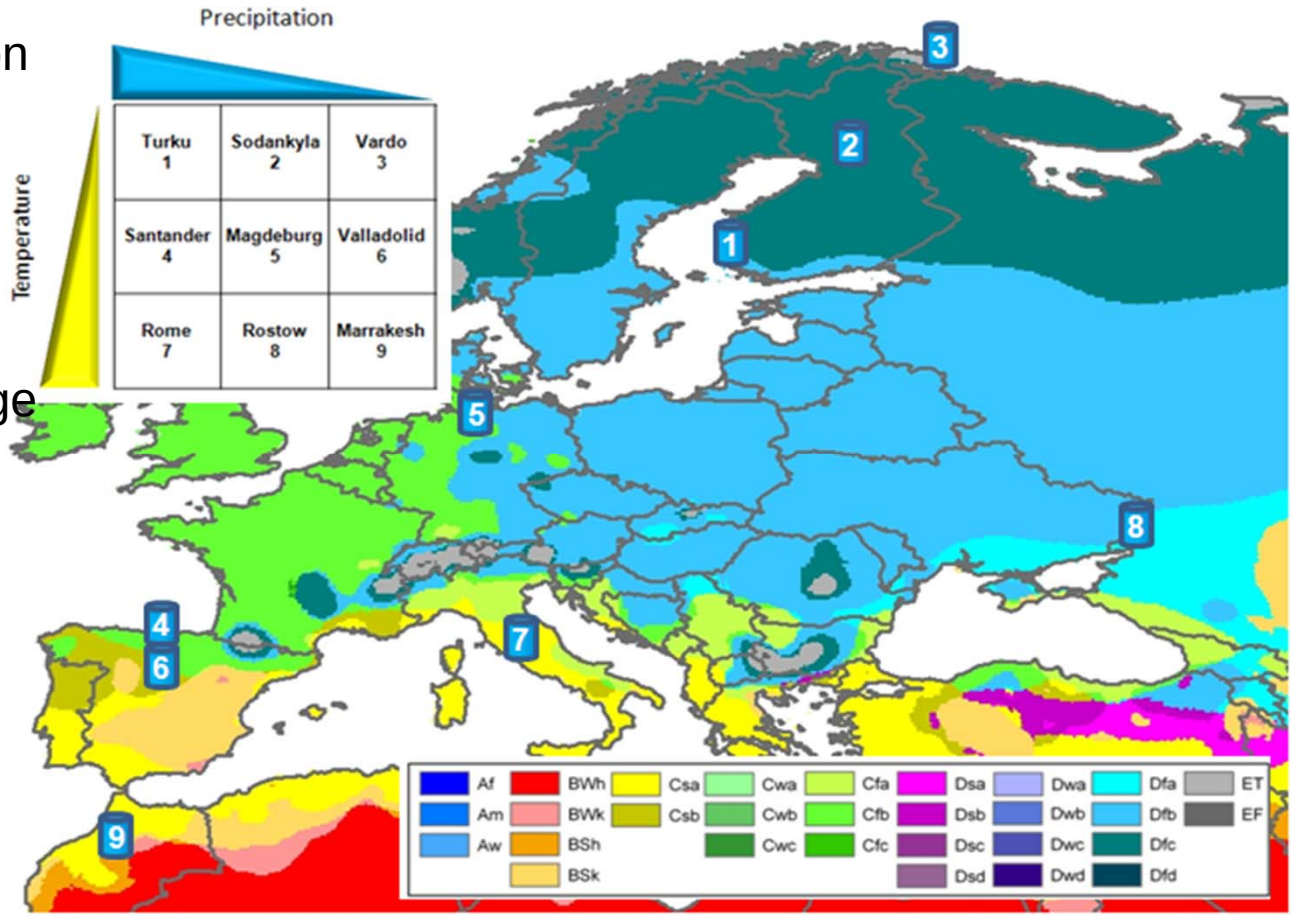
- Four sub groups: Analouge sites, soil-plant in different climates, dynamic site modelling and protection objectives.

Sub group 1. Analogue approach

- Model for calculating biosphere dose conversion factor

- Reference region approach to assesses influence of climate change

- Reference regions were selected due to the Köppen/Geiger classification



Am-243
Cl-36
Cs-135
I-129
Nb-94
Ni-59
Np-237
Pa-231
Pd-107
Pu-239
Ra-226
Se-79
Sn-126
Tc-99
Th-230
U-238
Zr-93

Sub group 1. Analogue approach

- Climate change is mirrored with reference stations
- Most important contaminant pathway: water from different interfaces between biosphere/geosphere, i.e. groundwater or surface water

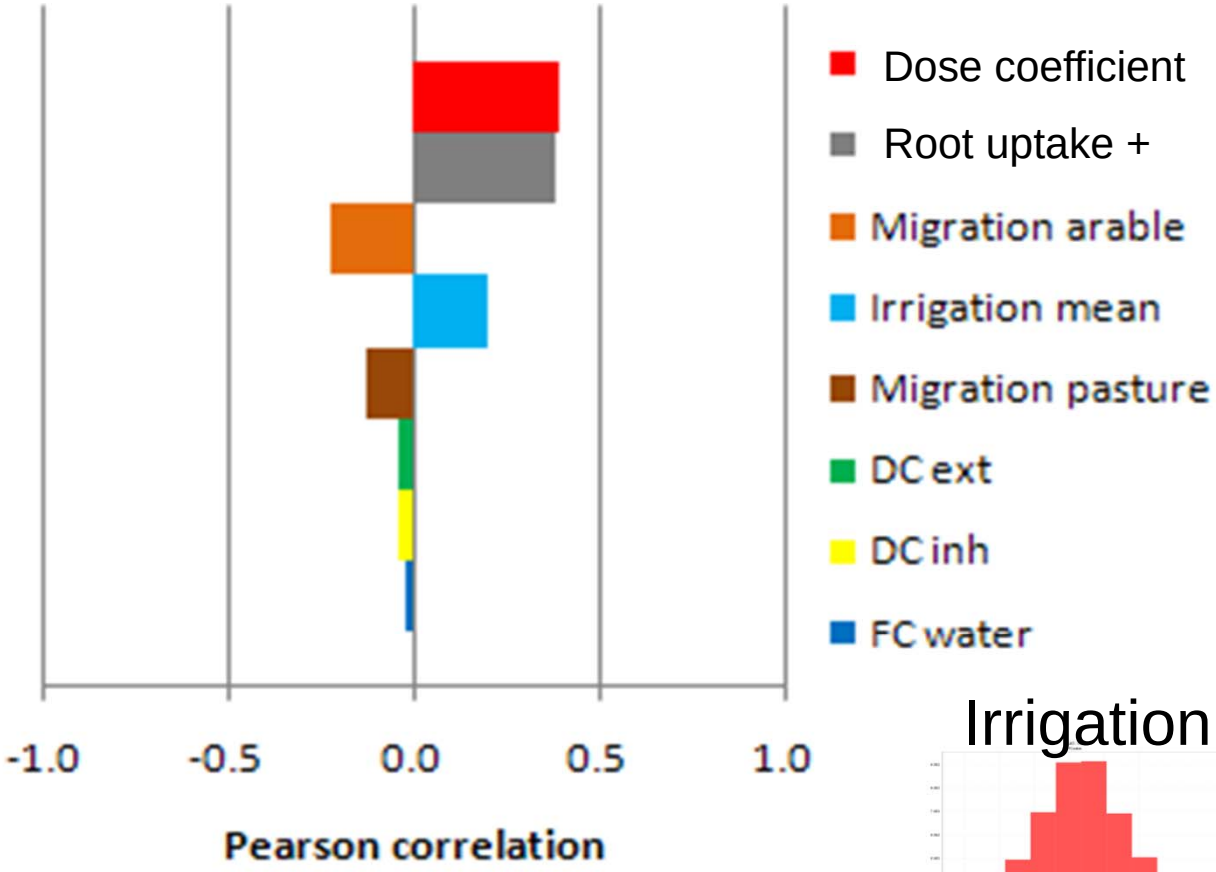
- Relevant processes can be switched on and off or parameters can be adjusted to adapt different climatic situations

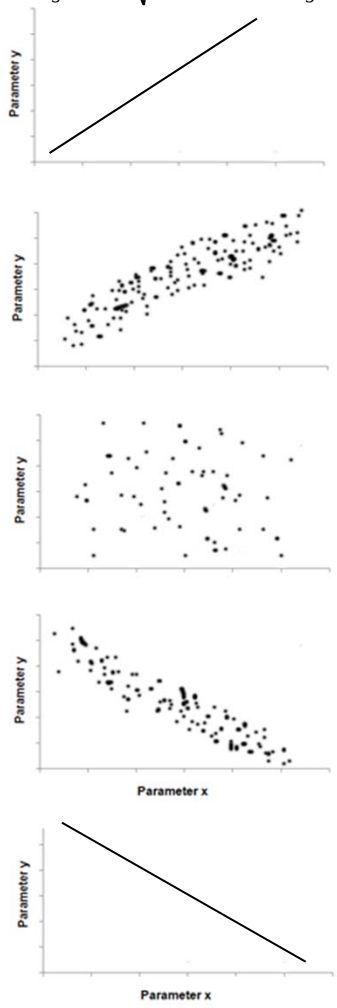
- Examples of states and processes that are adjusted to different climates
  - Water by irrigation from well
  - Consumption of food and water (FAO data)
  - Migration of radionuclides in soil
  - Transfer of radionuclides from soil to plant -> Sub group 2
  - Growing periods for plants
  - Dust concentration in air
  - Resuspension

Parameter selection for sensitivity analysis

- The ECOLEGO software was used for modelling and sensitivity analysis

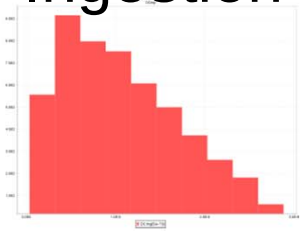
$$\rho_{x,y} = \frac{\sum (x_k - x_{average}) \cdot (y_k - y_{average})}{\sqrt{(x_k - x_{average})^2} \cdot \sqrt{(y_k - y_{average})^2}}, k = 1:N$$





Irrigation

Ingestion



- Triangular probability distribution function was used

Sub group 1. Analogue approach

Work done and planned contributions

Work done :

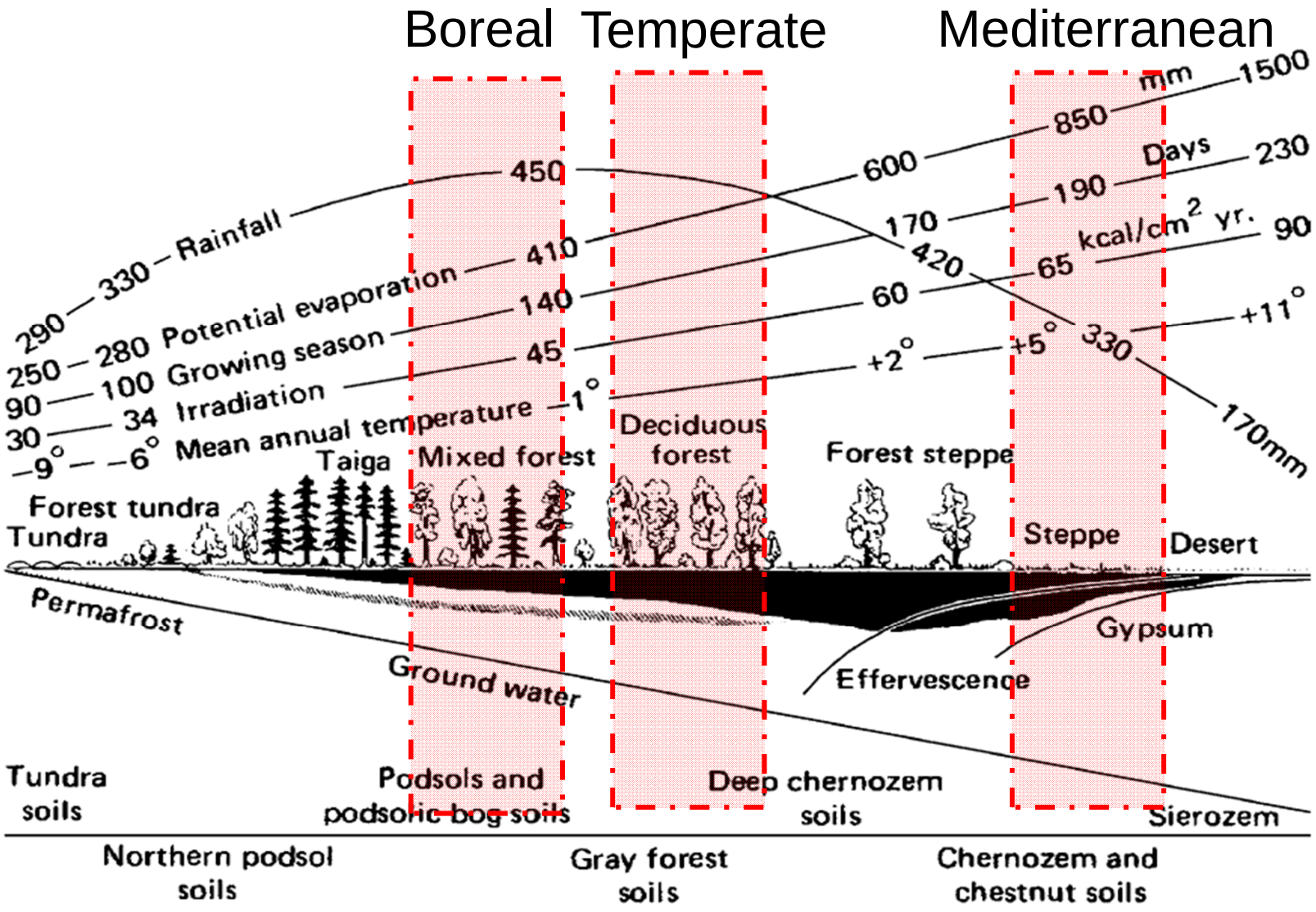
- Contribution to the interim/final report
- Outline of the analogue approach
- Identification of the relevant contamination pathways and processes for different climates
- Individual FEP lists for reference biospheres
- One soil type with modifications for pasture and arable land,
- Large set of nuclide-specific BDCF for different reference biospheres

Planned contributions:

- Improve and refine sensitivity analysis and add uncertainty analysis (correlations)
- Comparison of the analogue approach with other approaches (Yucca mountain)
- (Set up a database of BDCF's for different climates, soils, nuclides …)

- WG 3 **Synthesis**

Sub-group 2. Soil-plant System



EMRAS II WG3

Modelling work: input data

- Irrigation of cereals by 1 Bq/a or Bq/m³
  - Which normalisation ?
  - Maybe needs to be revised ?
- 5 different Radionuclides
  - Se-79, I-129, Ra-226, Cs-135, U-238
- Climate types
  - Sweden
  - Germany
  - Spain
- Soil type / composition
  - Specific climate and soil data
- Agricultural systems

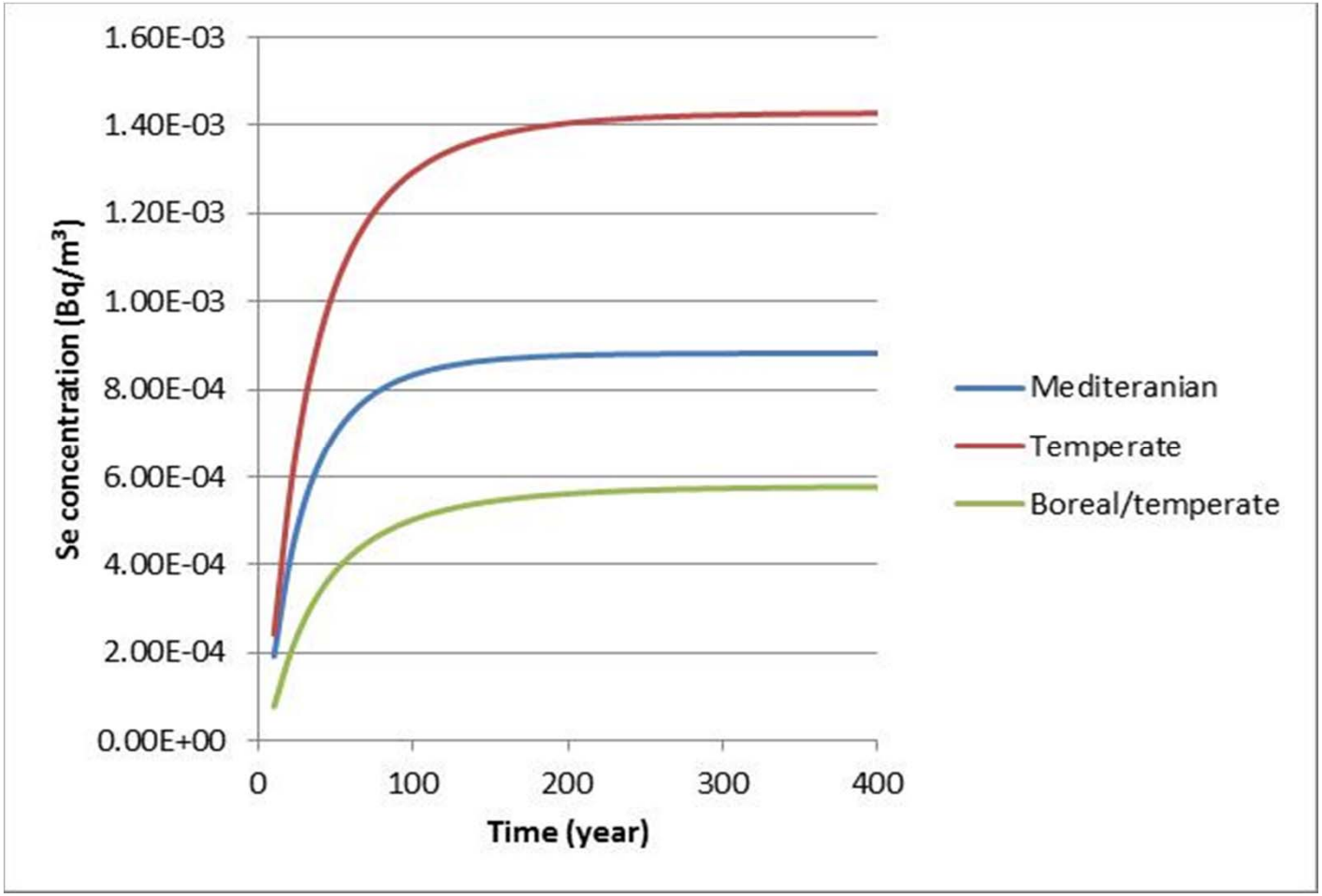
Modelling work: input data

- 4 models
  - Ciemat
  - SCK-CEN
  - SSM
  - Nottingham University
- Identification endpoints
  - Concentration in plants (Bq/kg fw)
    - Foliar uptake
    - Root uptake
  - Soil concentration at different layers (0-30 cm; 30-60 cm and 60 -100 cm) (Bq/kg dw)
- Calculation endpoint : until 10000 years

Input and structure of the report/work

1. General introduction on influence of climate change on the soil plant system
2. Relation with Biomosa, Biomass, Bioclim. Identifying the gaps
3. Discussion of the system (physical, chemical and biological processes)
4. Climate variables and relation with parameters for models
5. Description of the models
6. Section on model limitations
7. Results (deterministic)
8. Discussion

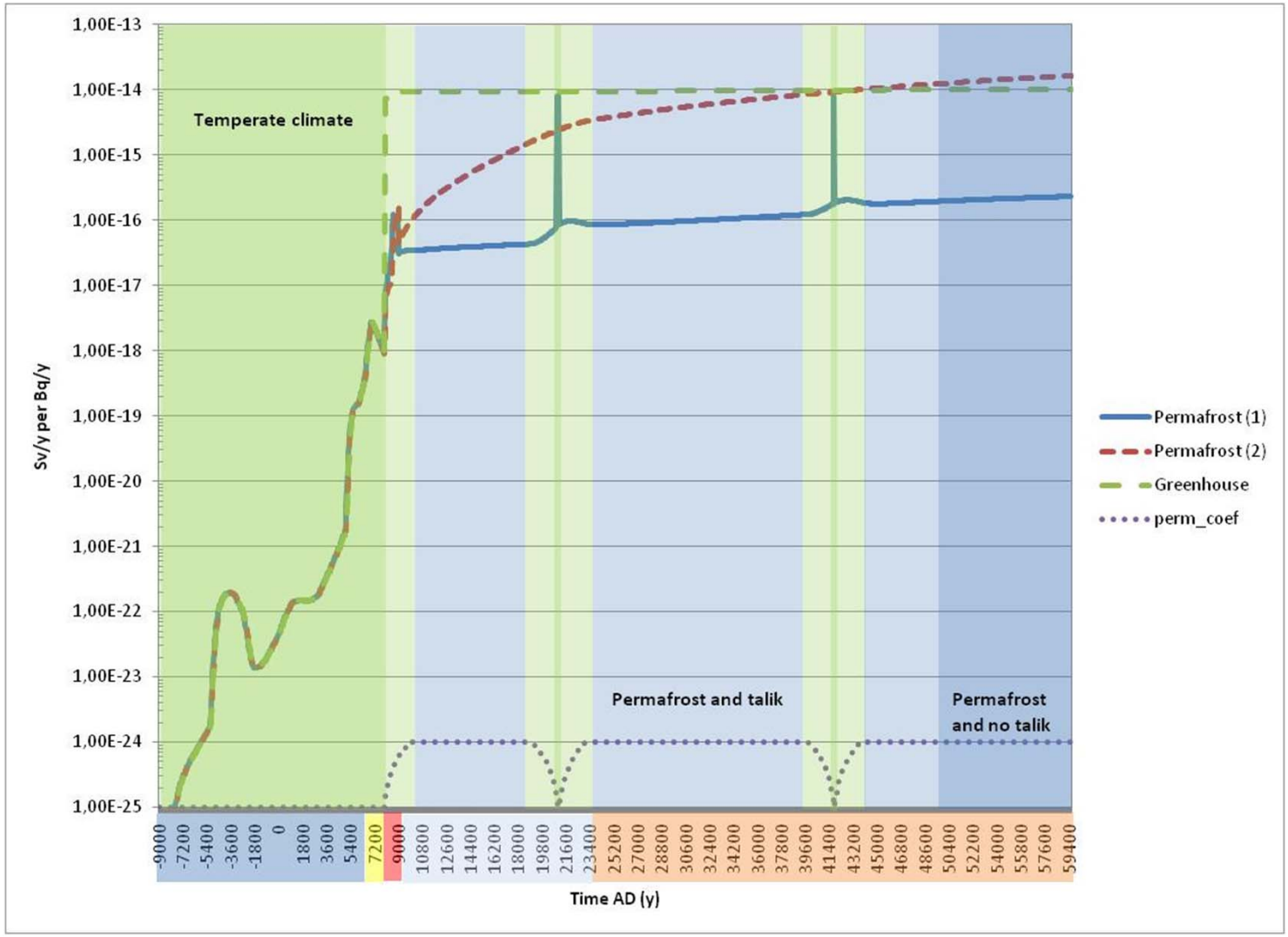
Some preliminary results



Sub-group 3. Dynamic modelling

Parameter/process	handled in radionuclide model	Importance in environmental change	How to implement and comments	id to interaction matrix row..colum	Generic relevance in radionuclide transport and dose models
Primary production	yes	no			Differences are more about details of parameter values
Respiration	yes	no			Differences are more about details of parameter values
Soil degassing	yes	yes	handled in the model by terr_degas_C	13..12	Temperature dependent process, important for nuclides with gaseous pathways
Evaporation	no	yes	Have to be discussed. Could be of importance, e.g high NaCl in lakes at Greenland	9..12	In some cases: important especially if there are no plants (transpiration) or if the climate is very warm, and possibly the evaporation from (small) lakes
Frozen soil/sediment/bedrock (permafrost or seasonal ground frost)	yes	yes	The model switches of the flow from regolith low, but is there a better way?	13..9	Affects the hydraulic properties (flow paths) and seasonal water flow conditions (interaction with deep groundwater)
Karst	no	Yes	Affects to the other parameters and possibly the conceptual model		Changes the land use and the hydraulic properties of the bedrock

Sub-group 3. Dynamic modelling



Calculated dose conversion factor for Cs-135 for different simulation cases

Sub-group 4. Demonstrating Compliance with Protection Objectives

SG4 Workplan 2011

SG4 is reviewing international and national

- Fundamentals (F)
- Requirements (R)
- Guides (G)

to identify how we are supposed to address environmental change in post closure safety assessment for waste repositories.

Final workgroup meeting at Nagra, Switzerland 21-23 September 2011

Meeting objectives

- Presentation/discussion of modelling results
- Reporting and final conclusions, discussion and draft production
- EMRAS III suggestions on topics

Report ready by 31 December 2011

- The report is a synthesis of sub group input on WG3 objectives
- Sub group reports in stand alone appendix to the report