OPERRA-HARMONE, Knowledge Database and FDMT Regionalization

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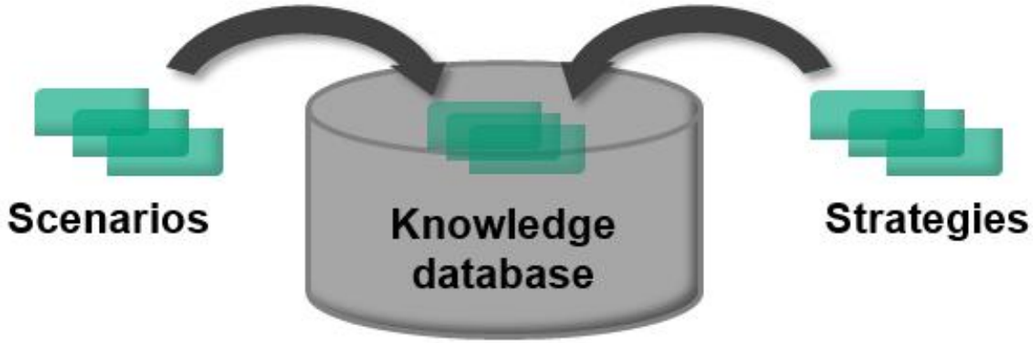
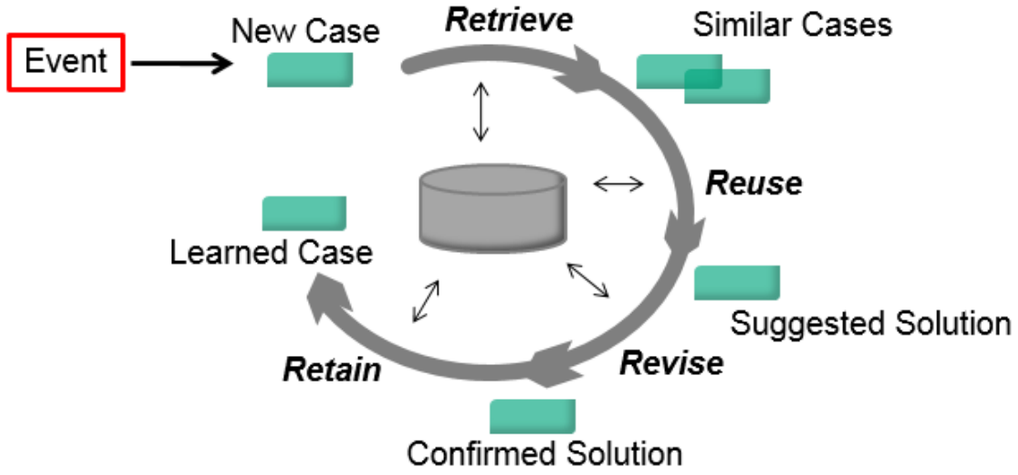
Knowledge database

- Knowledge database
  - Baseline scenarios
  - Generic strategies

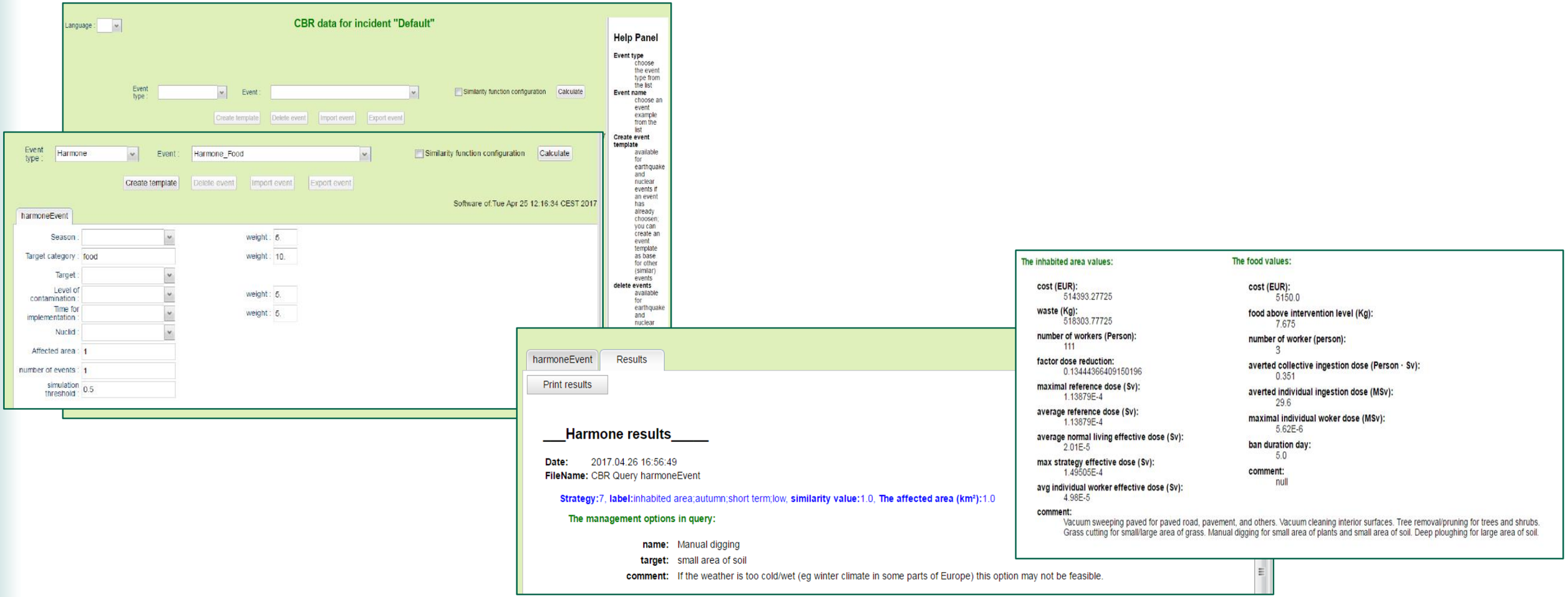


- Case-based reasoning
  - to identify similar events from the database
  - to reuse their solutions (applied or applicable strategies and their effectiveness)



Knowledge database

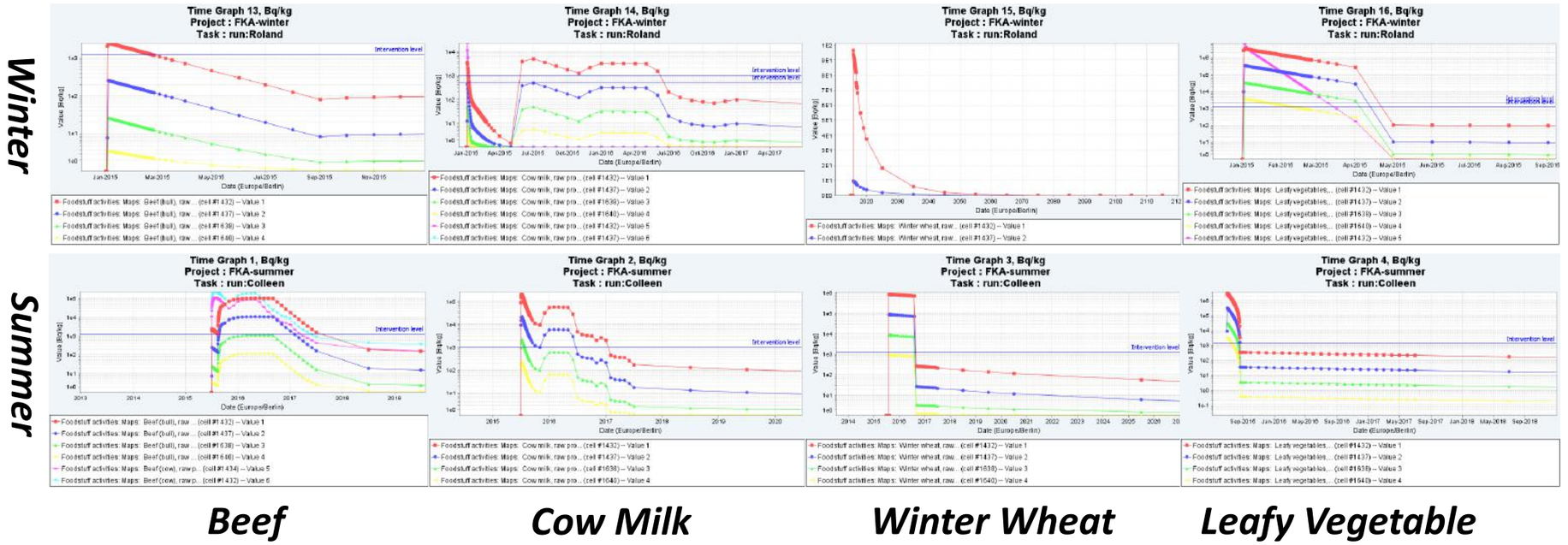
- Web-based decision support system



Knowledge database

- Scenario calculated by JRodos (ERMIN + AGRICP)
  - Contamination levels between 1000 and 100000 Bq/m ²Cs-137 contamination

    (Cs is taken as a representative nuclide)



  - Dry (food) and wet deposition (urban)
  - Winter, spring, summer and autumn
  - Radionuclides: FKA source term, but individual strategies for combination of radionuclides

- Strategies are developed for inhabited areas and food production systems

Table 1: Lower waste strategy – inhabited areas

Surface type	Short term (first week or two)	Intermediate term (up to three months)	Long term (after three months)
External walls	Do nothing[a]	Do nothing[a]	Do nothing[a]
Roofs	N/A[b]	Roof brushing (16)[c]	Roof brushing (16)[c]
Roads, pavements, other paved	Vacuum sweeping (34)	N/A[b]	N/A[b]
Internal surfaces	Vacuum cleaning (26)[d] and Washing (27)[e]	Vacuum cleaning (26)[d] and Other cleaning methods (23)[e]	Vacuum cleaning (26)[d]
Trees and shrubs	Collection of leaves (51)[f]	Collection of leaves (51)[f]	Collection of leaves (51)[f]
Small area of soil	Manual digging (39)[g]	Manual digging (39)[g]	Manual digging (39)[g]
Large area of soil	Deep ploughing (37)[g]	Deep ploughing (37)[g]	Deep ploughing (37)[g]
Small area of grass	Grass cutting and removal (38)[g]	Manual digging (39)[dg]	Manual digging (39)[g]
Large area of grass	Grass cutting and removal (38)[g]	Deep ploughing (37)[g]	Deep ploughing (37)[g]
Small area of plants	Manual digging (39)[g]	Manual digging (39)[g]	Manual digging (39)[g]
Large area of plants	N/A[b]	Deep ploughing (37)[g]	Deep ploughing (37)[g]

[a] As doses from external walls are never a major component of the dose it could be argued to do nothing in the strategy that necessitates little or no waste.

[b] No suitable recovery options are applicable on this timescale while minimising waste production.

[c] In extreme cold weather heated water may be required.

[d] While vacuum cleaning provides maximum benefit within a few weeks of deposition, over longer periods, contamination may be brought into buildings, and so repeated application regularly may be beneficial until any surrounding soil or grass areas are cleaned.

[e] As vacuum cleaning and water based cleaning target different types of internal surface, this is a situation where both options are required.

[f] Depending on time of the accident and time of leaf fall.

[g] If the weather is too cold/wet (eg winter climate in some parts of Europe) this option may not be feasible.

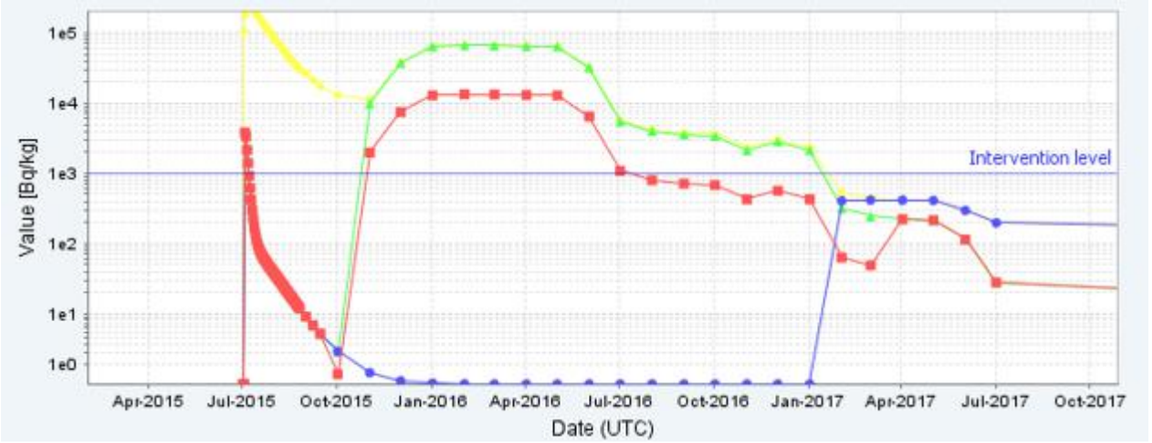
Table 3: Lower waste strategy – food production systems – deposition in the winter

Food type	Pre-deposition phase	Short term (first week or two)	Intermediate term (<= 3 months)	Long term (> 3 months)
Milk[a]	Closure of air intake systems (1) Short term sheltering of dairy animals (6)	Food restriction (11) Short term sheltering of dairy animals (6)	Food restriction (11) House and Clean feeding (29)	Food restriction (11) House and clean feeding (29) Add AFCF to concentrate ration Skim and burial ploughing
Meat[b]		Food restriction (11)	Food restriction (11 Selective grazing or Manipulate slaughter time Live Monitoring (32)	Not applicable < MPL
Grain	Not applicable < MPL	Not applicable < MPL	Not applicable < MPL	Not applicable < MPL
Root vegetable	No data supplied	No data supplied	No data supplied	No data supplied
Green vegetable	Protect harvested crops from contamination	Food restriction (11 Ploughing in of standing crop	Food restriction (11 Ploughing in of standing crop	Food restriction (11 Shallow Ploughing or Deep ploughing

[a] No actions are required below a deposition level of 10^5 Bq m^{-2}, as MPL is not exceeded. For deposition of 10^5 Bq m^{-2} or greater, milk exceeds MPL for at least 1.5y

[b] No actions are required below a deposition level of 10^6 Bq m^{-2}, as MPL is not exceeded. At a deposition level of 10^6 Bq m^{-2}, the MPL is exceeded for 2 month

- Comparison of the activity concentrations with strategies applied



Cow milk exceeds the intervention level following Cs deposition in summer

	Strategy
Red	RMOV (0 – 90 days), ADDS (90 – 540 days), SKIM (after 90 days)
Green	RMOV (0 – 90 days), SKIM (after 90 days)
Blue	RMOV (0 – 540 days)
Yellow	No countermeasure

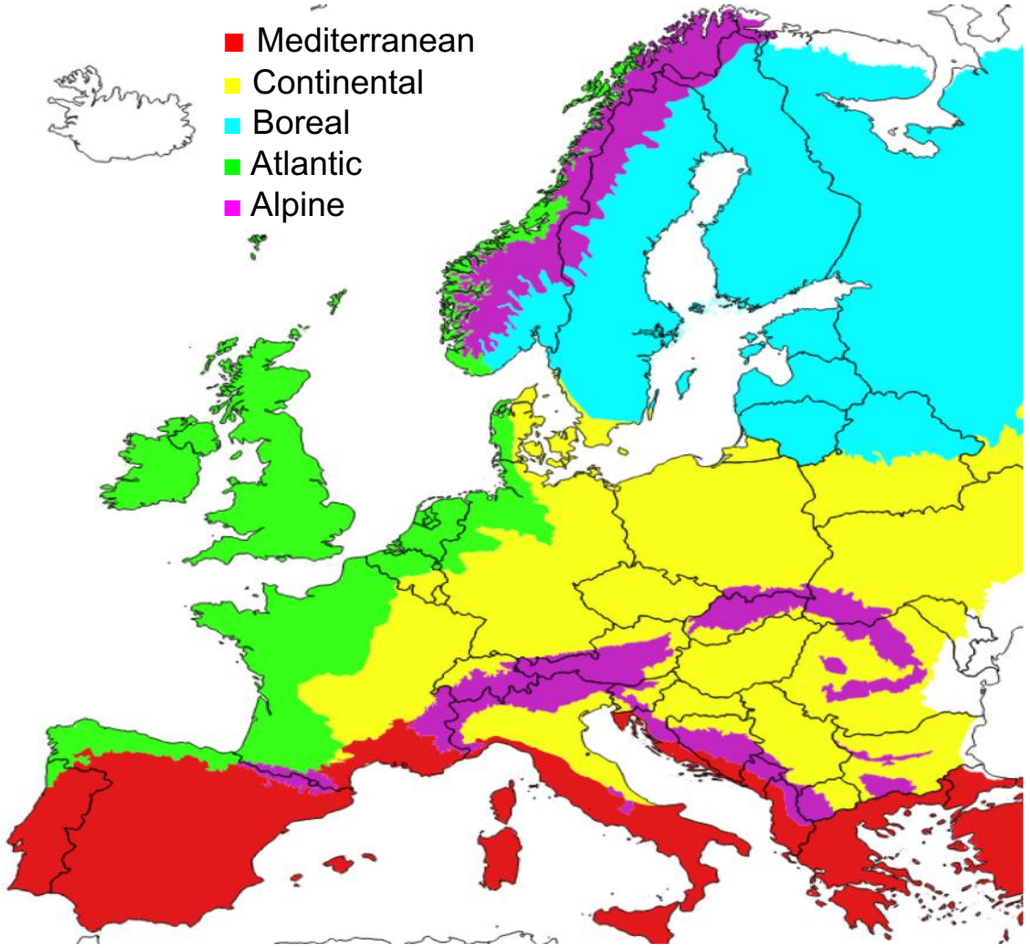
- RMOV: Removing animals from contaminated feed.
- ADDS: Addition of sorbents / boil. The sorbent is AFCF and the effectiveness is 80%, but for bull beef it is 78%.
- SKIM: Skim and burial ploughing. The effectiveness is 90%.

FDMT Regionalization

- Selection of regions, either defined as countries or regions sharing a set of similar exposure pathways, FEPs and parameters.

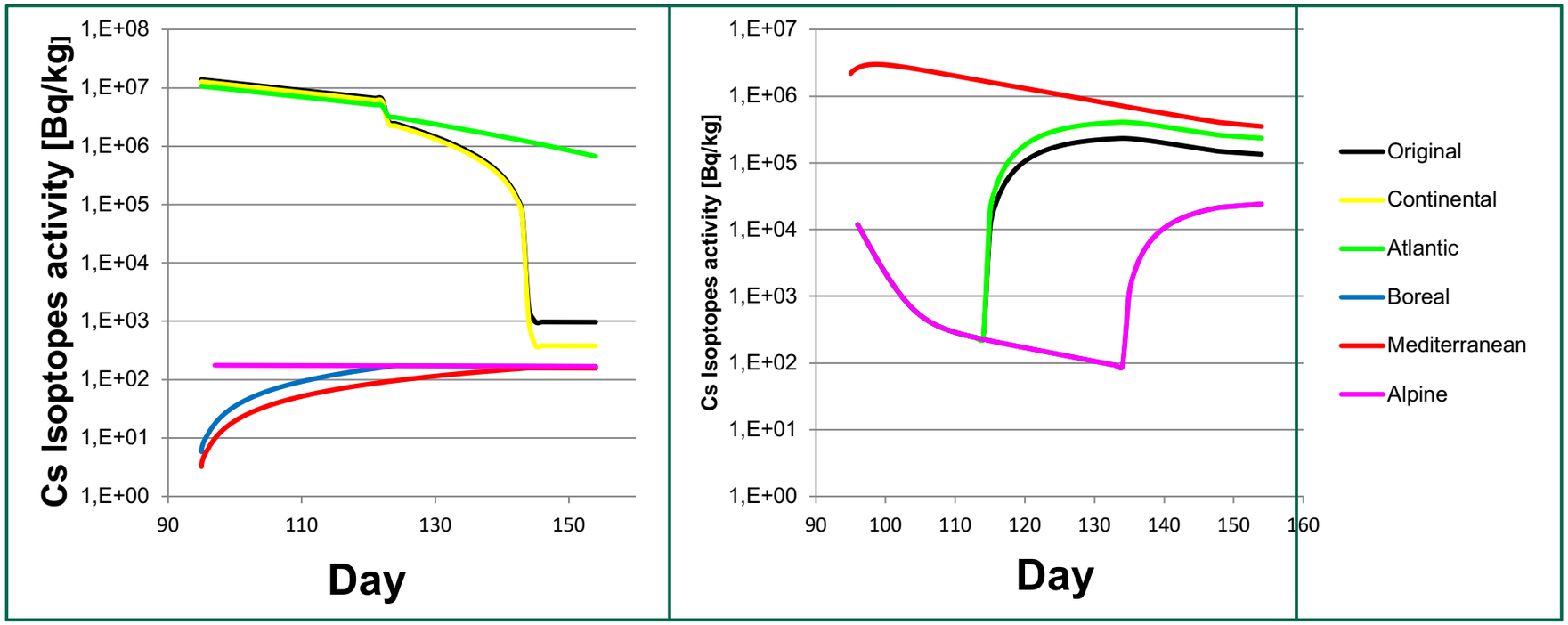
- Use of biogeographical regions (European Environment Agency 2012)
  - Mediterranean
  - Atlantic
  - Continental
  - Boreal
  - Alpine
  - Customisable

- Data in use
  - Database with values for geographically dependent parameters: e.g. food consumption rates for fruit (FAO 2016)
  - Population GEOSTAT (EUROSTAT 2016) Dataset



FDMT Regionalization

- Model result: Cs isotope activity for different radioecological regions in spring release
  - Differences in modelled activity are due to different Leaf Area Indices (LAI) and growth periods in the radioecological regions



Leafy Vegetable *Cow Milk*

FDMT Regionalization

- Exposure pathways, features, events and processes (FEPs) in the JRODOS models and associated parameters show a geographical dependency
- The original parameter data sets and material lists used in the terrestrial food chain and dose module (FDMT) of JRODOS were selected for southern Germany
- These model inputs were optimized for the use of JRODOS in other regions of Europe during the HARMONE project to reduce uncertainties in the dose assessment
- FDMT model results with the updated parameter sets show pronounced differences of radionuclide activities in different radioecological regions confirming the necessity of the optimization

Thank you very much for your attention

Questions?