Feature, Events and Processes (FEPs)

FEPs are terms used to define the relevant scenarios through the interaction matrix (IM), whereby:

Features include the components of the site, such as soil and water bodies (diagonal-elements of the IM)

Events include those incidents that may occur on the system on a short-term run, such as agricultural practices (ploughing, harvesting), earth quakes …(off-diagonal elements of the IM)

Processes include those things that are ongoing, for example irrigation of agricultural land, percolation, etc. (off-diagonal elements of the IM)

Conceptual model objects

Conceptual model object	Description
Source	Gas : tritiated water (HTO) and tritiated hydrogen gas (HT). Specific flux rates would need to be defined for a specific scenario. Water : Groundwater contaminated with HTO, used for irrigation and possibly upwelling into soil of interest. Scenario specific flux rates would also need to be defined.
Soil water	Liquid water in the soil pores. Relationships between degree of saturation, matric potential and hydraulic conductivity of agricultural soils need to be considered. They are influenced not only by soil characteristics (depth, texture, pH...), but also by the nature and extent of vegetation cover.
Soil gas	Tritiated water vapour (HTO) , and CH_3T in the soil pores??
Plant canopy atmosphere	A mixture of air from the free atmosphere and the soil pore space within the canopy (with or without lateral air flow). Important considerations relate to open and closed canopy structures and plant morphology[1].
Belowground plant material	Liquid water (HTO) and dry matter (OBT) in Roots.
Aboveground plant material	Liquid water (HTO) and dry matter (OBT) in Stems and leaves and fruits and grains.
Animal water	Liquid water (HTO) in the animal
Animal dry matter	Dry matter (OBT) of the animal
Sink	Anything outside volume of interest

Gas and water source interaction matrix

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SOURCE (Gas)			Dry deposition (if HT release)	1)Wet deposition 2) Sprinkler irrigation 3) Interception by soil		Advection/diffusion							1)Wet deposition 2) Sprinkler irrigation 3)Interception by plant		
	SOURCE (Water)			Irrigation (Infiltration) 2)Upwelling 3)Capillary rise									Interception of irrigation water		
		SOIL WATER													
			HT	Soil microbial oxidation											1)Surface run-off 2)Percolation to groundwater
Percolation				HTO Transport by bulk flow (see hydrological IM)	OBT formation	Diffusive exchange	Evaporation	Evaporation		Root uptake					1)Surface run-off 2)Percolation to groundwater
					OBT										
				1)Diffusive exchange 2)Gas sorption		SOIL ATMOSPHERE	Degassing	1)Diffusion 2)Pressure pumping		Root uptake			Aerenchyma	Aerenchyma	
						1)Diffusion 2)Pressure pumping	CANOPY ATMOSPHERE - slow air flow (below Zd)	Diffusion/advective transport					FoliarUptake	Gross photosynthesis	
							Diffusion/advective transport	CANOPY ATMOSPHERE - fast air flow (above Zd)					FoliarUptake	Gross photosynthesis	Free air
									BELOWGROUND PLANT MATERIAL			Translocation (assuming root uptake)			Cropping loss
										HTO	OBT formation				
			Root exudation	Root exudation	Death & decomposition (UL & LL)& ploughing	Root respiration					OBT Biological growth of roots				
									Translocation			ABOVEGROUND PLANT MATERIAL			1)Cropping loss 2) Weathering
							Transpiration	Transpiration					HTO		
							Aboveground plant respiration	Aboveground plant respiration						OBT Biological growth of aboveground parts	
															SINK

Soil layer interaction matrix (gas or water source)

The yellow boxes indicate the lower soil layer (LL) and the grey bowes indicate the upper soil layer (UL)

SOURCE (gaz)				1) Wet deposition 2) Sprinkler irrigation 3) Interception by soil	Advection/diffusion	
	SOURCE (Water)			Infiltration (Irrigation)		
		SOIL WATER (LL)	Diffusive exchange	Capillary rise (HTO)		Percolation
		Gaz sorption	SOIL ATMOSPHERE (LL)		Diffusion/advection	
Evaporation		Percolation		SOIL WATER (UL)	Diffusive exchange	
			Diffusion	Gaz sorption	SOIL ATMOSPHERE (UL)	
		Upwelling	Diffusion	Gaz sorption		WATER TABLE

Tritium interaction matrix for animals

ATMOSPHERE				Inhalation Skin absorption	Inhalation Skin absorption		
	SOIL				Ingestion	Ingestion	
		PLANT MATERIAL			Ingestion	Ingestion	
	1)Excretion 2) Death and decomposition	Excretion	ANIMAL		1) Translocation 2) Hmetabolism?		
Exhalation	Inhalation (burrowing animals)			HT		OBT formation	Excretion
Exhalation	Inhalation (burrowing animals)				HTO	OBT formation	Excretion
						OBT	1)Excretion 2) Death and decomposition (both at outcrop)
							SINK

General interaction matrix for the terrestrial environment

Processes of potential importance for H3 are highlighted in bold.

ATMOSPHERE	Deposition		1) Deposition and interception 2) GrossPhotosynthesis	Gross photosynthesis		Inhalation		1) Dry deposition 2)Precipitation 3) Interception		
1)Evaporation 2)Droplet production	**WATER BODIES**		**1) Root uptake 2) Irrigation**			Ingestion		**1)Irrigation 2)Recharge by surface waters**	Release from solution	Recharge by surface waters
		VEGETATION (ABOVE – BELOWGROUND)				Ingestion	Ingestion			
1)Respiration 2)**Transpiration**	Senescence and death		**WATER**						Root respiration	Biological weathering
1)Respiration 2) Leaf fall 3) Release of other organic compounds				**DRY MATTER**					Root respiration	1) Litter fall (at outcrop) 2) Senescence and death 3) Biological weathering
	1)Excretion 2) Death	Excretion			ANIMALS	1) Translocation 2) Hmetabolism?	Translocation			
Exhalation						**WATER**	OBT formation	Excretion	Inhalation (burrowing animals)	Excreion
							DRY MATTER			1)Excreation 2) Death and decomposition (both at outcrop)
Evaporation	Groundwater recharge		**Root uptake**		Ingestion			**SOIL WATER**	**Diffusive exchange**	Surface run-off
Diffusion			**Root uptake and transport in aerenchyma**					**Diffusive exchange**	**SOIL ATMOSPHERE**	Diffusive exchange
Resuspension (at outcrop) Diffusion	Desorption	1)External contamination 2) Irrigation			1)Ingestion 2)Bioturbation			1)**Diffusion** 2)Advection 3)Colloid transport	**Diffusive exchange**	**Interface with geosphere**

Comparison between models

"**EXP**"= explicit inclusion as a dynamically treated or constant FEP in the model

"**imp**" = Included, but subsumed within a broader FEP

Feature	Models									
	TOCATTA (IRSN)	EESAD (NIRS)								
Source	-	EXP								
Soil water	EXP	EXP								
Soil gas	imp	-								
Plant canopy atmosphere	EXP	EXP								
Below ground plant material	imp	-								
Above ground plant material	EXP	imp								
Animal water	EXP	EXP								
Animal dry matter	EXP	EXP								
Sink	EXP	EXP								

Diffusion	EXP	-								
Discharge from below (upwelling)		-								
Environmental change		-								
Erosion		-								
Evaporation	imp	EXP								
Excretion		-								
Exhalation		-								
Foliar uptake	EXP	-								
Gas sorption		-								
H metabolisation	EXP	imp								
Infiltration	EXP	EXP								
Ingestion	EXP	EXP								
Inhalation	EXP	EXP								
Interception	EXP	-								
Irrigation	EXP	-								
Microorganism metabolism & assimilation										
Gross photosynthesis and growth	EXP	imp								
OBT formation	imp	EXP								
Oxidation HT to HTO		EXP								
Percolation	EXP	EXP								
Ploughing		-								
Precipitation	EXP	EXP								
Respiration										