BLUEGEM

Biosphere and Land Use Exchanges with Groundwater and soils in Earth system Models

Belmont Forum, CRA Soils 2020

“Towards Sustainability of Soils and Groundwater for Society”

May 6, 2021 – Kickoff meeting

Today's agenda

4 points of half an hour:

1. Reminder of the main features of the project (goals, task organization, milestones)
2. Round table, linked with the tasks BLUEGEM
3. Discussion on short-term actions : link with stakeholders, Belmont kickoff meeting and 1st report in June, web site and data dissemination, advisory board, scientific vs administrative meetings, etc.
4. Questions and other topics

Who wants to take notes for the minutes?

BLUEGEM website (feedback welcome)
www.metis.upmc.fr/~ducharne/bluegem

Main features of BLUEGEM

Overaching goal: Explore the joint evolutions of climate, soils, groundwater, and irrigation, throughout the Anthropocene (1900-2100), to better understand their coupling, foresee their potential changes, and identify possible social consequences

- Proposal initiated more than 1 year ago, submitted last September, and selected by the Belmont Forum in February 2021 (with 5 other projects)
- 5 research teams from 4 countries & 2 stakeholder organizations
- Rich history of mutual collaborations: IGEM (IPSL & NTU), LS3MIP (IPSL & UT), NTU-UT bilateral project on LUC impacts on droughts and precipitation extremes over the Maritime Continent, several projects between MSU and MRC over the Mekong, climate change impact assessment in France (IPSL, OFB, etc.)
- **Over 1 million Euros for 3 years**
- Two kinds of funding: “normal “ and for Coordination of the 6 CRA projects

Main features of BLUEGEM

Three innovative objectives:

Objective 1. Establish the fingerprint of GW-SM interactions and irrigation on global and regional climate, water resources, biosphere, and soil carbon pools.

Objective 2. Provide improved projections of global and regional climate, water resources, biosphere and soil carbon pools, fully taking into account the influence of GW irrigation and GW-SM interactions.

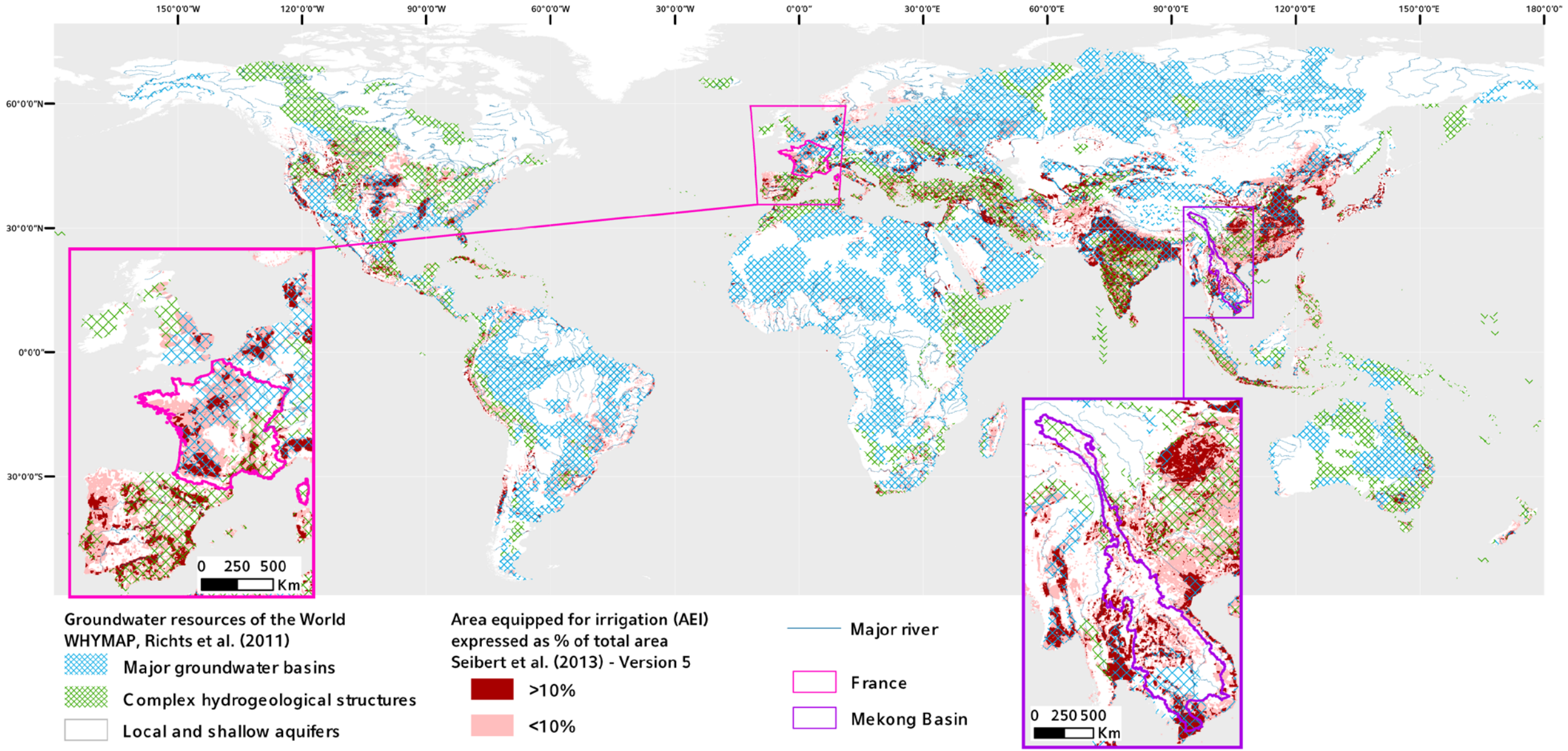
Objective 3. Integrate local and regional knowledge and expertise as well as socio-economic data to refine the land use and irrigation scenarios used in state-of-the-art climate projections (CMIP6) and to explore pathways for sustainable CZ management.

Main features of BLUEGEM

Two scales and three geographic domains:

- **Global scale**, with factorial simulations by two Earth system models (ESMs) to compare the influence of anthropogenic warming, land-use and irrigation management, and groundwater-related feedbacks, on past and future pathways;
- **Regional scale in two "focal areas"**, metropolitan France and the Mekong River basin, to provide contrasting examples of the studied processes and enable anchored transdisciplinary work with stakeholders, social and natural scientists.

Main features of BLUEGEM



Main features of BLUEGEM

We combine advanced numerical modelling and participatory methods:

- To quantitatively assess the influence of irrigation and groundwater on climate and critical zone processes, we use **global simulations by two state-of-the-art ESMs** used in CMIP6: IPSL-CM6 and CESM2. The corresponding land surface models, ORCHIDEE and CLM5, describe the dynamics of the biosphere and soil carbon, and represent groundwater-soil moisture interactions and irrigation.
- In addition to global ESMs, we also run **high-resolution land-only simulations in two focal areas** (France and Lower Mekong River basin), to more realistically reproduce the water fluxes and storages than global simulations, and be used in the tasks of the social dimension.
- In France, we will also carry out **integrated assessment modeling** of the groundwater / land use / irrigation nexus under climate change, owing to the AROPAj agro-economic model of European agricultural supply.
- BLUEGEM also strongly relies on **participatory research methods**, to engage local communities in the design and implementation of the project's research activities, and also as an effective vehicle to disseminate research results. Three participatory research methods will be used: participatory GIS, participatory cultural mapping, and storylines.

Main features of BLUEGEM

Type of activity	Global [MHL]	France [AD]	Mekong [YP]
T1 Coordination	**T1** - Project coordination between disciplins & domains **[AD]**		
T2.1 ESS Model developments	**T2.1Ga** - ORC: soil carbon **[BG]**	**T2.1F*** - ORC-HR: calibration **[AD,PP]**	**T2.1M** - CLM5-HR: calibration **[YP]**
	T2.1Gb - CLM5: water management **[MHL,YP]**		
T2.2 ESS Simulations & Downscaling	**T2.2G** - Factorial ESM simulations over 1900-2100 **[MHL]**	**T2.2FM** - Downscaling over France & Mekong **[HK]**	
		T2.2Fa - HR ORC simulations **[AD,JP]**	**T2.2M** - HR CLM5 simulations **[YP]**
		T2.2Fb - Run-time bias-corrected simulations **[FC]**	
T2.3 ESS Analyses	**T2.3a** - Model benchmarking **[HK,MHL]**		
	T2.3b - Trend attribution, influence of land-atmosphere feedbacks **[MHL,FC,HK]**		
	T2.3c - Impact assessment (water resources, soil carbon, biosphere) **[YP, BG,HK]**		
T3 HSS work		**T3F** - Agro-economic scenarios of LU & irrigation evolutions **[PAJ,AD]**	**T3Ma** - Hot spots and bright spots of farmer behaviors **[DK]**
			T3Mb - Farming futures and social-ecological feedbacks **[DK, SYK]**
T4 Transdisciplinary work	**T4G** - Participatory workshop on GW-irrigation management options **[AD, AJ]**	**T4F** - Plausible storylines for LU and GW management with stakeholders **[AJ,CM]**	**T4M** - Participatory GIS and participatory cultural mapping **[DK,YP, SYK]**
		T4FM - Comparison of the focus areas **[AD,YP]**	
T5 Dissemination & data management	**T5a** - Preparation of selected variables and indicators **[HK,PP]**		
	T5b - Data storage and exchanges among project partners **[HK,MHL]**		

Main features of BLUEGEM

Tasks	Domain	Leaders	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	Gets info from
T1 - Project coordination	All	AD													T4F,T4M
T2.1Ga - ORC Development: soil carbon	Global	BG													
T2.1Gb - CLM5 Development: water management	Global	MHL,YP													
T2.1F - ORC-HR: calibration	France	AD,PP													
T2.1M - CLM5-HR: calibration	Mekong	YP													
T2.2G - Factorial ESM simulations over 1900-2100	Global	MHL													T1
T2.2FM - Downscaling over France & Mekong	F&M	HK													T2.2G
T2.2Fa - HR ORC simulations	France	AD,JP													T2.1M,T2.2FM,T3F,T4F
T2.2M - HR CLM5 simulations	Mekong	YP													T2.1F*,T2.2FM,T4M
T2.2Fb - Run-time bias-corrected simulations	France	FC													T1,T2.2FM
T2.3a - Model benchmarking	All	HK,MHL													T2
T2.3b - Trend attribution, land-atmosphere feedbacks	All	MHL,FC,HK													T2
T2.3c - Impact assessment (water, soil C, biosphere)	All	YP,BG,HK													T2
T3F - Agro-economic scenarios of LU & irrigation	France	PAJ,AD													T1,T4F,T2.2G,T2.2.Fa,T5a
T3Ma - Hotspots and bright spots of farmer behavior	Mekong	DK													T2.2M,T2.3c,Other Project
T3Mb - Farming futures and social-ecological	Mekong	DK,SYK													T2.2M, T2.3c
T4G - Workshop on GW-irrigation management	Global	AD,AJ													T2.3,T5a,T4FM
T4F - Plausible storylines of LU-GW management	France	AJ,CM													T2.3,T3Fb,T5a
T4M - Participatory GIS and cultural mapping	Mekong	DK,YP,SYK													T2.2M,T2.3c,Other Project
T4FM - Comparison of the two focus areas	F&M	AD,YP													T2.2, T2.3, T3, T4F,T4M,
T5a - Preparation of selected variables and indicators	All	HK,PP													T2.2,T3F
T5b - Data storage and exchanges within project	All	HK,MHL													T1,T2.2, T2.3, T3,T4,T5a

Main features of BLUEGEM

CRA Coordination (with great expectations from the Belmont Forum!)

Coordination Action 1. Share BLUEGEM's global simulation results to the other projects

- We will share a list of our global simulations and main variables (on the BLUEGEM web page, planned under task T1), and upon request by the PIs of the other projects, we will extract the requested data for their regions of interest (in netcdf format). The results of the high-resolution simulations over France and Mekong may also be distributed if necessary, but in a more limited way, since the high resolution drastically increases the data file's size (for both storage and transfer).
- For easier appropriation, we also propose to plot maps and time series for selected variables, to be discussed with the CRA projects' PIs. Indicators based on simple combinations or the simulated variables may also be produced, if simple enough and upon discussion.
- The results of data processing will be made available online to the general public, in a FAIR way (Findable, Accessible, Interoperable, Reusable), unless they involve non-open input data (which will not be the case for our simulation results). This action will therefore contribute to **task T5a** of the project, aiming at disseminating the BLUEGEM results.

Main features of BLUEGEM

CRA Coordination (with great expectations from the Belmont Forum!)

Coordination Action 2 (and Tasks T4G). Gather scientists and stakeholders from other CRA projects to discuss plausible options for GW and irrigation management across the globe under climate change

The goal is to combine the results from the BLUEGEM project (global scale simulations, social science and transdisciplinary work in the focus regions), with the expertise of other CRA projects and invited international experts, gathered at workshops organized alongside the CRA meetings, to discuss plausible options for GW and irrigation management across the globe under climate change.

- ***kick-off meeting***: information on BLUEGEM and identification of interested projects
- ***mid-term meeting*** (half-day): informal exchanges on (i) BLUEGEM results and participatory work methods, (ii) the natural and social issues related to GW-irrigation-climate change in the areas addressed by the other CRA projects.
- ***end-of-term CRA meeting***: main workshop (1 or 2 days) to propose plausible solutions for sustainable GW and irrigation management, under the form of storylines.

Main features of BLUEGEM

Relevance to the CRA "Towards Sustainability of Soils & Groundwater for Society":

- Novel research to assess "climate change impacts on soil and GW resources in a long-time perspective", and also the reverse influence of GW, SM and socio-economic decisions on the future climate
- The socio-economic decisions we focus on are the ones controlling LU and irrigation changes, thus happening in "highly anthropized ecosystems"
- Our project will lead to "improved predictive capacity" of important CZ processes linked to GW, soils and irrigation, by improved articulation of their human and natural dimensions, both in models and their input socio-ecological scenarios
- We put a strong emphasis on transdisciplinary work and dissemination to a broad audience of local actors of LU, soils and water management owing to the engagement of influential stakeholders in France and LMRB, and a rich array of participatory methods

Round table

- 5 research teams from 4 countries & 2 stakeholder organizations
- Today's meeting focused on PIs and task leaders
- Short scientific profile on www.metis.upmc.fr/~ducharne/bluegem/people.php

						Dedicated time (in pers.mo but mean % time)					
Org.	Last name	First name	Initials	Gen.	Position	Y1	Y2	Y3	Total	%	Tasks (in bold if coordination)
IPSL	**12 pers (91.5 pers.mo)** + 2 pers requested (30 pers.mo)					55,5	37,5	28,5	121,5	24	
	Ducharne	Agnes	**AD**	F	Senior scientist	6	6	6	18	50	**Project, France, T1, T2.1F**, T2.2G, **T2.2Fa**, T2.3ab, T2.3c, **T3F**, **T4G**, T4F, **T4FM**, T5a
	Cheruy	Frederique	**FC**	F	Senior scientist	2	2	2	6	17	**T2.2Fb**, T2.2G, **T2.3b**, other T2.3
	Guenet	Bertrand	**BG**	M	Senior scientist	2	2	2	6	17	**T2.1Ga**, T2.3ab, **T2.3c**, T4F, T4FM
	Jezequel	Aglae	**AJ**	F	Junior scientist	2	2	2	6	17	**T4F**, **T4G**, T4FM
	Peylin	Philippe	**PP**	M	Senior scientist	1	1	1	3	8	**T2.1F**, T2.2Fa, T2.3, T4FM, **T5a**
	Polcher	Jan	**JP**	M	Senior scientist	1	1	1	3	8	T2.1F, T2.2Fa, T2.3, T4G
	Ciais	Philippe	PC	M	Senior scientist	0,5	0,5	0,5	1,5	4	T2.1Ga, T2.1F*, T2.3
	Ghattas	Josefine	JG	F	Research engineer	1	1	1	3	8	T2.1Ga, T2.1F*, T2.2G, T2.2Fb, T5b
	Baro	Aurelien	AB	M	GIS engineer	1	1	1	3	8	T2.1F, T2.3
	Arboleda	Pedro	PA	M	PhD student	12			12	33	T2.2G, T2.3
	Coulon	Maelle	MC	F	PhD student	6	6		12	33	T2.2Fb, T2.3ab
	X1				IPSL Post-doc	12	6		18	50	T2.1F, T2.2Fa, T2.3
	X2				Post-doc	9			9	25	T2.1Ga, T2.3
	X3				Post-doc		9	12	21	58	T2.2G, T2.2Fab, T2.3, T4FM
OFB	**2 pers (7.5 pers.mo)**					2,5	2,5	2,5	7,5	10	
	Magand	Claire	**CM**	F	Scientific officer	2	2	2	6	17	T3F, **T4F**, T4FM
	Augeard	Benedicte	AB	F	Scientific manager	0,5	0,5	0,5	1,5	4	T4F, T4G
INRAE	**2 pers (13 pers.mo)** + 2 pers requested (39 pers.mo)					18	18	16	52	36	
	Jayet	Pierre-Alain	**PAJ**	M	Senior scientist	3	3	3	9	25	**T3F**, T4F, T4FM
	Ollier	Maxime	MO	M	PhD student	2	2		4	11	T3F
	Humblot	Pierre	PH	M	Research engineer*	1	1	1	3	8	T3F
	X4				PhD student	12	12	12	36	100	T3F, T4F, T4FM
U-Tokyo	**2 pers (21 pers.mo)** + 2 pers requested (39 pers.mo)					20	20	20	60	42	
	Kim	Hyunjun	**HK**	M	Assoc. Professor	6	6	6	18	50	T2.2G, **T2.2FM**, T2.3a, **T2.3b**, T2.3c, **T5a**, **T5b**, **Data Management**
	Yamazaki	Dai	DY	M	Assoc. Professor	1	1	1	3	8	T2.2FM, T2.3c
	Tokuda	Daisuke	DT	M	Project scientist	12	12	12	36	100	T2.2G, T2.2FM, T2.3a, T2.3b, T2.3c
	Eiji	Ikoma	EI	M	Assoc. Professor	1	1	1	3	8	T5a, T5b
NTU	**3 pers (84 pers.mo)** + 2 pers requested (72 pers.mo)					34	34	34	102		
	Lo	Min-Hui	**MHL**	M	Assoc. Professor	6	6	6	18	50	**Global, T2.1Gb, T2.2G, T2.3ab,** T2.3c, **T4G, T5b**
	Kuo	Shih-Yun	**SYK**	F	Junior Researcher	2	2	2	6	17	**T3Mb, T4M**
	Chen	Yi-Ying	YYC	M	Assist. Researcher	2	2	2	6	17	T2.2G, T2.3b
	X5				Research assistant	12	12	12	36	100	T2.3abc, T5b
	X6				Research assistant	12	12	12	36	100	T2.1Gb, T2.2G, T2.3b
MSU	**2 pers (17 pers.mo incl. 3.75 requested)** + 2 pers requested (22 pers.mo)										
	Pokhrel	Yadu	**YP**	M	Assoc. Professor	3,5	3,5	3,5	10,5	30	**Mekong, T2.1M, T2.1Gb, T2.2M,** T2.3ab, **T2.3c, T4M, T4FM**
	Kramer	Dan	**DK**	M	Professor	2,2	2,2	2,2	6,6	18	**T3Ma, T3Mb, T4M**, T5a
	X7				PhD Student	4,5	4,5	4,5	14	38	T2.1M, T2.1Gb, T2.2M, T2.3abc, T4M,
	X8				PhD Student	2,8	2,8	2,8	8	23	T3Ma, T3Mb, T4M
MRC	**1 pers (3 pers.mo)**										
	Thim	Ly	LT	M	Research Scientist	1	1	1	3	8	T2.1M, T2.2M, T4M

Round table

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	T5b - Data storage and exchanges among project partners **[HK,MHL]**		

Short term actions

1. **With Belmont Forum and funding agencies**

- Are research conventions signed?
- First report due by June 15 (AD et al.)
- **CRA kickoff meeting at SRI Sustainability Research & Innovation Congress**
  - https://sri2021.org/
  - At least three members of natural sciences, social sciences, and stakeholders
  - Registration need ($240)
  - CRA Soils2020 event on Sunday June 13 at 12:00 – 15:00 (US CE time??)
  - 3-minute video will be needed
  - Linked with Coordination Actions…

Short term actions

2. Internal coordination

- Scientific and administrative meetings: Which scale? Which schedule?
  - Administrative with PIs every month ?
  - Scientific plenary meetings every 3 months?
  - Ad hoc meetings per action, domain, as required
  - Specific coordination for France (IPSL + OFB + INRAE) : OK?
  - Dedicated diffusion lists?
- Launching the work with stakeholders : Mekong, France

Short term actions

3. Advisory board:

- Who ?

  Alice Aureli (head of the UNESCO GW Systems and Settlements Section, Paris, France)
  Brian Eyler (Stimson Center Director for Southeast Asia, Washington DC, USA)
  Jay Famiglietti (U. Saskatoon, Canada), specialist of global GW issues
  Bridget Scalon (UT Austin, USA), specialist of global GW issues
  Stefan Siebert (Georg August Universität Göttingen, Germany), specialist of global irrigation for the FAO

- When to organize the first meeting, with whom from BLUEGEM?

Short term actions

4. Dissemination

- Public web site: www.metis.upmc.fr/~ducharne/bluegem

  Private page not yet private!
- Data dissemination: long-term data repository hosted by DIAS (Data Integration and Analysis System) in Japan https://www.diasjp.net/en
- Important task: list of shared variables (T5 & Coordination, to be publicized/extended at SRI2021)

Questions and other topics

- **ESS simulations :**
  - Start in 1900 or 1950?
  - SSP5-8.5 + which other SSP? SSP2-4.5
- **Synergies with other ongoing projects?**
- **Tight schedule, anticipate hiring** (e.g. with Bertrand Guenet)
- **???**