CLIMAX
general discussion

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CLIMAX was submitted to a Belmont Forum-JPI Climate joint call addressing:

CLIMATE SERVICES COLLABORATIVE RESEARCH ACTION

ON

CLIMATE PREDICTABILITY AND INTER-REGIONAL LINKAGES

(Drivers and mechanisms linking Poles & Monsoons

for societal usefulness of climate services)

CALL TOPICS

Projects had to address one or more of the following topics:

Topic 1-Understanding past and current variability and trends of regional extremes

- This topic is devoted to:
- ***Observation:*** *Place modes of large-scale sub-seasonal to decadal variability in a climatological context using historical and paleoclimate data and coupled Earth/climate system models for the past, present and future conditions,*

- ***Process:*** *Understanding drivers and mechanisms of observed large-scale variability and trends on sub-seasonal to decadal time scales and their regional representation (teleconnections, role of components such as cryosphere, oceanand/or stratosphere, orography, warming "hiatus" …),*

- ***Evaluation:*** *Attribution of discrepancies between regional observations and historical simulations and hindcasts, to uncertainties in the variability of natural forcings and of, modelling uncertainties and/or internal variability.*

Topic 2-Predictability and prediction skills for near-future variability and trends of regional extremes

Climate forecast skill is yet very unsatisfactory for supporting stakeholders' decisions. Only some potential sources of predictability have been detected so far. Further exploration may improve prediction skill:

- ***Exploration:*** *new regional model-based sub-seasonal/decadal prediction ensemble for the reliability of near-term projections for user-relevant spatial scales*
- ***Investigation:*** *impact of initializing coupled components of the sub-seasonal to decadal climate system other than the ocean (e.g. sea ice, land surface, vegetation, aerosols …)*
- ***Assessment:*** *test different approaches to improve near-future estimates of variability and trends (e.g. model weighting approaches), benchmark realism of projections and initialized predictions using empirical statistical relationships.*

Topic 3-Co-construction of near term forecast products with users

Although topics 1 and 2 above do address issues that are relevant for users, their utility needs to be progressed in order to fully benefit from new research results, with:

- ***Trans-disciplinarity:*** *Co-construction development of processes to co-identify and co-develop the useful knowledge, based on near-term climateforecasts in sub-seasonal to decadal scale, required by a group of users (from public/private sectors or communities)*

- ***Investigation:*** *Bounds and limits of climate information and its uncertainties, derived from sub-seasonal, decadal climate models and observations, for integration by users within their current constraints, values and representations.*

The development of inter-and trans-disciplinary collaborations is encouraged, especially for Topic-3, involving natural and social scientists to work with various type of users. Overall, an important target of this call is to provide results that can serve at different spatial scales and can be easily transferrable to emerging regional climate services.

CLIMAX goal and motivation

- An inter- and trans-disciplinary framework based on a European-South American research cooperation is proposed to underpin climate services in South America. Climate variability patterns linking the South American Monsoon region, including Amazonia, with southeastern South America, influence climate extremes and impact several societal sectors.

- More than 200 million people live in the region that is one of the world largest agricultural producing region and where the second world largest hydroelectric power plant is situated.

CLIMAX specific Objectives

1) to better understand the combined role of remote and lo… rica climate variability from sub-seasonal to decadal ti… occurrence and intensity of extreme events … improved understanding of the effects of land use … subtropics and their impact on extreme precipitation e…

TOPIC 1

2) to … levels associated with regional climate pattern from sub-sea…

TOPIC 2

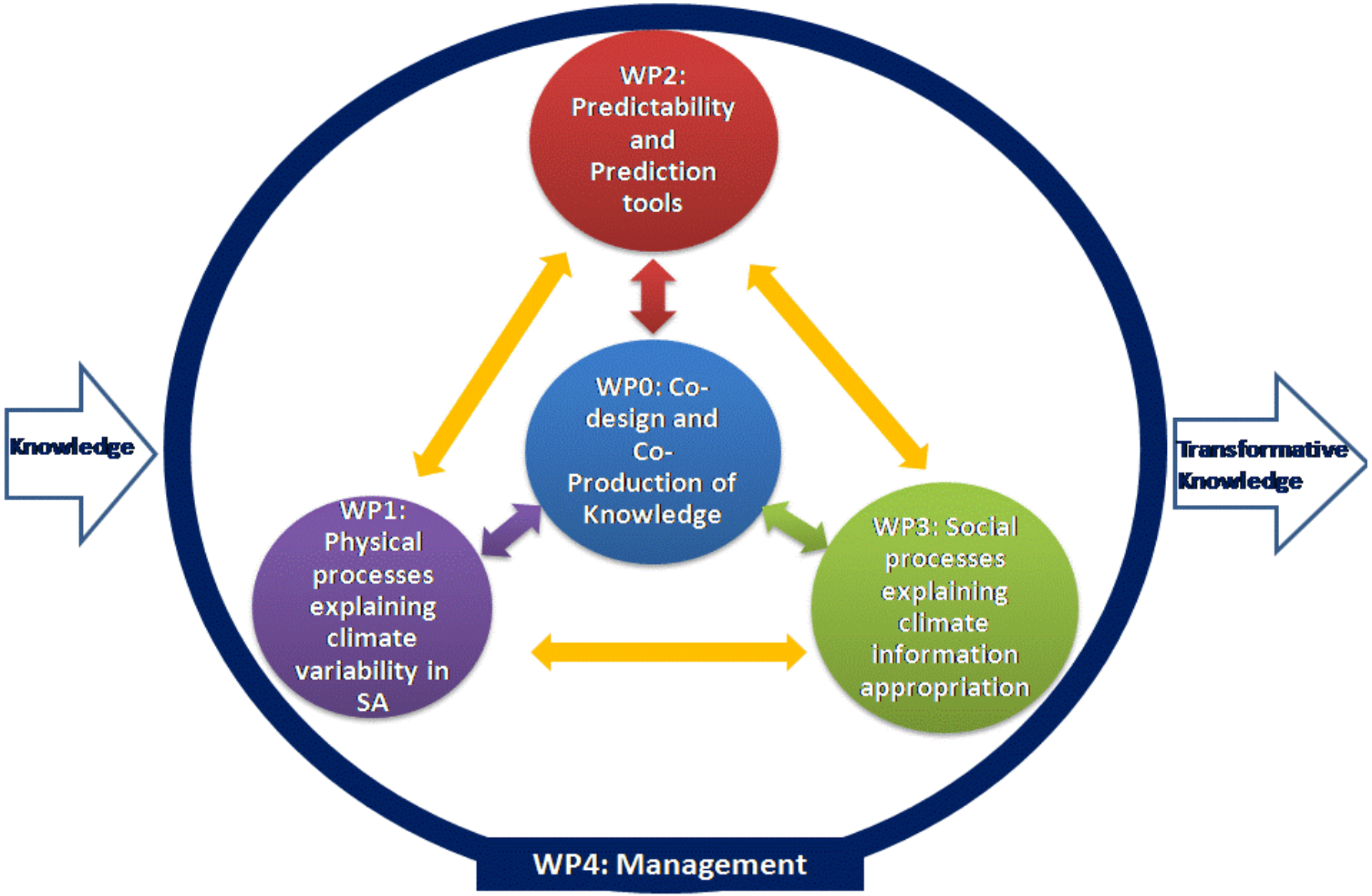
3) to develop in… tools not only of climate variability but also of climate impact on b… rology in SSA on subseasonal and seasonal time scales;

4) to analyze climate knowledge co-production in order to revise how climate data are used by various stakeholders in their s… texts; and

5) to analyze communication conditions o… linary process of knowledge co-production that determi… mation in the process. Innovative technologies will be c… and tools by the project for the SSA-RCC, agriculture and hydr… will be implemented in the context of the southern South America … entre, and will include actors from the national meteorological services, agriculture and energy stakeholders and organizations.

TOPIC 3

CLIMAX Project Conceptual Model



WP Discussion

WP1

Physical processes explaining climate variability in SA
Coordinators: K. Thonicke (PIK), A. Rammig (TUM)

Objectives:

WP1.O1: To describe how precipitation variability in SSA is influenced remotely by large-scale climate patterns (e.g. MJO, ENSO, SAM,PDO) through associated teleconnections (e.g. PSA) as well as by regional land surface conditions from subseasonal to decadal timescales. The combined influence of both remote and local sources of variability will be particularly addressed.

WP1.O2:To identify the main (remote and local) physical mechanisms linked to extreme precipitation in selected areas of tropical and SSA and link them to the regions of highest climate predictability identified in WP2. A focus will be on the analysis of the combined influence on precipitation extremes over SSA by different climate phenomena (such as ENSO and MJO) occurring simultaneously.

WP1.O3:To investigate how historical land-use and forest cover change in Amazon and southeastern Brazil on continental moisture transport. The influence of land-cover driven changes in moisture transport on climate variability in SSA will be particularly addressed. A further focus will be to quantify impact of changes in moisture transport and of land-use change on river hydrology in Southeastern Brazil.

WP1.O4: To co-design and co-develop new climate monitoring tools based on the knowledge resulted from achieving the previous WP1 objectives, for climate variability in SSA.

WP1

Tasks

WP1.T1: Analyses of precipitation variability and associated climate conditions at both large and regional spatial scales and from sub-seasonal to decadal timescales by applying empirical orthogonal functions (EOFs), correlations, composites and regressions analyses (INPE, CNRS/UMI3351)

WP1.T2:Analyses of the variability of soil moisture at the surface and in the rooting zone in SSA using the Global Land Data Assimilation System (GLDAS) and climate model outputs (CHFP, CFSv2, ENSEMBLES), from subseasonal to decadal time scales. Explore their links with the climate patterns analyzed in WP1.T1. (CNRS/UMI3351, INPE)

WPT1.T3 :Analyses of the role of forest disturbance and land-use change on forest fragmentation and degradation using a moisture recycling network model, and the dynamic vegetation models, LPJmLand INLAND. Investigate drought-induced changes in water conductivity in tropical trees and their impact on evapotranspiration and climate feedbacks in the Amazon and potential climate feedbacks (PIK, TUM, INPE)

WP1.T4: Assessment of seasonal to decadal precipitation variability associated with the amount and direction of moisture transport and recycling in South America by applying the CPTEC climate model and the moisture recycling network model which integrates drivers of climate and land-use change. Investigate impacts of changes in Amazon land surface characteristics on rainfall variability in SSA using the CPTEC/INPE AGCM and INLAND dynamic vegetation model. (PIK, TUM, INPE)

WP1.T5:Evaluation of the relationship between local land use change and hydrological change in SSA. Study of the potential effects of agroforestry on severe drought events. Historical series of hydroclimatic variables will be correlated with climate variability indexes, land surface and vegetation properties to explore the hydrologic response through numerical experiments (INPE, CNRS/UMI3351).

WP1.T6:Development of regional climate indices to monitor climate variability in SSA at subseasonal and seasonal timescales by applying combined EOFs to sets of key variables identified in WP1.T1 and T2. Moreover, an index illustrating the importance of source and intermediate moisture transport regions and their influence on SSA will be developed, based on WP1.T3 results. Variables that can be used as an early warning signal of critical climatic conditions will be co-designed and co-produced with the other WPs and coordinated by WP0, see section 11 (CNRS/UMI33513351, PIK, INPE).

WP2

Predictability and Prediction tools

Coordinators: I. Cavalcanti (INPE), R. Hutjes (WUR)

Objectives:

WP2.O1: To assess predictability and prediction skill for subseasonal, seasonal and decadal timescales from multi-model and multi-member prediction datasets.

WP2.O2: To apply the moisture recycling network model, improved in WP1, and evaluate how the model performance improved climate predictability of historical and near-future (i.e. until 2030) continental moisture transport.

WP2.O3: To perform hindcast experiments with hydrological and agricultural models forced by subseasonal and seasonal hindcasts, analyzing the propagation of predictive skill and uncertainties throughout the model chain.

WP2.O4: To co-design a regional prediction framework for the two WP0 case studies based on the outcomes of the previous WP2 objectives and on WP0 co-design workshops.

WP2

Tasks

WP2.T1: To apply relevant metrics (error quantifications, anomaly correlations and probabilistic verification scores) as well as traditional potential predictability definitions (e.g. [41]) on existing hindcasts from S2S, CHFP projects, and other global centres (ECMWF-S4), and the hindcasts of global and regional models available at CPTEC/INPE. The assessment will focus on precipitation and temperature, and later extended to other variables. (CPTEC/INPE, CNRS/UMI3351)

WP2.T2: Analysis of land cover change impacts on the regional climate, especially on the occurrence and intensity of extreme events in the near-future and their effects on the hydrology and carbon cycles. Conduct offline simulations with the land surface model ORCHIDEE and the dynamic vegetation model LPJmL forced by historical reanalysis and near-future multi-model climate projections (e.g. CMIP5). Changes in moisture transport from the tropics to SSA will be assessed under historic and future climate to attribute changes to deforestation and degradation. (LSCE, PIK, TUM,CCST/INPE).

WP2.T3: Development of products based on seasonal ensemble streamflow and crop yield forecasts in basins and regions of SSA (Paraíba do Sul and Iguazú Basins, the Argentinean Pampas and other areas to be selected with WP0). Assessment of seasonal ensemble streamflow forecast for drought and flood made by different hydrological models (MHD-INPE, ORCHIDEE, VIC). The ORCHIDEE model will also be used to predict forests, agricultural and pastures productivity in selected regions of SSA. The CASANDRA platform [45] based on the DSSAT crop model [25] will forecast crop yield in the Pampas of Argentina. Both potential skill (compared to reanalysis with same impact model) and actual skill (compared to observed values of discharge or crop yields) will be assessed. The relative contribution to the total skill originating from correct specification of initial conditions (e.g. soil moisture, vegetation status, snow, etc.) versus climate forcing quality respectively will be assessed [49]. The sensitivity of crop yields to the activity of the leading patterns of climate variability on subseasonal (e.g. MJO) and seasonal (e.g. ENSO, SAM, IOD) timescales will be assessed. Techniques for bias correction and calibration-downscaling of the information provided by climate prediction for its incorporation in impact models will be analyzed. (CPTEC/INPE, CCST/INPE, LSCE, PIK, WUR, CNRS/UMI3351).

WP2.T4: Co-development of a regional prediction framework for the two WP0 case studies based on the outcomes of the WP2 objectives and on WP0 co-design workshop discussions. (CNRS/UMI3351, CPTEC/INPE and WP0 participants).

WP3

Predictability and Prediction tools

Coordinators: I. Cavalcanti (INPE), R. Hutjes (WUR)

Objectives:

WP3.O1: Identify social representations and strategies of agriculture producers and hydropower stakeholders towards extreme climate events.

WP3.O2: Describe and analyze the contexts and situations in which climate becomes a relevant variable, and how the interaction between the agents and providers of climate information takes place.

WP3.O3: Document and analyze conflicts and controversies related to the interactions between stakeholders and providers of climate related information.

WP3.O4: Assess the agro climatic and hydropower forecast production process and the products released by SSA-RCC

WP3.O5: Contribute with WP0 to establishing communication and co-production bonds between scientific experts, meteorological institutions and territorial actors.

WP3

Tasks

WP3.T1: Ethnographic fieldwork at sites of the chosen case studies and each relevant institutional context. The fieldwork will include: a description of the region´s productive calendar, performance of semi-structured interviews with diverse actors, a determination of the spontaneous strategies they implement towards different climatic factors, microeconomic and socio-climatic surveys, assessing their effectiveness on each case study.

WP3.T2: Based on WP3.T1´s result, determination of risks thresholds for each actor´s category towards extreme climate events.

WP3.T3: Analysis of mass media publications, like news and articles on meteorology and public policies related to risk management and climate variability, as well as academic bibliography on the subject. Such material represents one of the main ways of climate social construction, central to better understand social perceptions and climate representations of the communities involved in the trans-disciplinary dialogue.

WP3.T4: Analysis and interpretation of the collected empirical data based in grounded theory: systematization, open codification, contrasting native categories and disciplinary analytical conceptual categories.

WP3.T5: Analysis about how the representations of climatic demands and services relate to socio-cultural conditions and politic context of the studied populations.

WP3.T6: Analysis of on workshops, meetings and training activities held by the project and by SSA-RCC, as central instances for ethnographic fieldwork. In these scenarios all engaged actors interact: academics, developers, forecasters, institutions, stakeholders and local actors.

WP0

Co-design and Co-Production of Knowledge

Coordinators: C. Gras (IRD), B. Kruijt (WUR), P. Etala (SSA-RCC/SMN)

Objectives:

WP0.O1: Facilitate interactions between CLIMAX consortium members (academics, meteorological services, stakeholders) throughout the whole transdisciplinary co-productive knowledge cycle (Fig.2).

WP0.O2: Facilitate the co-productive dynamics in each case study to create knowledge and information that matches jointly identified needs and practices.

WP0.O3: Facilitate the co-design of the web platform (to be developed by WP4.T1) and innovative technologies between researchers and sector actors to openly disseminate the products and tools resulted from the project.

WP0

Tasks

WP0.T1: Organization of an initial co-design workshop with all sectors and actors to asses existing climate information currently being used in the regional climate services, to co-define the specific objectives of each case study and to design a collaborative roadmap with a detailed work-plan.

WP0.T2: Implementation of a series of trans-disciplinary co-production cycles (Fig.2) for each case study, involving all CLIMAX participants. The number of cycles will depend on the evolution of co-production design, testing and evaluation. Once a product prototype is approved by all actors, WP4 will develop the corresponding technological support for its final use.

WP0.T3: Co-design with all WPs and stakeholders the strategies for dissemination of the new climate products and services and for training for all actors engaged as well as other interested actors. The strategies will be implemented by WP4.

WP0.T4: Organization and coordination of two CLIMAX project workshops to share, monitor, and assess the evolution of the co-production process. Foster a reflection on the CLIMAX project as a collective learning strategy.

WP4

Management

WP4 Coordinators: C. Vera (CNRS/UMI3351) + collaboration of all

Objectives:

WP4.O1. To develop the most efficient management support to the whole project network to provide the participants with the right environment for the project implementation.

The project coordinator (PI) is in charge of daily management and decisions on project progress, while annual project meetings represented by all partners jointly decide by majority upon major issues and project strategic choices.

Tasks

WP4.T1: Development of a web-based management Platform. The platform consisting of 3 main components: i) a component with restricted area for project participants to facilitate the flow of project information at agreed time and the work planning as well as to promote and facilitate the synergy for the co-production; ii) an open-access component to disseminate the prototype climate products that will be co-developed in WP0 in synergy with WP1 and WP2; and iii) an open-access component to describe the project characteristics and to provide the project communication material (described in section 12). The platform will include in particular a repository for all project related documents and data. The platform main structure will be hosted by CNRS/UMI3351, and, options for complementary web portals hosted by other partner institutions will be tested.

WP4.T2: Preparation of annual progress reports and the final report. WP4 will keep a track record of the project progress, cost and budget situation. To monitor and ensure timely completion of the project objectives, WP4 will organize annual project meetings for all project partners and monthly remote meetings for all WP leaders.

WP4.T3: Elaboration of the gender and ethics report. This will include the reviewing of ethics issues and relevant applicable rules, like those regarding access to the project information, advising the project team on gender and ethic issues, supporting promotion of gender equalities. The Project PI will install a gender and ethics advice commission, consisting of three senior researchers/institutional stakeholders from Argentina, Brazil and Europe, respectively. This commission will advise and mediate, not decide, in case of complaints or conflicts.

WP4.T4: Elaboration of information management rules and intellectual property rights of the project outputs, including access to third parties, in the form of a consortium agreement established and signed before month 3 of the project.

WP4 cont.

CLIMAX Impact, Engagement and dissemination plan
WP4 Coordinators: C. Vera (CNRS/UMI3351) + collaboration of all

Objectives:

WP4.O2 To foster and coordinate dissemination and communication activities of the CLIMAX project. Special focus will be made in disseminating the concept of climate services, which is not well known yet, to a wide public audience and other stakeholders in the region.

Tasks

WP4.T5: Development of the communication module for the project web-based platform based on the dissemination road map co-designed in WP0 by all project participants including stakeholders and in coordination with all WPs. It will include 3 levels of dissemination: scientific-technical, stakeholders, and public audience.

WP4.T6: Implementation of a forum for the early career scientists, PhD and Master students in the project to stimulate their direct interaction. The focus will be in contributing to form new generations of researchers in the co-design and co-production approach. The forum will interact with other international networks like YESS (http://www.yess-community.org/). This will be implemented through the web-based management platform and during project meetings.

WP4.T7: Elaboration of Climate Services communication material including the explanation of results and products delivered by the project. The material will be disseminated in different formats that will be discussed within WP0 such as digital storytelling or co-learning blog series.

WP4.T8: Development of a training agenda for stakeholders specialized in Climate Services topics, like the probabilistic nature of the climate predictions based on the innovative methods developed in WP1 and 2. The training plan will be co-designed with the stakeholders and scientists involved in the project in WP0. At least one training activity in Brazil and another in Argentina will be done.

CLIMAX Project Gantt Chart

Task	Year 1		Year 2		Year 3		Year 4	
	S1	S2	S1	S2	S1	S2	S1	S2
WP0.T1	M1							
WP0.T2	M3							
WP0.T3								
WP0.T4								
WP1.T1								
WP1.T2								
WP1.T3								
WP1.T4								
WP1.T5								
WP1.T6								
WP2.T1								
WP2.T2								
WP2.T3								
WP2.T4								
WP3.T1								
WP3.T2								
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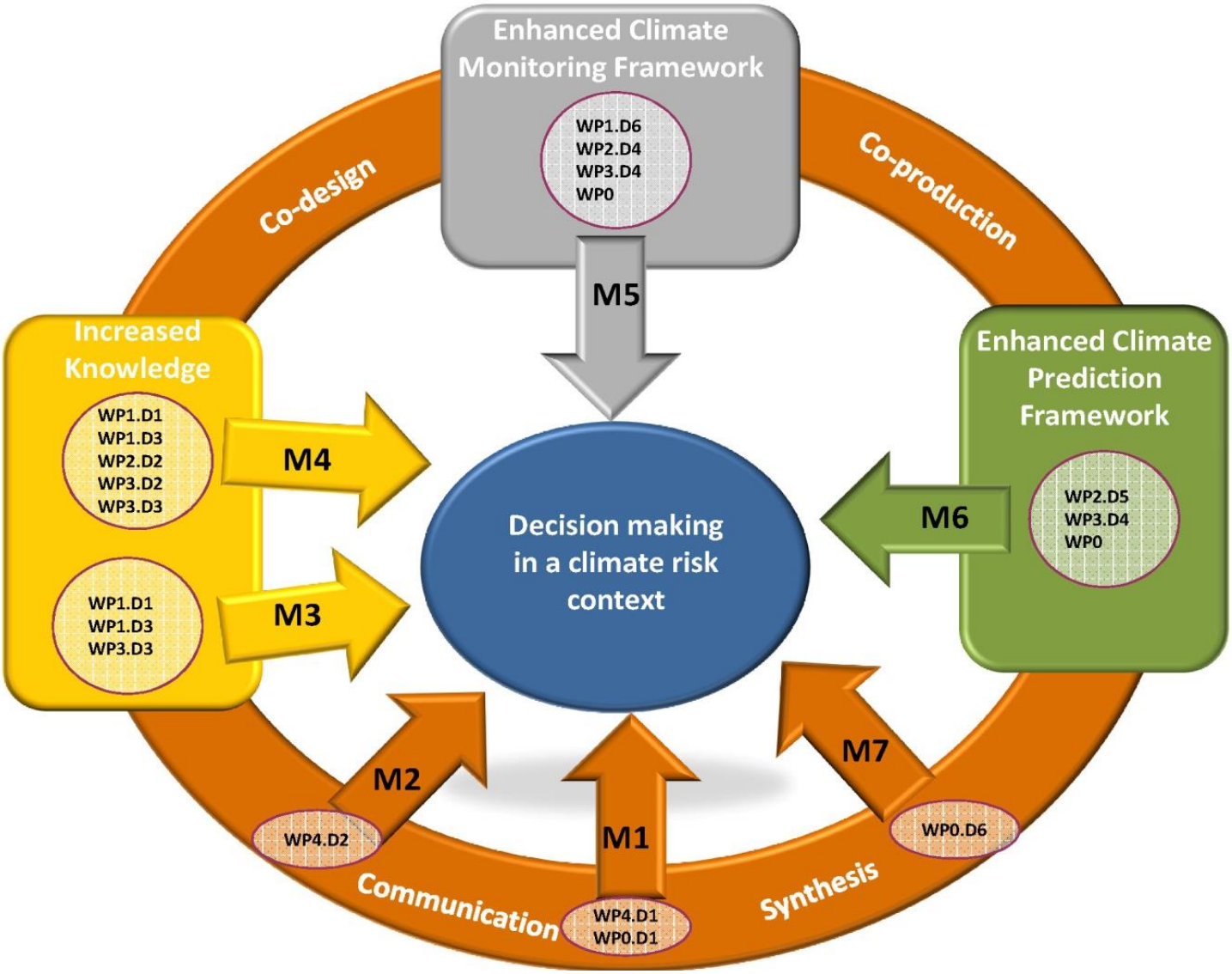
WP3.T4								
WP3.T5								
WP3.T6								
WP4.T1								
WP4.T2								
WP4.T3								
WP4.T4								
WP4.T5								
WP4.T6								
WP4.T7								
WP4.T8								

List of CLIMAX Project milestones

Milestone Number	Milestones	Means of verification	Expected date	Deliverables involved
1	Implementation of the Project web portal version 1 (including tools for internal interaction and project information for open access)	Access to the web site	Month 3	WP4.D1, WP0.D1
2	Forum for early career scientists, PhD and Master students to promote their direct interaction, with web-based platform support.	Access to the web site	Month 12	WP4.D6
3	Increased knowledge on socio-economic-climate drivers of the agriculture and energy sector in SSA	Report	Month 24	WP1.D1, WP1.D3,WP3.D2, WP3.D3
4	Increased knowledge about the impact of land-use change on climate and socio-economic (agriculture, energy) sectors in SSA	Report	Month 30	WP1.D2, WP1.D3, WP2.D2, WP3.D2, WP3.D3
5	New climate monitoring framework for decision making in SSA	Access via the project web-site	Month 36	WP1.D6, WP2.D4, WP3.D4, WP0, WP4
6	Enhanced climate prediction framework for decision making in SSA	Access via the project web-site	Month 48	WP2.D5, WP3.D4, WP0, WP4
7	WP0 synthesis report	report	Month 48	WP0.D6


Enhanced Climate Monitoring Framework
WP1.D6
WP2.D4
WP3.D4
WP0
Co-design
Co-production
M5
Increased Knowledge
WP1.D1
WP1.D3
WP2.D2
WP3.D2
WP3.D3
M4
WP1.D1
WP1.D3
WP3.D3
M3
Decision making in a climate risk context
Enhanced Climate Prediction Framework
WP2.D5
WP3.D4
WP0
M6
M2
WP4.D2
M1
WP4.D1
WP0.D1
M7
WP0.D6
Communication
Synthesis