PROJECT PLAN TEMPLATE

PROJECT	**#. TITLE**		**PROJECT LEADER**	**XXX**	
EMAIL LIST	mucm-project-XXX@lists.shef.ac.uk		**PROJECT TEAM**	XXXX	
OVERVIEW	This should be a brief overview of what this project will focus on				
ACTIVITIES	a) General activities which will be undertaken during the project (not specific, time constrained objectives) b)				
OBJECTIVES	#.1 Specific, detailed objectives with target date set #.2			*Target Date*	XXX 2011
PROGRESS UPDATE	#.1 Regular updates of progress against objectives (above) – at a minimum every 2-3 months with the date of when they were updated #.2 Target dates can be revised if required and agreed within project team and with AOH			*Updated*	XXX 2011
ACHIEVEMENTS / OUTPUTS	#.1 Near the end of the project duration, this section should be updated with any achievements or outputs of the project, or reasons for not completing them, together with the date of when they were achieved #.2			*Achieved*	XXX 2011

For an example, please see project 8 (Building the Community).

PROJECT PLANS

PROJECT	**1. SUPERPARAMETERISATION**	**PROJECT LEADER**	**Yiannis**
EMAIL LIST	mucm-project-super@lists.shef.ac.uk	**PROJECT TEAM**	Peter, Remi, Dan, Gemma, Henry

OVERVIEW

Also links to wider issues of model coupling, nesting and aspects of downsizing.

Super-parameterisation is a technique in ocean and atmospheric modelling, according to which, models of a fine process are embedded in a coarse model, in an effort to enhance its level of detail in the analysis, while keeping the overall computational complexity low. The present project attempts to super-parameterise an ocean model of deep convection, introducing the novelty of replacing the fine process model with an emulator, which should result in further decrease in the computational effort, compared to traditional superparameterisation.

The model we are working with is the MITgcm (global circulation model). This model is very flexible, and can be configured both as the Fine and as the Coarse model in our example. Initially, a volume of water, modelled with a high resolution grid, is cooled down from the top and the evolution of the temperature with time at different depths is observed. This is the Reference run of our problem. In the second stage, the volume of water is modelled with a coarser grid (Coarse model), and in each grid cell, a high resolution model (Fine model) is embedded. The idea is to match the temperature profile of the Reference model with this combination of Coarse and Fine models. In the final step, the Fine models are replaced by emulators, which are much faster, and again we try to match the temperature profile of the reference model, at a fraction of the computational cost.

ACTIVITIES

a) Build a prototype of a sub-grid-scale emulator within a coarser simulator. To be based on a cut-down ocean model with emulation of a fine-scale mixing model. A deterministic version based on a highly accurate emulator is one approach, but a stochastic version that accounted for uncertainty through a poorer emulator or boundary conditions that are not delivered by the coarser model will also be considered.

b) Preliminary exploration of an example in which tropical convection is nested within an atmospheric model

After trying a number of configurations, our current setup is as follows,
A 60 x 60 x 10 (x, y, z) Reference model is used for a volume of water equal to (6 x 6 x 2)km.
The Coarse model has a grid of (3 x 3 x 10) and the Fine models (20 x 20 x 10).
A reference run is obtained by cooling for four days a circle of radius ~2km lying on the centre of the surface of the water volume.
We then try to match the resulting temperature profile by combining the Coarse and the Fine models.
An emulator for the Fine model has been built, and replacing the Fine model with it showed negligible differences in the resulting temperature profiles.

OBJECTIVES

		Target Date
1.1	A paper for the oceanography literature using the cut-down ocean model REVISED OBJECTIVE: a technical report minimum, but preferably a paper to be completed by JULY 2011	~~Apr 2011~~ Jul 2011
1.2	A grant application to NERC on superparameterisation, possibly picking up wider issues as above	~~Apr 2011~~ Sept 2011

PROGRESS UPDATE

Updated Jan 2011

- Identified Coarse and Fine scale models. The first will be NEMO and second will be MITgcm. The coarse model will track temperature (T), salinity (S) and the three velocity components, u, v, and w in a coarse grid, possibly in a hydrostatic mode. The fine model will resolve small scale processes, like convection, again in terms of T, S, u, v and w, in a non-hydrostatic mode.
- George Nurser will be the NOC model expert.
- Due to its high complexity, NEMO will be set up by George.
- Yiannis has installed and learned how to run the MITgcm model.
- Current phase:
  - Emulate temperature.
  - Doubly periodic mode.
  - Same number of vertical layers.
- Need to determine the time stepping interface between the two models. For example, MITgcm needs several time steps to resolve the convective plumes and we need to determine how it will interface with NEMO, without needing to store the state variable of the model for each time step.

	• Next phase: · Include S, u, w and v. • Determine interpolation schemes that will map T, S, u, w, and v between the fine and the coarse grids.		
	• Configurations of the MITgcm are being used for both the fine and the coarse models. The model is configured and run by us, so we can have easy access to data. • The Fine and Coarse models have been coupled successfuly. The information being exchanged at the moment is temperature. In the future this should be expanded to velocities, pressure and perhaps salinity. • The results obtained with the combination of the Coarse and Fine models still differ from the reference results. The source of this discrepancy needs to be identified, and minimised to the degree that this is possible. Exchanging more information apart from temperature between the models could be of help, though it's not certain that this is the source of the problem. • An emulator of the Fine model has been built, and the approximation accuracy was deemed satisfactory. • The training points for the emulator however, were obtained by running the combination of the Fine with the Coarse model first. Ideally, we would like to avoid this step, and built and emulator by running the Fine model only. This is work in progress • The inputs and the outputs of the Fine model are highly correlated, as they represent temperatures in succesive vertical layers of the water volume. The application of PCA both in the input and output of the model is currently being investigated.		Apr 2011
ACHIEVEMENTS / OUTPUTS			

PROJECT PLANS

PROJECT	**2. BOWEL CANCER**	**PROJECT LEADER**	**Ben**
EMAIL LIST	mucm-project-cancer@lists.shef.ac.uk	**PROJECT TEAM**	Jeremy, Dan, Alexis
OVERVIEW	A stochastic health economic model is available in collaboration with Alan Brennan (AP). Alan and collaborators have tried earlier to calibrate this model to observed data, but without any clear idea of what they are doing.		
ACTIVITIES	a) Build an emulator for the stochastic model. Calibrate to observed data, but without incorporating model discrepancy. Use of this model for cost-effectiveness analysis will form a separate project (in the theme of informing decisions) at a later stage. (Grant application could then follow.)		
OBJECTIVES	2.1 Paper (at least a draft) on calibrating this model.	*Target Date*	~~Jul 2011~~ Sep 2011
PROGRESS UPDATE	No progress so far. I have not been able to get hold of the model - I am chasing this up. I am also chasing up a second stochastic model and calibration dataset from Richard White and colleagues at the London School of Hygiene and Tropical Medicine. BY starting 25th April who will take over this project. Extend target date to allow for this.	*Updated*	Jan 2011
ACHIEVEMENTS / OUTPUTS	2.1	*Achieved*	

PROJECT PLANS

PROJECT	**3. STOCHASTIC FEM**	**PROJECT LEADER**	**Noha**
EMAIL LIST	mucm-project-sfem@lists.shef.ac.uk	**PROJECT TEAM**	Henry, Peter, Yiannis
OVERVIEW	This will build on work going on with Rolls Royce, who have several SFE models.		
ACTIVITIES	a) Develop methodology for emulating the outputs of SFE models. This will be quite theoretical work, but will include some application using RR models.		

OBJECTIVES		*Target Date*
3.1	Draft paper on emulating SFEM outputs (which can be seen as whole distributions).	~~Apr 2011~~
	REVISED PLAN: paper will now be on Quadrature/links to design	July 2011
3.2	Funding application to RR to take this work further.	~~Apr 2011~~
		May 2011
3.3	Internal report on emulating SFEM outputs, drawing on ideas from other stochastic emulation projects (projects 4, 5, 10, 11)	Sep 2011

PROGRESS UPDATE		*Updated*
	Henry and I are in touch with Ron Bates (Rolls Royce), Giovanni Pistone (Torino) and Eva Riccomagno (Genoa) to start to plan a workshop in March in Genoa. It is to be on "sparse quadrature" which is the preferred method for handling outputs which take the form of Wiener chaos (polynomials of Gaussian Processes). We are at present collecting references, including to an PhD in Italy on the subject. We will give a list of these references, shortly. Henry will be seeing Gianni and Eva at a conference in Spain 12-15 November. Noha will write up a short summary of the work, as soon as I have submitted my Phd.	Nov 2010
	• Since I have submitted my PhD at last I am working hard to found my knowledge about the Stochastic Finite Elements method. The method is used to solve a system of partial differential equations. A short report on the SFE method and sparse quadrature in engineering uncertainty analysis will be done by April 2011. • A workshop in Italy will be attended in the university of Genoa on the 15/03/2011. Henry is giving a short course on Computer Experiments in Diendi workshop on industrial experimentation (joint with Daniele Romano). • Rolls Royce Update: A discussion with Dr.Bates and Dr. Avathen at Brunel university with a review to build up a project in the area.	Jan 2011
	Current Updates (by NY) • I passed my VIVA last month with minor corrections (misprints). • Henry and I attended the workshop in Genoa on quadrature. Henry gave a talk on sparse quadrature. • Henry gave the short course on computer experiments with my assistance as Daniele Romano cancelled his session. The second session we gave introduced the participants to the MUCM toolkit.	Apr 2011
	Future plans • Now I am working on a poster for using partial entropy sampling design to present in DEMA in Cambridge in August. We are also writing a paper on adaptive designs to be submitted to the ISI the 58th congress in Dublin. • I am still working on the SFE and quadrature review to be finished by the end of April.	

ACHIEVEMENTS / OUTPUTS		*Achieved*
3.1		
3.2		

PROJECT PLANS

PROJECT	**4. SYSTEMS BIOLOGY**	**PROJECT LEADER**	**Ian**
EMAIL LIST	mucm-project-sysbio@lists.shef.ac.uk	**PROJECT TEAM**	Michael, Alexis

OVERVIEW

The primary interest in such models is calibration, to estimate transition rate parameters.

Systems Biology is a rapidly expanding area which involves the investigation of chemical reaction networks found (usually) within cells. There are a large number of such models available ranging from small (a few rate parameters i.e. inputs, and one or two chemicals) to very large (100's of rate parameters with 80+ chemicals). The vast majority of these networks have been studied using standard coupled differential equations. While these differential equation models are suitable if the numbers of molecules of all chemicals are large, such deterministic models break down for low numbers of molecules which often occur for processes that involve gene translation (as many of these networks do).

In these low molecule count cases, stochastic modelling, which describes the number of molecules of each chemical species as a random process, is more appropriate. The stochastic formulation is usually simulated using the Gillespie algorithm, a relatively fast forward simulator, which incorporates various mass action kinetic laws.

The primary interest of this Project is to develop emulation techniques for the stochastic systems biology models described above, and to use these to perform history matching and possibly calibration in order to learn about the transition rate parameters, which are of major interest to the Biologists.

ACTIVITIES

a) Build a case study using an intermediate size regulatory network model. This will include design considerations and discrepancy modelling. Apply history matching (possibly also calibration).

OBJECTIVES

		Target Date
4.1	Draft paper on history matching a stochastic model.	~~Apr 2011~~ June 2011
4.2	Grant application to BBSRC (or at least some progress on drafting such an application). REVISED PLAN: Submission within 6 months	~~Apr 2011~~ Sept 2011
4.3	NEW OBJECTIVE: Paper from AB's thesis	Sept 2011

PROGRESS UPDATE

Updated

We have developed a Bayes Linear emulator for stochastic models and applied it to

1. a 2-parameter toy model (the Birth-Death process)
2. a 2-parameter simplified version of the Prokaryotic model
3. the full 8-parameter version of the Prokaryotic auto-regulation gene network

In each case we have used the univariate emulator to evaluate implausibility measures and hence to history match the model. In the full Prokaryotic model we have so far performed 2 waves of history matching and found great benefits in accuracy in the second wave, allowing for large reductions in the input space. We are now down to 0.19% of the original input space, and can now see substantial amounts of structure in the non-implausible volume. The above work, along with further considerations of which univariate combinations of outputs it is most effective to use and along with a possible wave 3, will form the basis of the paper that is Objective 4.1. — Feb 2011

We have been establishing contact with members of the Biology Department at Durham University. Specifically, IV has held several meetings with Dr Junli Liu, a systems biologist here at Durham. Dr Liu has several models that might be of interest to MUCM2 members of various size (we have been discussing two models with 17 inputs and 64 inputs), but most of the models are currently deterministic. We have been encouraging Dr Liu to explore the stochastic versions of these networks (as the conversion from deterministic to stochastic is quite straightforward). We are also discussing and exploring the possible funding opportunities provided by BBSRC, as relates to Objective 4.2.

Issues relevant to this 6 month period:

- Emulation and history match of 2 simple models: Complete
- Set up, emulation and wave 1 history match of full Prokaryotic model: Complete
- Wave 2 emulation, history match and physical interpretation of non-implausible volume: Complete — Feb 2011
- Wave 3 emulation and history match: To be done

	• Decision about which univariate combinations of outputs to use for the history match (dimension reduction): To be done • Complete writing of paper for Objective 4.1: To be done. • Discussions regarding BBSRC funding: Ongoing Future Issues of interest: • Full multivariate emulation needed (will involve emulation of covariance structures). • The Design problem (deciding on location, repetition, completion time and proportioning of evaluations between waves). Some thoughts on but nothing concrete as of yet. • Incorporation of Model Discrepancy in the stochastic setting (what are the possible and appropriate MD structures). • Diagnostic measures for stochastic emulators (repetitions vs location: how should we test the emulator?). • Incorporation of different data types (e.g. single cell incomplete time-course data).		
ACHIEVEMENTS / OUTPUTS	4.1 4.2	*Achieved*	

PROJECT PLANS

PROJECT	**5. AGENT-BASED MODELS**	**PROJECT LEADER**	**Alexis**
EMAIL LIST	mucm-project-agent@lists.shef.ac.uk	**PROJECT TEAM**	Dan, Jeremy, Ian (if a grant application for an agent-based model project at Durham is successful)
OVERVIEW	Someone at Aston has built an agent model of crowd behaviour. An interesting feature is that agent models often have discrete inputs and/or outputs.		
ACTIVITIES	a) Using the crowd behaviour model develop a simple emulator as a proof of concept.		

OBJECTIVES			*Target Date*
	5.1	Conference paper on emulating the crowd behaviour model.	~~Apr 2011~~ Sep 2011
	5.2	NEW OBJECTIVE: obtain and emulate a larger agent based model	Sep 2011
PROGRESS UPDATE	5.1	Brief discussion with local Aston group developing agent based models (28/10/2010). Will get conference paper describing model and later on some java code so we can run the model.	*Updated*
		The initial model is quite simple with continuous inputs. Number of inputs is 10-12, currently the team has perturbed one-at-a-time 2-3 of them to see effects. Output is percentage of violent people. Time series output is also available. Goal is to build good enough emulator to do sensitivity analysis jointly on entire input set. Implausibility could also be useful to figure out interesting input domain. We will try by end of year to have working emulator (Dec 2010). Goal is to have conference paper in application conference on applying emulation on this type of model.	Jan 2011
		Going through paper describing agent based model. Next step is to obtain code, run simulator and perform exploratory analysis. (22/1/2011)	Jan 2011
		Attended OR Society Simulation Special Interest Group Meeting on the current state of Agent Based Models (ABM). Focus of meeting was on the use of ABM in social science and operational research (24/3/2011).	Apr 2011
ACHIEVEMENTS / OUTPUTS	5.1		*Achieved*

PROJECT PLANS

PROJECT	**6. NONSTATIONARY EMULATION**	**PROJECT LEADER**	**Gemma**
EMAIL LIST	mucm-project-nonstat@lists.shef.ac.uk	**PROJECT TEAM**	Peter, Noha, Yiannis, Jeremy
OVERVIEW	This will also link to the wider issues of discontinuous outputs.		
ACTIVITIES	a) Review approaches to emulating nonstationary outputs (including treed GPs). Assemble a small collection of suitable models displaying nonstationary and/or discontinuous behaviour.		

OBJECTIVES		*Target Date*	
	6.1 Review (internal report or draft paper)		~~Apr 2011~~ May 2011
	6.2 Two or three suitable models to work with REVISED PLAN: Continue to build a model set, explore 2 or more approaches and begin to write up about work		~~Apr 2011~~ Sep 2011
PROGRESS UPDATE	6.1 Have been looking at use of GMRFs to represent a GP. Specifically, Lindgren et al. (2010) use an approximate solution of stochastic partial differential equations to provide the link between GMRFs and GPs with the matern correlation function. They show how this can be extended to generate GMRFs to represent non-stationary GPs.	*Updated*	Jan 2011
	The Lindgren 2010 approach works quite well in 2 dimensions and although their method is theoretically extendable to more than 2 dimensions, in practice this isn't quite so straightforward. The main problem is with the triangulation of the input space and the subsequent triangulation if further design points are required as a result of the validation process. (Attended RSS read paper 16 Mar 2010). This approach is being put on hold for the time being and am now focusing on more traditional methods of dealing with non stationarity such as Sampson and Guttorp 1992 and Higdon et al 1999.		Apr 2011
	6.2 Have mentioned to members of subgroup (dimate and uncertainty) at NOC that I'm looking for such models.		Jan 2011
	We've been looking at using the MIT gcm and although non stationarity is achieved, the output of this model is not ideal for our purposes. A model of the doppler effect is being used as a toy model in 1 dimension and if this is successful some sort of ocean model with an acoustic element where we look at sound speed, current etc might provide a better "real model" example.		Apr 2011
ACHIEVEMENTS / OUTPUTS	6.1 6.2	*Achieved*	

PROJECT PLANS

PROJECT	**7. DECISIONS THAT EXPAND MODELS**	**PROJECT LEADER**	**Jonathan**
EMAIL LIST	mucm-project-decision@lists.shef.ac.uk	**PROJECT TEAM**	Michael, Henry
OVERVIEW	Durham has access to a new reservoir model that can be used to explore this topic. It is a live reservoir for which decisions about new well bores may be realistic.		
ACTIVITIES	a) Get to know the simulator and scope how it might be used as a case study of decisions that expand models.		
OBJECTIVES	7.1 Clear plan of work for a further 6 months to complete this project. REVISED PLAN: detailed spec of problem (if get the go ahead with BG) To be left to continue as originally for next 6 months	*Target Date*	~~Apr 2011~~ Sep 2011
PROGRESS UPDATE	7.1 • Durham have submitted a proposal for a substantial decision support project with BG • Identified initial goals for analysis of the Marathon model. • **Marathon:** Initial analysis of the Droshky model principally complete (JAC & MG) • Scoping of possible decision problems for exploration (JAC & MG) • **BG:** Durham are pursuing a decision support project with BG involving decisions related to the placement of appraisal wells. (IRV & MG)	*Updated*	Feb 2011 Apr 2011
ACHIEVEMENTS / OUTPUTS	7.1	*Achieved*	

PROJECT PLANS

PROJECT	**8. BUILDING THE COMMUNITY**	**PROJECT LEADER**	**Tony**
EMAIL LIST	mucm-project-community@lists.shef.ac.uk	**PROJECT TEAM**	Jo, Dan, Jeremy, Henry, Michael, Peter, Yiannis
OVERVIEW	Reaching out to new user groups via email lists, open days, short courses and continuing development of the Toolkit and website.		

ACTIVITIES

a) Set up and management of our own server to host mucm.ac.uk at Sheffield as well as the Toolkit and associated software.

b) On-going development of the Toolkit

c) Build wider community contact lists of people working in this field

d) Identify conferences at which to give short courses

OBJECTIVES

		Target Date
8.1	MUCM Server: installation and transfer/update of website/toolkit	~~Apr 2011~~ July 2011
8.2	Toolkit: release 8 – REVISED DATE OF JULY 2011	~~Feb 2011~~ ~~Apr 2011~~ July 2011
8.3	Set up wider community MUCM mailing list and continue to build	Nov 2010
8.4	Confirm at least one conference at which to give a short course	Apr 2011
8.5	Complete and polish a set of basic short course modules	Sep 2011
8.6	Confirm additional short courses for 2011	Aug 2011
8.7	Fix venue and dates for UCM 2012 and set up programme committee	Sep 2011
8.8	Complete new-look website	Aug 2011

PROGRESS UPDATE

		Updated
8.1	I have been enquiring at Sheffield about the best way to provide all the UCM community services at Sheffield. After initial contacts this has been shelved while I concentrate on the toolkit release 7. I will get back to this in the New Year.	Dec 2010
	We will have our own virtual server at Sheffield. The Computer Centre will help to set this up and run it, but we are currently exploring how that would work and what services it will be realistic to provide.	Jan 2010
	Progress with the web server has been slow. The computing centre at Sheffield were approached to set up a MUCM server to cover the regular website, the wiki and the toolkit website, as well as possible future services like a preprint repository and a networking forum. It seems that even though we have some money for this they are not really very keen on doing it. So the topic will be referred to the forthcoming team meeting for discussion.	Mar 2010
8.2	Release 7 (the final release officially under MUCM1) is delayed until the last minute - 31 December 2010. At that point, it has to include the final two case studies, since that will be claimed in our final report to EPSRC. In connection with this, we realised that release 6 still did not include any material on calibration, which is essential for CS2 to link to (and probably also CS3). So Tony has undertaken to write a calibration thread by Christmas!	Dec 2010
	Release 7 finally went live in January. Release 8 is not now likely to happen until April.	Jan 2010
	Other projects have encountered problems in getting going and developing momentum, and Tony thought it best not to load more toolkit development on people right now. Particularly given the uncertainty over the web server. This will also be discussed at the team meeting,	Mar 2010

		but we really need to aim for a new toolkit release no later than June.		
	8.3	Requested & received names for UCM mailing list. List members have been emailed with opening message and unsubscribe option. Due to high number of list members taken from the SAMO list unsubscribing (and many of these doing so by replying to all) initial list was deleted and then everyone emailed again asking them to subscribe if interested. Membership is now circa 250 and still steadily increasing.		Nov 2010
		This seems to have settled down and a couple of general messages have been sent out. Once the new Sheffield platform for UCM is sorted out, we'll ask list members about adding services and functionality.		Dec 2010
	8.4	Tony will be giving a course in connection with the workshop "Mathematical Science of Understanding and Predicting Regional Climate: A School and Workshop" to be held at the Institute for Mathematical Sciences, University of Singapore. The workshop part runs from 7 to 11 March 2011. It is preceded by a week-long "school", and the MUCM course will form one day of this, 4 March. However, this is a somewhat opportunistic running of the course. Tony was invited to join the workshop and is running the course (on his own) while there. The organisers are paying something for the course to reduce the cost to MUCM of Tony's attendance at this meeting. It is probably not important enough to constitute one of the courses we planned to give at conferences to bring MUCM to the attention of new communities. Possible additional courses will be discussed at the theme day in January.		Dec 2010
ACHIEVEMENTS / OUTPUTS	8.1		*Achieved*	
	8.2			
	8.3	UCM mailing list set up and is being used by members to share information but this will be developed further in terms of adding services and functionality		Dec 2010
	8.4	Tony gave the one-day course mentioned above. These slides are now being worked on by Dan and Peter to improve the presentations. They will be giving two 90-minute sessions at the EGU (European Geosciences Union) General Assembly 2011 in Vienna on April 6th. Dan and Peter have set up a DropBox folder to share the presentations and development with others in the team. This includes new Powerpoint templates. Henry has also been involved in a short course based in part on Tony's presentations.		Mar 2011

PROJECT PLANS

PROJECT	**9. COUPLED MODELS**		**PROJECT LEADER**	**Yiannis**	
EMAIL LIST	mucm-project-coupled@lists.shef.ac.uk		**PROJECT TEAM**	Peter, Remi, Dan, Gemma	
OVERVIEW	Yiannis – please provide				
ACTIVITIES	a) Yiannis – please provide b) Yiannis – please provide				
OBJECTIVES	9.1 Find a suitable model 9.2 Carry out initial investigation			*Target Date*	Sep 2011 Sep 2011
PROGRESS UPDATE	9.1 9.2			*Updated*	
ACHIEVEMENTS / OUTPUTS	9.1 9.2			*Achieved*	

PROJECT PLANS

PROJECT	**10. MULTI-OUTPUT STOCHASTIC MODELS**	**PROJECT LEADER**	**Ian**
EMAIL LIST	mucm-project-multioutput@lists.shef.ac.uk	**PROJECT TEAM**	Michael, Alexis
OVERVIEW	Ian – please provide		
ACTIVITIES	a) Ian – please provide b) Ian – please provide		
OBJECTIVES	10.1 Identify a case study to work on 10.2 Report at end of 5/6 months on progress	*Target Date*	Sep 2011 Sep 2011
PROGRESS UPDATE	10.1 10.2	*Updated*	
ACHIEVEMENTS / OUTPUTS	10.1 10.2	*Achieved*	

PROJECT PLANS

PROJECT	**11. EMULATING DISTRIBUTIONS**	**PROJECT LEADER**	**Remi**
EMAIL LIST	mucm-project-distributions@lists.shef.ac.uk	**PROJECT TEAM**	Alexis, Ian, Noha, Peter
OVERVIEW	Remi – please provide		
ACTIVITIES	a) Remi – please provide b) Remi – please provide		
OBJECTIVES	11.1 Work on methods for emulating quantiles 11.2 Develop case study, e.g. in the rabies model	*Target Date*	Sep 2011 Sep 2011
PROGRESS UPDATE	11.1 11.2	*Updated*	
ACHIEVEMENTS / OUTPUTS	11.1 11.2	*Achieved*	