PART 2: DESCRIPTION OF THE PROPOSED RESEARCH AND ITS CONTEXT

Background

The EPSRC/UKCIP programme on the impacts of climate change on the built environment, transport and utilities is primarily aimed at impact assessment and end user strategy rather than scenario provision. It is, however, clear that the overall success of the programme depends to a large degree on the quality and consistency of the climate scenarios used by the various projects. Thus EPSRC and UKCIP agreed that a common climate scenarios service, focusing on further development of the UKCIP02 scenarios, was required and invited CRU, WRSRL and the Hadley Centre to submit a proposal (based upon our original expressions of interest and previous expertise in developing climate scenarios) in parallel with the eight other proposals. This proposal has been produced following the guidance received from EPSRC and UKCIP and after considerable discussion (at the Champions' meetings and by email and telephone) with end users and stakeholders involved in the other proposals (see Relevance to Beneficiaries).

The starting point for scenario construction will be the four generic IPCC SRES emissions scenarios and the UKCIP02 scenarios (Hulme *et al*., 2002) which are the most recent, detailed and reliable scenarios for the UK. Thus, the main (but not the only) source of climate model output will be the HadCM3, HadAM3 and HadRM3 simulations carried out by the Hadley Centre. The HadRM3 simulations represent the current state-of-art in regional climate modelling. However, they have a number of disadvantages with respect to the EPSRC/UKCIP climate impacts programme:

1) they were run for 1961-1990 and 2071-2100 only, whereas many stakeholders require information for intermediate periods (e.g., the 2020s and 2050s), and longer trend-free time series are required for the estimation of many extreme events, such as 50-year return period events;
2) output is only available at the daily timescale, not sub-daily;
3) the spatial resolution of 50 km x 50 km is still coarser than required for some applications and some degree of averaging occurs in the model parameterisation so that further downscaling, to obtain point rainfall, for example, is required;
4) some features of present-day climate, particularly with respect to extreme events such as wind gust speed, high temperatures and extreme rainfall, are poorly represented;
5) a limited number of emissions scenarios are represented, few ensemble runs are available and the use of a single model all mean that the full range of uncertainty cannot be quantified; and,
6) urbanized portions of the land surface are neglected, thus ignoring potential changes in the urban heat island effect and the impacts of additional heat sources in cities.

A number of different approaches could be used to address these disadvantages. The most appropriate with respect to points 1 to 5, given the need for (a) self-consistent scenarios for a number of variables, and (b) sub-hourly precipitation scenarios, in the form of mean changes, time series and probability distributions in both cases, involve:

- two (i.e., daily and hourly) weather generators available in CRU (Tasks 1 to 5); and,
- the development and application of the Generalised Neyman-Scott Rectangular Pulses model for the construction of specialised rainfall scenarios by WRSRL (Tasks 6 to 11).

Point 6 will be addressed by the Hadley Centre using a new representation of urban areas in General Circulation Model (GCM) simulations of climate change (Task 12). Task 13 will involve dissemination of the scenarios developed by Tasks 1 to 12 to the successful projects, together with the organisation of two project workshops and provision of ongoing support and advice in the use of climate scenarios.

Programme and methodology

Aims and objectives

The principle aims and objectives of the proposed work are:

- to provide high spatial/temporal resolution state-of-art climate scenarios for selected case-study locations as a common service to projects funded under the EPSRC/UKCIP climate impacts programme; and,
- to provide continuing support and advice to the users of these scenarios.

Tasks 1-5: CRU weather generators and work on storm-track changes

The CRU daily weather generator (WG) was originally developed by Phil Jones and Mike Salmon (Jones and Salmon, 1995), as an improvement on the widely-used Richardson (1981) weather generator, in order to provide inputs to crop yield models across the EU. The WG uses a two state Markov Chain to determine whether a day is wet or dry – the two states being whether the previous day was wet or dry. The amount of rain on wet days is determined using a gamma distribution derived from wet day rainfall totals. Precipitation is the primary variable and regression relationships are established between this and other variables (mean temperature, diurnal temperature range, vapour pressure/relative humidity, sunshine duration and wind speed), based on whether a day is wet or dry and the values of the variables on the previous day. These relationships retain the cross- and auto-correlations between and within each of the variables at each time step. The primary component of the WG is the stochastic precipitation generator. In theory, the non-precipitation variables could be simulated from daily precipitation series derived from other sources (e.g., from the WRSRL precipitation model, though issues relating to parameterisation and perturbation of the WG would arise).

In order to apply this WG to the construction of climate change scenarios for the built environment, transport and utilities, a number of modifications are required, together with some re-coding and updating in order to produce a more generic model. In particular, more user-friendly and efficient options for perturbing the WG parameters to reflect climate change are required. Recent testing of the WG, with HadCM3 output and observed data for Heathrow, as part of a Tyndall Centre-funded project on the built environment indicates that it is desirable to explore ways of improving the simulation of the secondary variables such as sunshine (sunshine hours are overestimated during winter) and wind (e.g., by considering changes in circulation-type frequency). The WG will also be extended to calculate potential evapotranspiration (PET), using a Penman Monteith method, from the standard output variables.

A sub-daily version of the WG is available. It simulates hourly values for the same set of variables and is forced by the daily precipitation time series. It has been less well tested than the daily version and requires further work before it will be suitable and sufficiently reliable for application in the EPSRC/UKCIP climate impacts programme.

In addition to the WG approach, a more physically-based approach to the development of wind scenarios will be developed. This will be based on information about storm-track changes derived from a current Tyndall Centre-funded project which will be used to develop scenarios of wind which should be more reliable, particularly with respect to maximum wind speeds, than those based on raw HadRM3 daily average wind data. The UKCIP02 scenarios report, for example, does not even assign a low confidence level to the wind scenarios (Hulme *et al*., 2002).

The proposed CRU work is divided into the following five tasks [each of which will involve detailed validation and evaluation using observed data for selected (three to five) case-study locations]:

Task 1: Modification and updating of the daily WG focusing on the development of generic, user-friendly, efficient subroutines for perturbing the parameters in climate change studies.
Task 2: Development of methodologies for perturbing the WG parameters based on the UKCIP02 scenarios and to quantify some of the uncertainties relating to emissions scenarios and inter-/intra-model variability.
Task 3: Improvements to the daily WG, focusing on secondary variables such as vapour pressure/relative humidity, sunshine and wind.
Task 4: Development of the hourly WG.
Task 5: Development of wind scenarios based on storm-track changes.

CRU deliverables (D1 and D2)

Daily and hourly time series of precipitation, mean temperature, diurnal temperature range, vapour pressure/relative humidity, sunshine duration, wind speed and PET for 3-5 case-study locations.

These time series will be self-consistent, i.e., cross- and auto-correlations between and within each of the variables will be retained. Thus it will be possible to investigate joint events, such as wind-driven rain. The possibilities for generating time series of hourly gust speeds will also be explored.

Tasks 6-11: WRSRL specialised rainfall scenarios

Methods have been developed and applied at WRSRL over the last ten years for generating rainfall scenarios suitable for engineering impact assessments, with appropriate characteristics of space-time scales and extreme values (Kilsby *et al*., 1998). Use of aspects of this existing methodology is proposed for producing tailored scenarios, using the UKCIP02 scenarios as a starting point.

The basic tool for producing rainfall series is the Generalised Neyman-Scott Rectangular Pulses (GNSRP) model. This is the basis for the StormPac software (developed by WRSRL for WRc). It has been regionalised for any site in the UK (Cowpertwait *et al*., 1996) and is capable of producing rainfall series of arbitrary length and time resolution. Current work, for example, is using 10,000 year series at 1 hourly resolution for flood frequency analysis. It has been shown to realistically reproduce extreme values for engineering impact studies, most recently using multi-site data of intense events from Italy (Cowpertwait *et al*., 2002). The model has recently been parameterised in the WRINCLE EU-funded project for 0.5 degree grid squares across Europe for both present and future climates.

The method uses selected rainfall statistics to refit the GNSRP model parameters. These statistics can be from observed rainfall, or downscaled from GCM outputs of atmospheric variables. For this programme, the model parameters will be adjusted using the UKCIP02 50 km rainfall statistics (corrected to match observed climatology where appropriate). A more detailed version of the regionalised model for the UK based on the MetOffice/UKCIP 5 km observed rainfall climatology is the logical starting point, and such work is related to that being performed currently at WRSRL under the SWURVE EU-funded project.

Two complications must be addressed before the requirements of the programme can be met in full:

1. The model must be shown to reproduce the extreme statistics at 1 day and 1 hour durations for a range of return periods. This is not necessarily straightforward, hence a new fitting procedure using skew has been developed at WRSRL to allow better matching of observed rainfall growth curves.
2. Observed and modelled trends in extreme rainfall must be incorporated into the model as appropriate. Trend analysis using a small number of sites is notoriously unreliable, and for this reason WRSRL has performed a regional frequency analysis in SWURVE, of trends in extreme rainfall across the UK from 1961-2000 which is ideal for this purpose.

The following six tasks are required in order to complete this work:

Task 6: Set up the GNSRP model for the whole UK using the MetOffice/UKCIP 5 km climatology. This will allow long rainfall series to be generated for any site in the UK.

Task 7: Parameterise the GNSRP model to match observed 1961-1990 return periods (e.g., 10 or 25 year annual maxima) for daily rainfall.

Task 8: Parameterise the GNSRP model for the whole UK for future climates, also at 5 km, incorporating trend analysis and regional frequency analysis of HadRM3 from the SWURVE project.

Task 9: Reparameterise and validate the GNSRP model for hourly and 15 minute rainfall consistent with daily totals (present/future) using observed sub-daily time series and statistics.

Task 10: Interface from GNSRP model to CRU daily WG.

Task 11: Extend model to allow for changing proportion of convective/frontal rainfall in future climate (e.g., from HadRM3), i.e., allowing for increased variance, more intense rainfall etc., using 'storm type' parameter sets as has been done previously for a hierarchical model based on 'weather types'.

WRSRL deliverables (D1 and D3)

D1: Example of model output. D3: Software package to run the GNSRP model for any given UK location (at a 5 km resolution) in order to produce precipitation scenario time series with the following characteristics:

1. Daily, hourly or 15 minute time resolution;
2. Arbitrary length, e.g. 10, 1000, 10,000 years;
3. Available for control (1961-1990) and future scenarios (derived from UKCIP02 base);
4. Control scenarios matching statistics of observed climatology (e.g., mean, variance, 2, 5, 10, 25 year annual maxima); and,
5. Future scenarios incorporating changes projected by UKCIP02.

Task 12: Development of scenarios of climate change in urban areas (Hadley Centre for Climate Prediction and Research)

The most recently developed Hadley Centre GCM is HadAM3, with a resolution of 3.75˚ longitude by 2.75˚ latitude, approximately 300 km over the UK. In GCMs, the surface is represented as the average for all different types of terrain in that area. However, the Hadley Centre has recently developed a new scheme which treats each model grid box as a mosaic of tiles representing five different vegetation types plus bare soil, open water, ice and urban areas. In this way, the model "sees" the effect of urban areas, even when these only represent a small fraction of the area of the grid box. Not only does this allow the effect of urban areas on climate to be simulated (giving a better prediction of climate change in general) but it allows climate over an urban surface to be predicted even if that surface type only covers a small fraction of the grid square.

The main difference between urban and rural areas is in their thermal capacity (and hence inertia) and their evaporative potential. Tests of the tile scheme have shown that it can reproduce some of the observed urban phenomenon, such as sustained positive turbulent heat fluxes through most of the night, and near-neutral boundary layers above cities up to an altitude of a few hundred metres. The urban scheme has been implemented within the Met Office mesoscale weather forecast model, and has reduced errors in forecasts for both bias and standard deviation within built-up areas. For the first time, the Hadley Centre is in a position to provide global climate predictions which take account of urban effects.

The atmospheric climate model, incorporating the new tiling surface scheme, will be run for 25 years with CO_2 concentrations at current levels, and prescribed sea-surface temperatures (SSTs). It will then be run with CO_2 concentrations double those of the present day, and with SSTs increased to levels expected at that time. (This is for computational efficiency. Once results have been analysed for the $1xCO_2$ and $2xCO_2$ conditions, changes can be scaled to specific future periods and emissions scenarios). Two further model experiments will be performed, for present day and future climates, including additional inputs of sensible heat at the urban surface. For the present day, the additional heat inputs will be based on information about current energy consumption. For the doubled-CO_2 state, additional heat inputs will be estimated from projections of future energy use under a projected doubled-CO_2 climate.

Results from the model experiments will be analysed and presented in terms of both mean temperatures and extremes, together with humidity (which is important for aspects such as urban greenspace planning and thermal comfort). Presentation of extremes will include, for example, the number of days per year and season with maximum/minimum temperatures above a selected threshold. Comparison of the four simulations and output for urban and rural areas will allow investigation of (a) the Urban Heat Island effect at the present day, and validation against observations, (b) the importance of changes to the Urban Heat Island effect, and whether climate change impacts assessments have over- or under-estimated the potential effects of climate change in the urban environment, and (c) the importance of urban heat sources in the current climate and how this might change in a future world.

Hadley Centre deliverable (D4)

A report describing the analysis of changes to urban and rural temperatures and extremes, and humidity.
The significance of the results will be explained, and the need for further work reviewed. It will not be appropriate to provide output from these simulations to individual projects. The results will, however, provide semi-quantitative guidance as to how the CRU WGs can be perturbed, based on expert judgement, in order to generate scenarios which reflect, in part, the differences between urban and rural areas.

Task 13: Workshops, dissemination and ongoing support/advice in the use of climate scenarios

Two workshops will be held for members of all successful project consortia. The first (W1), at the start of the project, will be used to make final decisions about the deliverables based on end user requirements, including locations. The end users needs for time series mean that scenarios must be provided for spot locations, not for regions. (However, for consortia wishing to scope out impacts across wider regions or the whole of the UK, the UKCIP02 maps and datasets can be used to provide information at the monthly/seasonal timescales.) The WRSRL GNSRP model is a regionalised model and can, in theory, be run for any location. The CRU WGs require 20-30 years of observed daily/hourly data for the six variables for calibration and validation for each location. Appropriate data are available for airport sites at Edinburgh, Manchester and Heathrow, and for some other potential case-study locations. Final decisions about locations (likely to be a maximum of 5) will be taken at W1. W1 will also be used to make final decisions about the time periods for the scenarios (e.g., 2020s, 2050s, 2080s) and time-series length (e.g., 100 years, 1000 years). Time series will be provided for the four UKCIP02 emissions scenarios, i.e., low, medium-low, medium-high and high, based on the HadRM3 simulations (for consistency with UKCIP02) and for a limited number of additional scenarios/models (to reflect a wider range of uncertainty).

The second workshop (W2), will present the final scenarios, provide advice on scenario use and answer user questions/comments. The project deliverables D1 to D4 will be made available for downloading from a project web site, together with D5: a series of technical briefing notes on issues such as the models used and the underlying assumptions, uncertainties and confidence limits and guide to good practice in scenario use).

Assessments of scenario reliability will be undertaken as part of the proposed climate scenarios work. The CRU WGs, for example, will be calibrated and validated on independent data periods. WRSRL will parameterise their rainfall model to match observed 1961-1990 return periods for daily rainfall. Where possible, levels of confidence will be assigned using expert judgement and the UKCIP02 terminology (i.e., high/medium/low confidence). If necessary, it will be made clear that not even a low confidence level can be assigned to particular variables/scenarios.

Tasks 1 to 12 will meet the majority of the expressed scenario needs of the eight proposals (see Relevance to Beneficiaries). However, some projects have more specialised requirements (e.g., for variables such as lightning and storm surges). Thus, together with the provision of ongoing expert support and guidance in the use of the scenarios, advice will be given about scenarios for variables not included in the deliverables. The UKCIP02 results will be used for this purpose, together with, where possible, ongoing work in other national and international research programmes and expert opinion, to arrive at a plausible range of values. In some cases, it may be possible to suggest areas of future work to address these additional needs.

Workplan, project management and links with the Integrating Framework

The project workplan, including the scheduling of Tasks 1 to 13, deliverables D1 to D5, workshops W1 and W2 and the two project meetings (M1 and M2) is attached. Arrangements for project management, including a description of how this project fits within the Integrating Framework for the EPSRC/UKCIP research programme, are given in the Annex.

Relevance to Beneficiaries

The principal and immediate beneficiaries of the proposed work will be end users and stakeholders involved in the successful projects funded under the EPSRC/UKCIP climate impacts programme. Identification of the most suitable methods of scenario construction and the scenario deliverables has been an iterative process, involving considerable interaction with users and stakeholders involved in the eight other proposals. As part of this process, all consortia were asked to comment on whether the proposed output variables and formats from the CRU and WRSRL models were likely to be useful. The results of this consultation exercise are shown in the table on the next page, which indicates that most consortia are likely to find the majority of proposed outputs useful. As a result of comments received, it was decided to calculate PET from the CRU WG output variables and to provide values for relative humidity as well as vapour pressure, giving a suite of eight variables (see D2).

In order to ensure that the scenarios are available for use at an early stage of the programme, the proposed starting date of this project is three months earlier than that of the other projects. For the same reason, existing methods and models will be refined for the specific purposes of this programme, rather than developing entirely new methods. Nonetheless, the outputs will represent the state-of-art in high-resolution climate scenario construction and a valuable refinement of the UKCIP02 scenarios.

Dissemination and Exploitation

All project deliverables will be made available via the project web site, starting with D1 (examples of WG/GNSRP model output for initial testing of impact models in other projects) in Month 9. All deliverables will be restricted for use by members of the successful projects initially, but deliverables D1-D2 and D4-D5 will be made publicly available at the end of the programme, again via the project web site.

The scenarios will be provided as a common service to all successful projects and it is anticipated that detailed and sector-specific analyses will be carried out in individual projects. As part of the CRANIUM project on risk and uncertainty, for example, CRU and WRSRL propose to carry out novel and detailed analyses of extreme events, including the construction of joint distributions, e.g., high windspeed and high rainfall. The results of these analyses will be disseminated to the consortia during the course of the programme, thus adding further value to the scenarios (if the CRANIUM proposal is successful). Additional analyses and further refinements will be carried out in other projects. The urban drainage consortium, for example, proposes to make use of the 15-minute rainfall scenarios (with guidance from WRSRL) to derive estimates of 1-minute precipitation (important for roof and house drainage), while the buildings consortium will use the WG scenarios (with guidance from CRU) to modify the CIBSE building design data.

Justification of Resources

The work will be undertaken by existing staff, ensuring that it can start promptly. CRU will use the varied expertise of five post-doctoral researchers (20 months in total), together with unpaid contributions from the two unpaid principal/co-investigators. Similarly, WRSRL will employ experienced researchers (13 months), specialised in rainfall modelling, object orientated programming, extreme event analysis and GIS, again with unpaid contributions from two investigators. The Hadley Centre modelling work (3.5 months consultancy) will be undertaken under subcontract to CRU. The travel and subsistence budget includes the costs of the two workshops, together with attendance at Integrating Framework and project progress meetings (see Annex), and travel to meetings and/or institutions associated with the other successful projects. The CRU staff budget includes 0.5 months for computing support, which is essential for Tasks 1-5 and 13. Similarly, one day per month UNIX support is included for WRSRL, essential for Tasks 6-11.

Variable	***Likely to be useful***	***May be useful***	***Unlikely to be useful***
Daily: precipitation	✔✔✔✔✔	??	
Daily: mean temperature	✔✔✔✔✔✔		✗
Daily: diurnal temperature range	✔✔✔✔✔✔✔		
Daily: vapour pressure	✔✔✔✔	? ?	✗
Daily: sunshine duration	✔✔✔✔✔✔	?	
Daily: wind speed	✔✔✔✔✔✔✔		
Hourly: precipitation	✔✔✔✔✔	? ?	
Hourly: mean temperature	✔✔✔✔✔✔	?	
Hourly: diurnal temperature range	✔✔✔✔✔✔	?	
Hourly: vapour pressure	✔✔✔✔✔✔		✗
Hourly: sunshine duration	✔✔✔✔✔✔	?	
Hourly: wind speed	✔✔✔✔✔✔	?	
15 minute: precipitation	✔✔✔✔✔	? ?	
Format			
Mean changes (frequency distributions)	✔✔✔✔✔✔	?	
Time series	✔✔✔✔✔✔✔		
Probability distributions (reflecting some of the uncertainties)	✔✔✔✔✔✔	?	

✔utilities, ✔transport (structures), ✔built heritage, ✔urban drainage, ✔transport (Transport Research Laboratory), ✔risk, ✔buildings N.B. The socio-economic consortium did not identify a direct need for climate scenarios and no response was received from the urban environments consortium.

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Project work plan Project work plan

Task	***Person***	***2003*** ... ***2004*** ***A M J J A S O N D J F M A M***
1: Modification and updating of the daily WG focusing on the development of user-friendly and efficient subroutines for perturbing the parameters in climate change studies	Matthew Watts (CRU) 2 person months	
2: Development of methodologies for perturbing the daily/hourly WGs focusing on the UKCIP02 scenarios and to quantify some of the uncertainties	Clare Goodess (CRU) 3 person months	
3: Improvements to the daily WG, focusing on secondary variables	Matthew Watts (CRU) 3 person months	
4: Development of the hourly WG	Matthew Watts (CRU) 5 person months	
5: Development of wind scenarios based on storm-track changes	Clair Hanson (CRU) 2 person months	
6: Set up the GNSRP model for the whole UK using the UKCIP 5 km climatology	Ahmad Hashemi (WRSRL) 2 person months	
7: Parameterise the GNSRP model to match observed 1961-1990 return periods for daily rainfall	Ahmad Hashemi (WRSRL) 2 person months	
8: Parameterise the GNSRP model for the whole UK for future climate, also at 5 km, incorporating trend analyses and regional frequency analysis	Hayley Fowler (WRSRL) 2 person months	
9: Reparameterise and validate the GNSRP model for hourly and 15-minute rainfall consistent with daily totals (present/future) using observed sub-daily time series and statistics	Ahmad Hashemi (WRSRL) 2 person months	
10: Interface from the GNSRP model to the CRU daily WG	Michael Murray (WRSRL) 2 person months	
11: Extend the GNSRP model to allow for changing proportion of convective/frontal rainfall in future climate using 'storm type' parameter sets	Aidan Burton (WRSRL) 2 person months	
12: Development of scenarios of climate change in urban areas	Richard Betts (Hadley Centre)3.5 months	
13: Dissemination and ongoing support/advice in the use of climate scenarios *This task will continue until Month 36, i.e., March 2006, with CRU working one person month per year.*	Clare Goodess/David Viner (CRU) 3 person months H.J. Fowler (WRSRL) 1 month	
Deliverables	***Institution***	***A M J J A S O N D J F M A M***
D1: Examples of WG/GNSRP model output for testing impacts models	CRU, WRSRL	D1 D1
D2: Daily/hourly scenarios for 8 variables for 3-5 representative case-study locations	CRU	D2
D3: Software package to run the GNSRP precipitation model for any given UK location	WRSRL	D3
D4: Report describing the analyses of changes to urban/rural temperature and humidity	Hadley Centre (HC)	D4
D5: Technical briefing notes on issues such as the models used and underlying assumptions, uncertainties and confidence limits, and guide to good practice in scenario use	CRU, WRSRL, HC	D5 D5
Workshops/project progress meetings	***Institution***	***A M J J A S O N D J F M A M***
W1: Main focus: to make final decisions about the deliverables, based on end user requirements	CRU, WRSRL, HC	W1
W2: Main focus: to present the final scenarios and provide advice on scenario use	CRU, WRSRL, HC	W2
M1/M2: Project progress meetings	CRU, WRSRL, HC	M1 M2

ANNEX: PROJECT MANAGEMENT

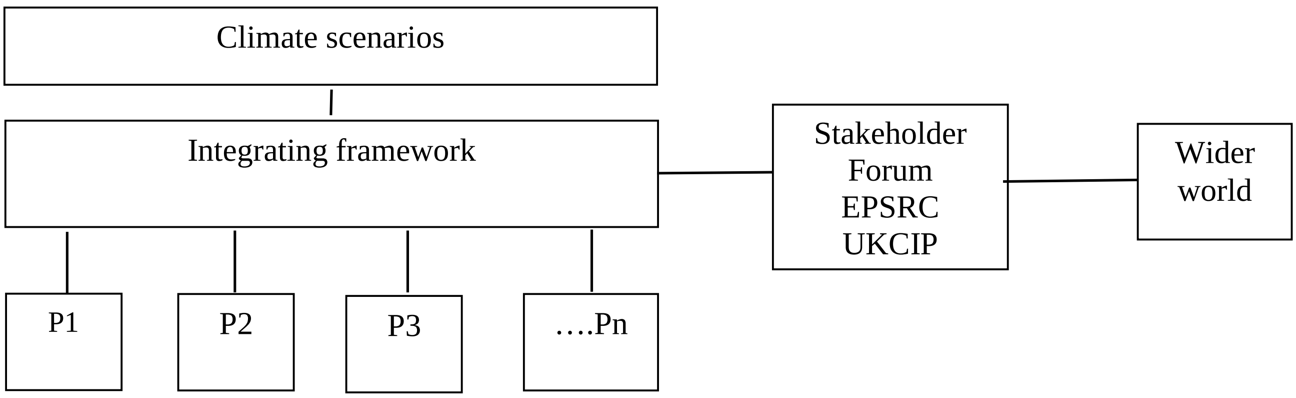
Management of the Construction of Climate Scenarios for the Integrating Framework Project
The project will run for 36 months (1 January 2003 to 31 December 2005). Scenario construction work will, however, finish in December 2003, with the final scenarios delivered in January 2004. Following the second workshop (W2) in February 2004, work will be confined to the provision of ongoing support and advice by CRU in the use of the scenarios (1 person month per year). The timing of the 13 project tasks, five deliverables, two workshops and two progress meetings is shown in the workplan on the previous page.

The CRU principal investigator, Professor Phil Jones, will be responsible for overall co-ordination of the project. The CRU Co-investigator, Dr Jean Palutikof, will provide expert advice, particularly with respect to work on wind and storm tracks. Day-to-day work at CRU will be supervised by Dr Clare Goodess, who will also play a leading role in liasing with end users and stakeholders in the successful proposals (building on links developed during the course of the proposal development process). The Hadley Centre will be a subcontractor to CRU: Dr Richard Betts will be responsible for this work. Chris Kilsby will have responsibility for the work at WRSRL, with additional expertise provided by Professor Enda O'Connell.

The principal means of communication between the three institutions will be electronic, e.g., email. A password protected web site will be set up at the start of the project to provide access to common data sets and working documents. This will be expanded during later stages, in order to allow members of the successful projects access to the deliverables (which will be made publicly available at the end of the EPSRC/UKCIP programme).

Two project progress meetings will be held. The main foci of the first meeting (M1) in Month 6 will be to ensure that consistent methodologies are being used and to follow-up issues arising from the first workshop, while the second meeting (M2) in Month 12 will focus on finalisation of the deliverables and planning for the second workshop (W2).

Role within the Integrating Framework
This project on the construction of climate scenarios will feed directly into the proposed Integrating Framework and, through this, to the stakeholder forum, the wider world and the other successful projects:



Provision has been made in the travel budget for a lead researcher (likely to be Dr Clare Goodess) to attend all Integrating Framework meetings.

The proposed work on climate scenarios is intended to provide a common service to all successful projects. Thus it is designed to meet as many as possible of the expressed end user requirements. Continuing two-way communication and feedback between the scenario providers and users is seen as vital to the success of the EPSRC/UKCIP programme. If other common climate scenario needs are identified through the Integrating Framework, ways in which the planned work could be modified to meet these needs will be considered. However, scientific and resource constraints mean that major changes in the proposed work are unlikely to be feasible. In addition to these interactions with the Integrating Framework, the scenario construction project will work closely with UKCIP in order to ensure consistency with the UKCIP02 scenarios and to make maximise use of the UKCIP datasets and expertise.