CARPE DIEM

Critical **A**ssessment of available **R**adar **P**recipitation **E**stimation techniques
and
Development of **I**nnovative approaches for **E**nvironmental **M**anagement

Contract N° EVG1-CT-2001-00045

18th Month – Management Report
January 1st, 2003 – June 30th, 2003

Section 1

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SECTION 1: MANAGEMENT AND RESOURCE USAGE SUMMARY

1.1. Objectives of the reporting period

Objectives of the reported period were mainly the following:

1.1.1. WP 1 - Project Management

- Organisation of project meetings;
- Reporting on project status;
- Organisation of the 1st project workshop;
- Technical Steering Committee meeting.

1.1.2. WP 2 - Extraction of information from Doppler Winds

- Dual-Doppler retrieval over selected case studies;
- Preparation for multiple Doppler wind retrieval.

1.1.3. WP 3 - Data Assimilation

- Implementation of the observation operators for radar radial winds in 4D-Var.

1.1.4. WP 4 - Assessment of NWP model uncertainty including models errors

- Definition of methodology;
- Bibliographic references research;
- Set-up of software modules for the methodology selected.

1.1.5. WP 5 – Assessment of improvements in NWP

- Analysis of selected MAP cases;
- Acquisition of MAP radar data.

1.1.6. WP 6 – Anomalous propagation

- Analysis of ANAPROP cases;
- Modelling of microwave-terrain interaction;
- Development of visualisation tools;

1.1.7. WP 7 – Advanced surface radar-based rainfall estimate applying NWP model data

- Use of HIRLAM real-time fields into the 3d radar composite grid for VPR correction;
- Hail identification algorithm;
- Use of NWP data for particle identification.

1.1.8. WP 8 – Use of polarimetric data to improve the radar rain estimate

- Review of polarimetric techniques for radar rain estimate

1.1.9. WP 9 - Assessment of the Bias, Spatial Pattern and Temporal Variability of errors in the different sources of areal precipitation estimate.

- Assessment of different remote sensing rainfall estimation techniques;
- Comparison of flood estimates and forecasts using the semi-distributed model in the Swedish catchment
- Comparison of flood estimates and forecasts using the simpler lumped models in the Irish catchment
- Comparison of flood estimates and forecasts using the more complex distributed model in the Irish catchment

1.1.10. WP 10 - Optimal use of radar, NWP and raingauge data in precipitation forecasts for improving flood forecasts in urban and rural catchments

- Definition of methodology for best mixing of different rainfall data for flood forecasting.

1.1.11. WP 11 – END-USERS' level of service requirements

- Updating of basic end user requirements;
- Participation of end-users in the project workshop;
- End-user assessment.

1.1.12. WP 12 – Project results dissemination

- Project web-site updating;
- Joint workshop CARPE DIEM - MUSIC
- Project promotion activity towards end-users, scientists and decision-makers.

1.2. Scientific/Technical progress made in different work packages according to the planned time schedule:

1.2.1. WP 1 - Project Management

As planned in the project timetable a Technical Steering Committee meeting have been organised jointly with the mid-term project meeting and the 1st project workshop.

At the meeting all participants was present:

- Pier Paolo Alberoni, ARPA.SMR, as project co-ordinator;
- Nils Gustfasson, SMHI, as AREA 1 scientific rapporteur
- Madhu Chandra, DLR, as AREA 2 scientific rapporteur
- Ezio Todini, PROGEA, as AREA 3 scientific rapporteur
- Dusan Zrnic, NSSL-NOAA, as expert on radar-meteorology
- Andrea Rossa, MeteoSwiss, as expert on weather numerical model and COST717 chairman;
- Paolo Burlando, ETH, as expert on hydrology.

The report of the external members of the TSC is under preparation and it will be place on the web-site and distribute within the consortium and the EU Scientific Officer as soon as it will be ready.

We can anticipate here that, from the discussion done during the meeting, no particular problems seems to be present within the CARPE DIEM plan.

The first project workshop was carried out jointly with the MUSIC project (N° EVK1-CT-2000-00058). At the workshop more than 50 researchers/end-users. A complete report wrote by Prof. Pegram of the university of Natal (south Africa) is available on the project web site.

1.2.2. Area 1 – Data assimilation and NWP improvements (WP 2, 3, 4, 5)

The work in Carpe Diem Research Area 1 makes progress in accordance with the plan. An additional component, an atmospheric model and data assimilation inter-comparison study has been added to the plan.

1.2.2.1. WP 2 - Extraction of information from Doppler Winds

A digital terrain map has been examined with regard to suitability for dual doppler radar wind retrievals with data from the radar stations in S. Pietro Capofiume and Gattatico in Northern Italy. A retrieval area has been selected - this area also makes retrievals including data from a third radar at Monte Grande possible. (University of Essex).

The software for generation of radar wind super-observations, to be applied in variational data assimilation, has been further developed. The sensitivity to the spatial scale of the super-observation has been examined. Furthermore, a new algorithm for de-aliasing of radar radial wind data has been developed. The new algorithm has proven to perform satisfactory for radar wind data from Sweden and Finland. (SMHI).

1.2.2.2. WP 3 - Data Assimilation

The observation operator used in the variational data assimilation of radar radial wind super-observations has been further developed. Taking into account the effects of refractivity gradients on the vertical propagation of the radar beam as well as the broadening of the radar beam have proven to contribute to an improved fit between observed radar data and model-data. The impact of these refinements on the assimilation and forecast remain to be checked. (FMI and SMHI).

The data assimilation scheme based on nudging for initialisation of the regional MASS forecast model has been further developed by enhancement of humidity initial data based on radar and satellite data. Case studies have indicated significant improvements of short-range precipitation forecasts. (University of Barcelona).

1.2.2.3. WP 4 - Assessment of NWP model uncertainty including models errors

Two approaches for online estimation of forecast error statistics, to be applied in atmospheric data assimilation, are investigated – A Maximum Likelihood Estimation approach and a Kalman Filter approach. The first approach will be applied to the estimation of forecast error standard deviations in a full-scale limited area model (HIRLAM), while the second approach will be applied to a simplified model with emphasis on baroclinic developments. Software development and data exchange between the partners have started. (PROGEA and SMHI)

1.2.2.4. WP 5 – Assessment of improvements in NWP

A planning meeting on the Carpe Diem atmospheric model and data assimilation inter-comparison study was held in Bologna 29-30 April 2003. Three partners will run data assimilation and forecast experiments for the period 3-8 November 1999 utilising observations from the Meso-scale Alpine Project (MAP). Experiments will be carried with different assimilation techniques (3D-Var, 4D-Var, Optimum interpolation and nudging) and with and without radar data. Since the different models and the different assimilation techniques will be applied on the same model integration area, a simple multi-model ensemble forecasting experiment will be made possible. (SMHI, ARPA/SMR and University of Barcelona)

1.2.3. Area 2 – Improve radar products by using NWP results (WP 6, 7, 8)

1.2.3.1. WP 6 – Anomalous propagation

Essex and Barcelona have liaised over terrain data and have now implemented a high resolution 30 m terrain elevation map, and also land coverage data. Essex have been developing software to interpolate data to radar coordinates, and to generate suitably smoothed radial terrain profiles, so that it will be possible to model the reflection and diffraction effects of terrain through anaprop and blockage. They have also been developing new algorithms for the fast calculation of the phase integrals for the Huyghens-Frenel approximation to the terrain scattering, by evaluating the orthotomic locus of the source reflection point. In addition, they have also been working on the display aspects for the anaprop modelling application, so that radar, anaprop predictions and terrain information can be simultaneously displayed.

1.2.3.2. WP 7 – Advanced surface radar-based rainfall estimate applying NWP model data

During the first 18 months FMI have been monitoring reflectivity data from 7 C-band Doppler radars and temperature data from 3 sounding stations continuously. The following results were obtained and are in addition to those mentioned in the 12 month report:

a) Software which composites 3D temperature data from the operational NWP model HIRLAM into the radar grid. This package is the elementary tool required for deliverables 7.1 - 7.4 for the application of NWP data to improve radar measurements. The knowledge of the 3D temperature field enables the estimation of 3D hydrometeor phase field which is crucial for the correct estimation of attenuation of microwaves along the radar beam. 3D temperature data will also improve automatic real time diagnosis of the type and quality of each measured VPR , which so far is only based on interpolated sounding data.

b) Comprehensive validation of the VPR correction scheme has been performed using neighboring radar pairs. Ideally, when the VPR correction has been performed for the lowest elevation data from radar A at range r, the corrected dBZ should be equal to the measured reflectivity at radar B, located at range r from radar A as data from B at very short ranges is obtained practically at ground level. Using data bins in the circular area between 5 - 15 km from the radar at Anjalankoski (B) and corresponding bins from the radar at Vantaa (A), located 140 km from Anjalankoski, and applying the VPR correction for Vantaa during 13 months, in cases when precipitating VPR was diagnosed at Anjalankoski, we found that the average bias, reduced from 2.6 dB to -0.05 dB and the standard deviation decreased slightly from 4.0 dB to 3.9 dB. During winter months, when precipitation is shallow, the bias reduced from 4.9 dB to -0.1 dB whereas the standard deviation increased slightly from 4.1 dB to 4.5 dB.

c) Representative climatological VPR. A statistical survey of all the VPRs measured in Finland has revealed that our first guess climatological VPR (applied in the correction scheme) was slightly erroneous. The proper values of the average vertical reflectivity gradient are:

- *In rainfall -4.7 dB/km above the bright band and -0.7 dB/km below the bright band. The average bright band amplitude is 7 dB.*
- *In snowfallthe corresponding value is -3.3 dB/km.*

The new climatological VPR has replaced the old one in the correction scheme.

d) Probability distribution of VPRs in snowfall. We have studied the probability distribution of the radar reflectivity factor in snowfall at various heights based on 54 000 snowfall VPRs (see Fig. 1). A very important implication of the result concerns the planned GPM/EGPM satellite missions: the K-band active radars on the satellites, measuring snowfall up to latitudes 83 degrees, have been suggested to obtain the sensitivity of 10-18 dBZ. From Fig. 1 we can see that the mission will fail as at least in the Finnish climate such sensitivity will detect no more than 5-20 % of all snowfall cases. No doubt the suggested sensitivity is sufficient to diagnose socio-economically important heavy snowfall cases but not the dominating weak snowfall, which is important in the high latitude climate.

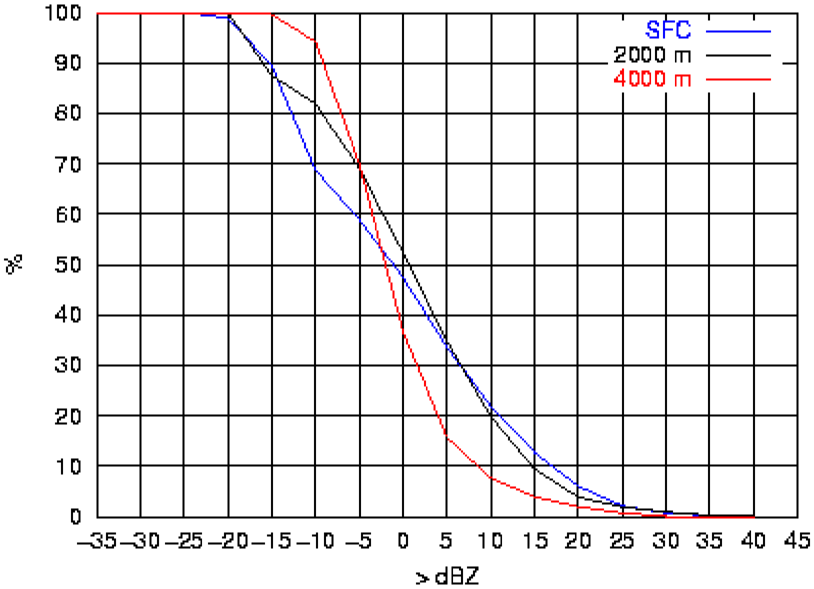

Fig. 1. Cumulative distribution function of radar reflectivity factor (dBZ) in snowfall based on 54 000 vertical profiles of reflectivity in snowfall in Finland. Three graphs represent different heights above the ground level (sfc denotes ground level).

A National End User Meeting held at FMI in February 2003 revealed that both End Users are satisfied to the results achieved. They also requested that the VPR correction scheme should be implemented into their operational radar products as the correction will greatly improve the long range accuracy of radar based precipitation measurements. This wish is valid in spite of the fact that in the cases of long range overhanging precipitation (consisting 19 % of all VPRs) the scheme will enhance the existing overestimation of the radar measurements. Both End Users deduced that some overestimation now and then is not so severe for their operations as is the more common underestimation at long ranges.

Validation studies clearly show that the VPR correction scheme developed in the CARPE DIEM project eliminates efficiently the large measurement bias due to the effects of the VPR. Thus the objective of WP7.4 is already achieved in operational level at least at ranges around 140 km from a radar. Further validation will hopefully confirm this result also at longer measurement distances (150 - 250 km). The conclusions regarding snowfall detection and its implications to the GPM/EGPM mission has been orally reported both at the 3rd GPM Workshop at Noordwijk, 23-26 June, and at the GPM Session in the 31st AMS Radar Conference, 6-12 August. Additionally Fig. 1 has been send to some key persons in the satellite planning groups. It remains to be seen whether these CARPE DIEM results will have influence on the K-band radar specifications applied in the satellites.

In summary, work is proceeding on target and the following actions are planned during the next six months.

- Further validation of the VPR correction method will be performed using a larger data set of radar pairs and gauge data.
- The VPR correction method (Deliverable 7.4) will be implemented operationally, provided that the problem of overhanging precipitation does not does not have a significant detrimental effect.
- A paper will be submitted of the VPR correction method to a reviewed Journal.
- NWP model fields (from the HIRLAM model) will be added to obtain the 3D hydrometeor phase distribution (Deliverable 7.1).
- Diagnosis of the regions of overhanging precipitation will be started based on radar and NWP data.
- An attenuation correction scheme will be implemented.

1.2.3.3. WP 8 – Use of polarimetric data to improve the radar rain estimate

Work at DLR on WP8 has been significantly delayed as a result of the refurbishment of the radar and significant changes to both the hardware and software. Although data collection was begun in March this year, early analysis revealed that there were substantial differences in the Doppler phase measured for the two polarisation channels, and that the measured differential phase was clearly in error. This is believed to be due to a fairly minor error in the software writing the data to file rather than an actual hardware fault. This has been reported to the Institute responsible for maintaining the radar, and although work to determine and fix the problem has been begun, we are still not in a position to give an estimate as to when this problem is likely to be satisfactorily resolved.

he preferred course of action is likely to be to see this as presenting an opportunity to review progress to date and the difficulties encountered, particularly with regard to the impact of changes to the radar which had not been planned for at the time of the original proposal. A revised work plan will then be drawn up to take account of the difficulties encountered.

1.2.4. Area 3 – Flood forecasting (WP 9, 10)

1.2.4.1. WP 9 - Assessment of the Bias, Spatial Pattern and Temporal Variability of errors in the different sources of areal precipitation estimate

The assessment of the bias, spatial pattern and temporal variability in the different sources of areal precipitation have been carried out separately over the different testing-domain.

Partner 4 have compared over a "quite" large catchment, the precipitation estimate dome with raingaues, radar and NWP output. The major characteristic of the different sources are:

- Interpolated station observations (PTHBV)
    - o Based on all available stations, corrected for observation losses.
    - o Optimal interpolation.
    - o Frequencies of wind direction and wind speed included in the description of the topographic influence.

- Spatial resolution 4x4km2. Temporal resolution 24 hours.
- Period with data 1961-2002.

- Radar estimates
    - Spatial resolution 2x2 km2. Temporal resolution 3 hours.
    - Evaluation so far only made for accumulated 24 hour precipitation.
    - Period with data 2000-2002.Hirlam forecasts
    - Spatial resolution 22x22 km2. Temporal resolution 6 hours.
    - Evaluation so far only made for accumulated 24 hour precipitation (6-30hours).
    - Period with data 2002.The results could be summarised as follows:
- Comparison of radar and interpolated station data 2000-2002
    - Higher spatial resolution and realistic spatial variability for single days in radar data
    - Technical problems cause non-realistic local spatial gradients in radar data.
    - Systematic deviations both spatially and temporally - could be explained by technical problems and/or physiographic factors.
- Comparison of HIRLAM forecasts and interpolated station data 2002
    - No obvious systematic deviations.
    - Higher spatial variability in HIRLAM forecasts.
    - Hirlam tends to generate small rainfall events during dry periods

Partner 8 deals with the observations of precipitation using geostationary IR satellite data. The Naval Research Laboratory (NRL) technique is in continuous development at **Partner 8** in cooperation with NRL and has been adapted to the local data processing chain. The constantly evolving temporal and spatial characteristics of precipitation and its relation to satellite observations require that any statistical tuning or calibration to infrared (IR) brightness temperatures follow the rain characteristics. Time- and space-coincident microwave (MW) and geostationary IR satellite data are thus saved each time a SSM/I orbit pass intersects with Meteosat's full disk coverage. This has made possible the construction of lookup tables, which relates the IR temperature to the MW-based rain rate. WP 10 - Optimal use of radar, NWP and raingauge data in precipitation forecasts for improving flood forecasts in urban and rural catchments

The TOPKAPI model, developed at the University of Bologna, is now installed at NUID, a calibration have been performed and the base-flow component it is added now. An analysis and integration of archived radar data over the **Partner 9** catchment is now commenced as well as the use of operational NWP data (HIRLAM).

In order to use properly the TOPKAPI the refinement of the rating equations for the catchment gauges is an on-going activity.

1.2.5. WP 11 – END-USERS' level of service requirements

The first workshop of the project was organised jointly with the EU project Music. The goals of the workshop were the discussion with the end-user panels of both projects.

The general discussion centred around three principal topics:

Lead Time – how is this determined

Quality of Forecasts – how is this information conveyed to the user

Training and Interaction – how to promote this activity effectively

with a fourth topic which could be headed

Communication with Public

The main points made are summarised here (refer to the workshop summarise for a complete discussion).

Lead Time

Lead time is scale dependent and damage dependent. There is a need to distinguish between lag time and lead time. Dusan Zrnic highlighted the need for a hybrid model (from CARPE DIEM) to fill the gap (1h to 3h) between the stochastic forecasts at high resolution based on radar ('good' up to 1h) and the coarser resolution forecasts based on NWP models ('good' from 3h to 6h).

Quality of Forecasts

Deterministic hydrological forecasts are problematic because they pretend to be precise - there is a need for probabilistic or ensemble forecasts in interpretable form to quantify uncertainty. Sources of uncertainty include: precision of precipitation measurement, estimation, modelling and forecasting in time and space; precision of flow estimates; validity of rainfall/runoff models. It is important to improve quality in radar estimates of precipitation.

Training and Interaction

End users are not people "we" meet. Who are the end users? decision makers? the public? Uncertainty about the future is handled differently at different levels in the communication hierarchy. There is a need for simple decision rules – limit the choice between two or three – do not make them too complex – it is essential to educate and communicate.

Communication with Public

There is a need for graded warnings → graded action/response – suggest "n hours" to take specific precautionary action to reduce panic → reduces damage to credibility due to false alarm.

Beware communication depending on mobile phone technology in times of crisis – e.g. experience of saturation of mobile phone network during recent tornados in US. To counter this, try the "Floodline" concept used in UK, outsourced to call centres run by an agency. Other techniques include direct telephone, activated voice-messaging, sirens, multimedia systems. In Japan there exists a "wake-up call" system via TV when there is a need for an earthquake warning. NOAA uses dedicated radios. In Sweden, events with longer warning lead times allow internet messages via dedicated web-site to be disseminated.

1.2.6. WP 12 – Project results dissemination

Partner 7 continue the updating and managing of the project web-site (http://carpediem.ub.es).

1.2.7. Original Gantt chart

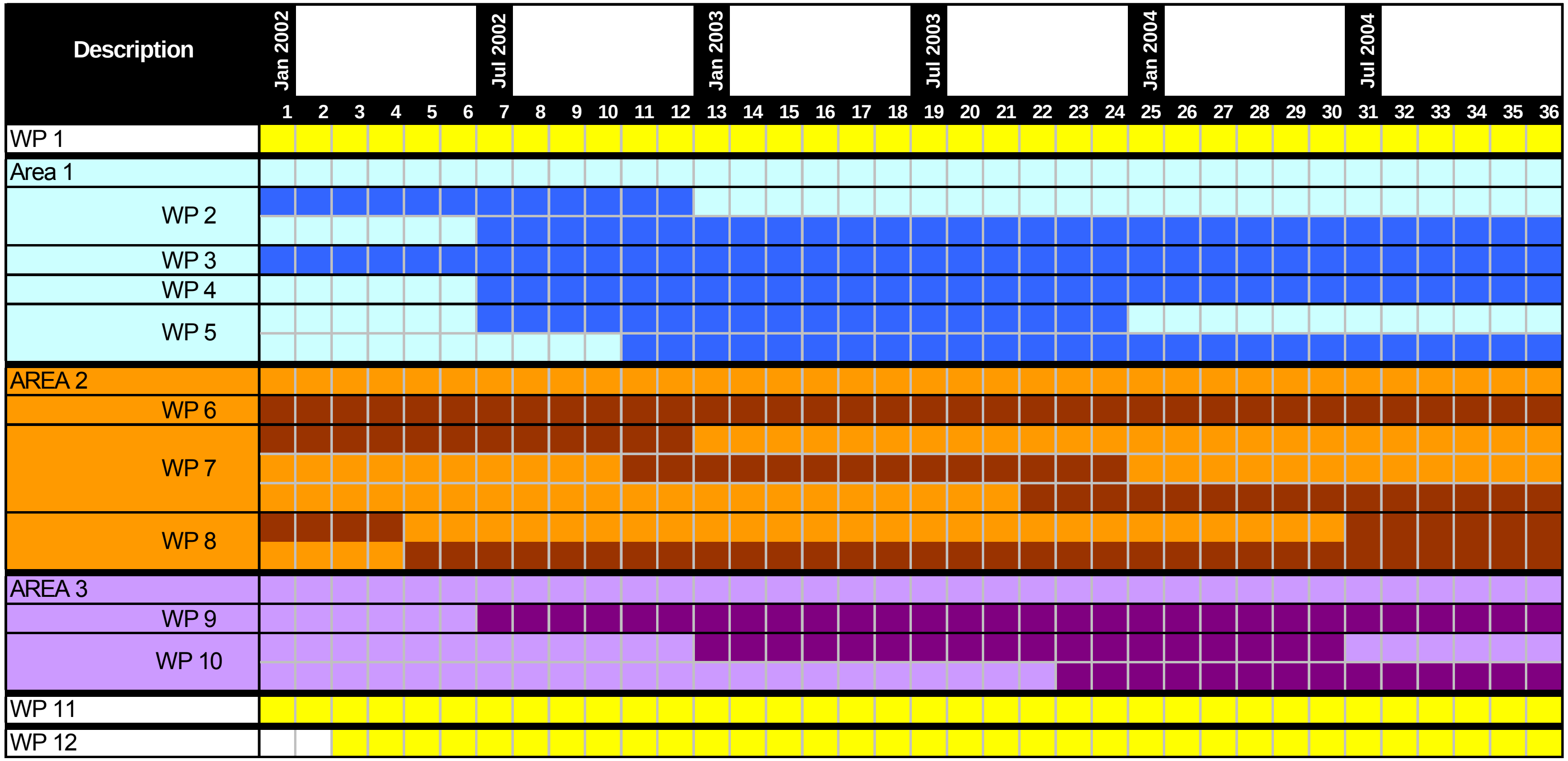

TABLE 1 – ORIGINAL GANTT CHART OF THE DISTRIBUTION OF THE WORK AMONG THE DIFFERENT WPS.

1.2.8. *Modified Gantt chart*

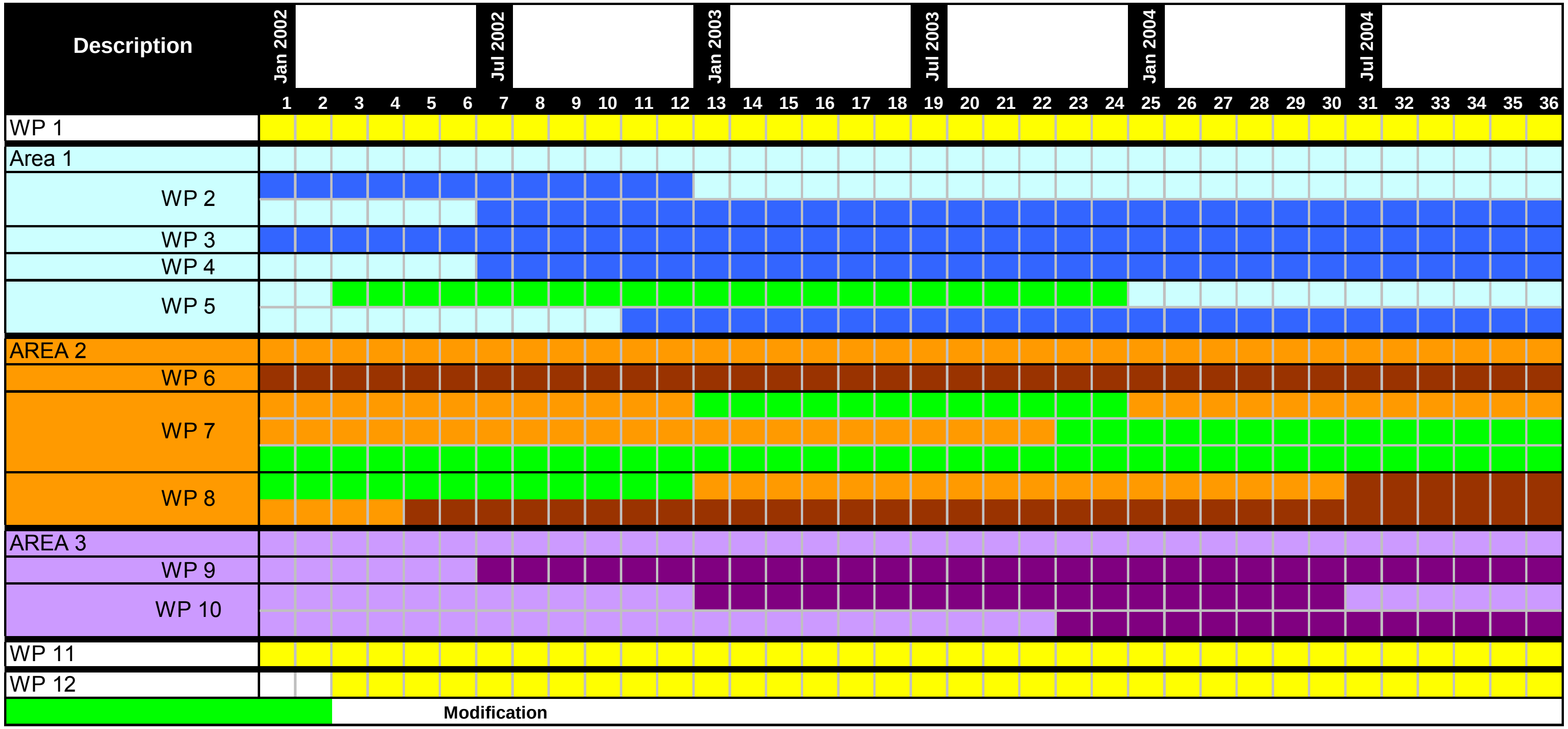

TABLE 2 – MODIFIED GANTT CHART OF THE DISTRIBUTION OF THE WORK AMONG THE DIFFERENT WPS.

1.2.9. Planned and Used Manpower

WP	ARPA-SMR		PROGEA		DLR		SMHI		FMI		UE		UB		CNR-ISAC		NUID		WP TOTAL	
	U	P	U	P	U	P	U	P	U	P	U	P	U	P	U	P	U	P	U	P
1	1,0	1,2	1,0	1,0	0,2	0,3	0,3	0,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	2,5	2,9
2	1,0	1,0	0,0	0,0	1,6	2,9	3,5	3,5	0,0	0,0	6,0	6,0	0,0	0,0	0,0	0,0	0,0	0,0	12,1	13,4
3	0,0	0,0	0,0	0,0	0,0	0,0	1,0	1,0	0,1	1,7	0,0	0,0	4,0	4,2	0,0	0,0	0,0	0,0	5,1	6,9
4	0,0	0,0	11,0	10,0	0,0	0,0	2,8	2,8	0,0	0,0	0,0	0,0	2,0	1,5	0,0	0,0	0,0	0,0	15,8	14,3
5	6,5	6,9	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	8,0	8,0	0,0	0,0	14,5	14,9
6	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	6,0	6,0	2,5	3,3	0,0	0,0	0,0	0,0	8,5	9,3
7	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	6,7	5,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	6,7	5,0
8	0,0	0,0	0,0	0,0	3,0	4,2	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	3,0	4,2
9	0,0	0,0	2,5	2,0	0,0	0,0	3,0	3,0	0,0	0,0	0,0	0,0	0,0	0,0	3,0	3,0	0,0	1,4	8,5	9,4
10	2,0	2,5	2,5	2,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	7,9	4,5	12,3
11	0,0	0,2	0,0	0,0	0,0	0,0	0,4	0,4	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,5	0,4	1,1
12	0,5	0,2	0,5	0,3	0,1	0,4	0,0	0,0	0,0	0,0	0,0	0,0	0,5	1,0	0,0	0,0	0,0	0,2	1,6	2,1
Partner Total	11,0	12,0	17,5	15,3	4,9	7,8	11,0	11,0	6,8	6,7	12,0	12,0	9,0	10,0	11,0	11,0	0,0	10,0		
TOTAL																			83,2	95,8

TABLE 3 – PLANNED AND USED MANPOWER RESOURCES BY WORKPACKAGES AND PARTNERS.

1.2.10. Planned and Used Financial Resources

WP	ARPA-SMR		PROGEA		DLR		SMHI		FMI		UE		UB		CNR-ISAC		NUID		WP TOTAL	
	U	P	U	P	U	P	U	P	U	P	U	P	U	P	U	P	U	P	U	P
1	2259	5396	7500	7000	1924	3326	2262	2262	0	0	0	0	0	0	0	0	0	0	13945	17984
2	2259	4317	0	0	15394	27935	29238	29238	0	0	21855	25400	0	0	0	0	0	0	68746	86890
3	0	0	0	0	0	0	7540	7540	630	9466	0	0	13076	10845	0	0	0	0	21246	27851
4	0	0	50000	46000	0	0	21111	21111	0	0	0	0	3575	5680	0	0	0	0	74686	72791
5	14684	30219	0	0	0	0	0	0	0	0	0	0	0	0	38378	38378	0	0	53062	68597
6	0	0	0	0	0	0	0	0	0	0	22560	25400	7523	6150	0	0	0	0	30083	31550
7	0	0	0	0	0	0	0	0	33733	27452	0	0	0	0	0	0	0	0	33733	27452
8	0	0	0	0	28863	39907	0	0	0	0	0	0	0	0	0	0	0	0	28863	39907
9	0	0	10000	8000	0	0	22618	22618	0	0	0	0	0	0	14392	14392	0	4692	47010	49702
10	4518	10792	10000	8000	0	0	0	0	0	0	0	0	0	0	0	0	0	25975	14518	44767
11	0	899	0	0	0	0	3015	3015	0	0	0	0	0	0	0	0	0	1676	3015	5590
12	1130	981	3000	2000	962	3628	9000	6500	0	0	0	0	300	689	0	0	0	609	14392	14407
Partner Total	24850	52605	80500	71000	47143	74795	94784	92284	34363	36918	44415	50800	24474	23364	52770	52770	0	32953		
TOTAL																			403299	487488

TABLE 4 – PLANNED AND USED FINANCIAL RESOURCES BY WORKPACKAGES AND PARTNERS.

1.3. Milestones and deliverables obtained

1.3.1. Milestones

M 0.1. Start of activities
M 0.2. 1st TSC meeting
M 1.1. Basic end-Users requirements
M 1.2. Web site established
M 1.3. Critical review of polarisation techniques
M 2.1. Pre-processing of radar data
M 2.2. Data quality assessment
M 2.3. Definition of multiple Doppler analysis
M 2.4. Overview for software modules to be applied for assimilation of radar and satellite data.
M 2.5. Descriptions for ingestion of satellite and radar data.
M 2.6. Description of observation operators, including tangent-linear and adjoint versions, for radar radial winds in 3D-Var.
M 2.7. Results from first tests using simulated data in 3D-Var
M 2.8. Implementation of fast Hybrid Parabolic Equation model
M 2.9. Incorporation of terrain elevation data
M 2.10. Implementation of the program which produces the VRP correction over the whole radar network
M 2.11. Verification on the improvement in radar derived surface precipitation using VPR correction
M 3.1. Implementation of the observation operator for 4DVAR
M 3.2. Assessment of errors in the input of hydrological models
M 3.3. 1st workshop, End-Users panel meeting
M 3.4. 2nd TSC meeting
M 3.5. End-users Assessment document

1.3.2. Deliverables

W.P.	Deliverable	Deliverable title	Delivery date (Plan/Exp.)	Status
1	1.1	Set-up of Technical Steering Committee	2	
1	1.2	Report of the kick-off Meeting	2	
1	1.3	1st TSC report	2	
8	8.1	Critical review of present state of the art multi-polarisation rainfall estimation techniques	4/12	
11	11.1	Basic End-Users requirements	6/12	
12	12.1	web site	6	
2	2.1	Super-observation dataset	12	
2	2.2	Maps of the partner 1 region detailing those areas accessible to dual-Doppler analyses, and any accessible to three Doppler radars.	12	
5	5.1	Analysis of severe weather situations	12,24	
5	5.2	Set-up of VSRF procedure	12	
8	8.2	Climatology of variations in Z-R at different spatial and temporal scales of model input obtained by Φ_{DP} method	12/24	
7	7.4	Improvement of radar derived surface precipitation using integrated VRP correction from a radar network and from a NWP model	36	
7	7.1	Diagnosis of hydrometeor liquid water fraction in 3D radar volumes, based on NWP model fields	13	
2	2.3	Multiple Doppler dataset	18	

W.P.	Deliverable	Deliverable title	Delivery date (Plan/Exp.)	Status
4	4.1	Software modules for ML/SKF approach	18	
6	6.1	PC-based application producing predicted images of terrain or sea clutter caused by anaprop effects based on mesoscale NWP model products	18	
9	9.1	Comparison of precipitation estimates with mesoscale analysis and stochastic model.	18	
11	11.2	End-Users Assessment document	18,36	
12	12.2	Workshops	18,36	

Legend				
COMPLETED	PARTIALLY AVAILABLE	DELAYED	CANCELLED	ANTICIPATED

1.4. Deviations from the work plan or /and time schedule and their impact to the project

A number of deviations, as to be considered as: reorganisation, added topics and delay, from the original plan and time schedules have taken place:

It has been agreed during the Kick-off meeting that a data assimilation and model inter-comparison experiment based on MAP data will be carried out with participation of **Partner 1**, **Partner 4** and **Partner 7**. This in response to a comment by the Carpe Diem Technical Steering Committee, a planning meeting was held in April to organise the intercomparison.

As reported in the previous reports there has been some re-ordering of tasks within Work Package 7, this cause the anticipation of the **Deliverable 7.4 - Improvement of radar derived surface precipitation using integrated VRP correction from a radar network and from a NWP model** and the delay of **Deliverable 7.1**.

Work Package 8 has been subject to a number of delays and as a consequence is currently running somewhat behind schedule. Since the work is largely self-contained and there are no external dependencies, this does not imply any knock on effect on other work packages, and the situation is regarded as recoverable within the time frame of the project.

Work on **Deliverable 8.2** has also been subject to delay, in this case as a result of the ongoing refurbishment of the radar system at DLR. In addition to actual hardware replacements, software and data formats have been modified making further changes to analysis software necessary.

1.5. Co-ordination of the information between partners and communication activities

1.5.1. Meetings

Two project meetings have taken place during the reporting period. Details and presentations can be found in the restricted area of the project's web site (http:carpediem.ub.es/partners_only).

An extra meeting was held in Bologna 29-30 April 2003 to plan the atmospheric model and data assimilation inter-comparison study.

1.5.2. Co-ordination of the information between Partners

For the time being, all the information among the partners were exchanged via e-mail.

The CARPE DIEM web site, developed at **Partner 7**, is available since project's inception, also allowing a direct link with each partner Institution.

1.5.3. Communication activities

National End User Workshop, 5th of February 2003

National Flash Flooding Seminar, 23rd of May 2003

3rd GPM Workshop, 24th to 26th of June 2003

EGS 2003: "Using satellite and radar data in a NWP model to improve the short-term rain forecast" by Picanyol, M.; Miro, J.R.; Codina, B.; Aymami, J.; Vidal, J.

Publications:

Bech.,J. Codiba, B. Lorenete, J., Bebbington, D., 2003: The sensitivity of single polarization weather radar beam blockage correction to variability in the vertical refractivity gradient. Journal of Atmospheric and Oceanic Technology 20 (6) 845-855.

1st CARPE DIEM WORKSHOP

A mid-term workshop was organised to present CARPE DIEM work to a larger community and to the End User panel.

The workshop was focused on the identification of the end user needs and to understand the actual level of day-to-day use of radar information in their practices.

The workshop was organised together with the MUSIC project in a two-day period with up to four time-slots.

- End-User presentation
- Discussion
- Presentation of MUSIC and CARPE DIEM projects and results
- Conclusion

1.6. Difficulties encountered at management and co-ordination level and proposed/applied solutions

No dramatically difficulties have been encountered during the reporting period. We want here highlights only that one partner have caused a delay in the delivering of the report. A quite significant delay is occurred to provide the cost statement to the co-ordinator.

We want highlight here that some partners experience a problem in recruit trained personnel, the effect of this is partially reflected in the lower level of expenses at this point of the project. We suggest here to use part of the funds to get lower level personnel and make a training-on-the-job. This will have a positive effect in a bigger number of young people (e.g. just graduate people) trained in a research activities.