



# EGSIEM Minutes



Horizon2020

## EGSIEM Kick-Off Meeting

|                            |                      |                  |   |
|----------------------------|----------------------|------------------|---|
| <b>Date(s) of Meeting:</b> | 13./14. January 2015 | <b>Location:</b> | Kuppelraum, Main Building<br>University of Bern |
| <b>Minute Taker:</b>       | K. Cann-Guthauser    | <b>Doc ID:</b>   | EGSIEM KO Minutes                               |
| <b>Attachments:</b>        | Presentations        |                  |   |

## Participants

| EGSIEM Management & WP Managers    | Additional EGSIE Consortium Members | Advisory Board Members, Associated Members, Guests |
|------------------------------------|-------------------------------------|--|
| Adrian Jäggi / UBERN (AJ)          | Stéphane Bourgogne / G&C (StB)      | Richard Gross / JPL (RG)                           |
| Christian Leumann / UBERN (CL)     | Sean Bruinsma / CNES (SB)           | Jürgen Kusche / UBonn (JK)                         |
| Rolf Dach / UBERN (RD)             | Jean-Michel Lemoine (JML)           | Annette Eicker / UBonn (AE)                        |
| Keith Cann-Guthauser / UBERN (KCG) | Krzysztof Sońnica / UBER (KS)       | Peter Salamon / JRC (PS)                           |
| Ulrich Meyer / UBERN (UM)          | Andreja Susnik / UBERN (AS)         | Urs Marti / swisstopo (UM)                         |
| Matthias Weigelt / UL (MW)         | Peter Ruzek / UBERN (PR)            | Holger Steffen / LM (HS)                           |
| Frank Flechtner / GFZ (FF)         | Christian Gruber / GFZ (CG)         | Thomas Gruber / TUMunich (TG)                      |
| Andreas Güntner / GFZ (AG)         | Benno Gouweleeuw / GFZ (BG)         | Martin Horwath / TUDresden (MH)                    |
| Torsten Mayer-Gürr / TUG (TMG)     | Beate Klinger / TUG (BK)            | Pavel Ditmar / TUDelft (PD)                        |
| Jakob Flury / LUH (JF)             | Andreas Kvas / TUG (AK)             | Gerhard Heinzl / AEI (GH)                          |
| Sandro Martinis / DLR (SM)         | Hendrik Zwenzner / DLR (HZ)         | Maddalena Tognola / UBERN (MT)                     |
|                                    | Tamara Bandikova / LUH (TB)         | Martin Zabe-Kühn / UBERN (MZK)                     |

## Distribution

|  |                            |
|--|----------------------------|
| All Participants, EGSIE Consortium, Advisory Board | Ms. Ines Marin-Moreno / EC |
|--|----------------------------|

## List of Annexes

|  |
|--|
| <p>Presentations from EGSIE Consortium Members and Guests:</p> <ul style="list-style-type: none"> <li>• Annex01: Welcome (AJ)</li> <li>• Annex02: EGSIE Project Overview &amp; Advisory Board (AJ)</li> <li>• Annex03: Administrative Overview (KCG)</li> <li>• Annex04: Deliverables &amp; Milestones (AJ)</li> <li>• Annex05: Gravity Field Analysis (TMG)</li> <li>• Annex06: Integration of Complementary Data (MW)</li> <li>• Annex07: Scientific Service (UM)</li> <li>• Annex08: NRT and Regional Service (FF)</li> <li>• Annex09: Hydrological Service (AG)</li> <li>• Annex10: Dissemination and Exploitation (AJ)</li> <li>• Annex 11: Presentations from External Guests</li> <li>• Annex12: Meeting Review (AJ)</li> </ul> |
|--|

|          |   |  |
|----------|---|--|
|          | <b>EGSIEM Kick-Off Meeting 13./14. January 2015, MINUTES</b>  |  |
| <b>1</b> | <b>Welcome and purpose of Meeting [Jäggi/Leumann]</b>   |  |
|          | <p><i>See Annex01</i></p> <p>CL (UBERN Vice Rector of Research) welcomes the participants of the Kick Off Meeting. AJ (Project Coordinator) then highlights the main purpose of the meeting, which is to introduce everyone to the project and to ensure that everyone is aware of their responsibilities.</p>  |  |
| <b>2</b> | <b>Introduction of all Participants [All]</b>   |  |
|          | AJ invites all participants to introduce themselves to the General Assembly.  |  |
| <b>3</b> | <b>EGSIEM Project Overview &amp; Advisory Board [Jäggi]</b>   |  |
|          | <p><i>See Annex02</i></p> <p>AJ presents the aims of the project and introduces the proposed members of the Advisory Board.</p>   |  |
| <b>4</b> | <b>Administrative Overview [Cann-Guthauser]</b>   |  |
|          | <p><i>See Annex03</i></p> <p>KCG presents the main project bodies and key points of the Grant &amp; Consortium Agreements.</p> <p><i>Executive Board:</i></p> <p>The Executive Board, as proposed in the Description of the Action, is duly appointed. It consists of AJ, MW, FF, AG.</p> <p>JF queries which individuals were responsible for completing timesheets. MT replied that it was only those people who were employed solely on an EGSIEM contract who did <u>not</u> need to complete a timesheet, all others who were receiving a salary from the project and who had other responsibilities would need to complete a timesheet.</p> |  |
| <b>5</b> | <b>Upcoming Deliverables [Jäggi]</b>  |  |
|          | <p><i>See Annex04</i></p> <p>A list of the most pressing EGSIEM Deliverables is given by AJ. They are:</p> <ul style="list-style-type: none"> <li>• Management Guidelines, UBERN - Month 2 (M02)</li> <li>• Processing Standards and Models M02</li> <li>• Concept of NRT Service M03</li> <li>• EGSIEM Project Website, UBERN - M03</li> <li>• Reference Frame Product Report M10</li> </ul> <p>Such a reminder will be given at every General Assembly meeting.</p> <p>Two slides are shown to guide the discussion about the Processing Standards.</p>   |  |
| <b>6</b> | <b>WP2: Gravity Field Analysis [WP Leader: Mayer-Gürr]</b>  |  |
|          | <i>See Annex05</i>  |  |

|   |                             |
|---|-----------------------------|
| <p><i>Improved Processing Tools:</i></p> <p>GFZ: No further remarks.</p> <p>TUG: AJ and JK ask about the unbiasedness of the TUG solutions due to the use of (constrained) daily solutions as additional dealiasing products. This might influence the anticipated combination of solutions. Further discussions will be needed, the issue will be picked up by the TUG group.</p> <p>UBERN: The quality of the Celestial Mechanics Approach (CMA) solutions is correlated with the solar flux. TMG advised to adopt a stochastic approach to minimize the noise.</p> <p>CNES: GPS Processing at CNES – IGS Repro1 in use, now 2. Down-weighting of GPS observations is an issue, which led to degraded sectorial coefficients. JML proposed to strive for a combination with SLR data and to increase the weight of the GPS observations. In the latest RL03 solutions a band of high variability was found near the poles which has no physical meaning.</p> <p>LU: a better orbit integration is needed to further improve the solution quality. Stochastic pulses will possibly be incorporated.</p> <p><i>Instrumental behavior:</i></p> <p>Discussion about Level 1B data. LUH Data is only available for one test month. If more data is available, it can be used at the various ACs. TUG can also provide their improved attitude data. TG strongly advises avoiding a duplication of the Level-1B processing.</p> <p><i>Processing Standards:</i></p> <p>The tidal system (zero-tide, tide-free) must be clearly indicated in the solutions. Concerning the reference frame, harmonized standards (IGS standards adopted at CODE) will be automatically adopted as every AC will use the GNSS orbit and clock products from WP 3.</p> <p>TMG outlines that background models are used for different purposes (see presentation) and that it is not of interest to strive for a harmonization. Instead it is of advantage to use different background models so that model errors may average out in the combination. A clear inventory is, however, needed to exactly know which background models are adopted at the individual ACs.</p> <p>TMG proposes to add back the monthly mean of all gravitational accelerations which are reduced during the processing (dealiasing products, tides, ...) before combination. Further discussions are needed to clarify the needs for a practical realization, e.g. concerning data gaps.</p> <p>Proposal for gravity field solutions (see presentation for details):</p> <ul style="list-style-type: none"> <li>- Set to zero all degree one terms of background models (use center of mass system).</li> <li>- Normal equations should be unconstrained. A Table should be collated to show which parameters are estimated by which processing centers (part of AI#001).</li> <li>- Reduced dynamic orbits introduce prior information (biased towards prior gravity field) and must not be used in the observation vector.</li> </ul> <p>TG reports about the GGOS Bureau for Products and Standards (GGOS-BPS), which IAPG is operating together with TUM-DGFI. It ensures consistent standards across all IAG components. Identifies user needs and requirements for products, initiates steps and procedures for the development of new and integrated products and GGOS-BPS includes GGOS-WG „Contributions to Earth System Modelling“. See slides from TG for</p> | <p>AI#001</p> <p>AI#002</p> |
|---|-----------------------------|

|   |  |  |
|---|--|--|
|   | <p>further details (not shown at the meeting).</p> <p>UM has started collecting information on different processing centre approaches and gives an overview of the commonalities and differences at GFZ, CSR, and UBERN. The table shall serve as basis for the EGSIEM standards document and will therefore be validated and further extended by the individual ACs in the next two weeks (see AI#001). It is generally agreed that care has to be taken to not bias the solution. ACs should not be forced to all use exactly the same observational data, but lists of the actually processed days should be recorded and exchanged between ACs. Obvious discrepancies in the processing, e.g. the use of different GPS antenna offsets might be sorted out.</p> <p>JK remarks that we are confronted with data, model, and analysis errors. Whereas there is nothing that can be done about the first error source (all ACs are essentially using the same data), the other errors are expected to be reduced in the combination. JK recommends that in case it is not clear which background model is better, a large variety of models should be used. Where it is clear and established what the best practice is, this should be adopted by the ACs.</p> <p>RD reports on the standardization within the IGS. IGS has created a spreadsheet, which lists the individual groups approaches, they also have regular meetings to highlight changes in approaches, so when a new approach is announced, the results are exchanged and other groups may follow (if results improve), i.e., “friendly competition”.</p> <p>TG adds that the Standards for the final product should be made available. This is important for the combination with other products, e.g. from altimetry. GGOS has provided a table which may serve as a possible starting point.</p> <p>AJ presents one slide with a proposal on how to establish the Standards document (see presentation). The proposal is reflected in AI#001. It is generally agreed that an update of the document at a later stage might be needed.</p> <p>The End to End simulator presentation was postponed until the next General Assembly Meeting (see below for dates). The slides are included in the presentation in annex.</p> |  |
| 7 | <p><b>WP3: Integration of Complementary Data [Weigelt]</b></p>   |  |
|   | <p><i>See Annex06</i></p> <p>MW introduces the aims of the WP: pre-processing of all necessary supplementary data, utilising reference frame and SLR data, and validating these readings with GNSS site displacements and Ocean Bottom Pressure data. It also includes the extraction of Lake and river levels from Hydroweb data (Task 3.7), GIA for separating hydrological trends(Task 3.8), and the compilation of historical flood situations(Task 3.9).</p> <p><i>Reference Frame:</i></p> <p>RD explains the reprocessing approach followed by the CODE group using the Bernese GNSS software and highlighted the work on IGS-repro2 (computed at TU Munich during 2013/2014 based on the CODE processing strategy from Summer 2013). For GNSS-SLR space ties GLONASS will be relevant: Only two GPS satellites are equipped with SLR reflectors and are meanwhile out of service; but an increasing number of SLR stations are tracking the full GLONASS constellation. The ‘regular’ Rapid CODE products meet the requirements of the EGSIEM NRT service.</p> <p>KS presents SLR solutions which are consistently generated to GNSS solutions with the Bernese GNSS software. Regular monthly gravity field models are derived from up to 10</p>  |  |

|   |   |        |
|---|---|--------|
|   | <p>spherical satellites and show a very high level of consistency with the results from GRACE-based results with a lower spatial resolution.</p> <p><i>Validation:</i></p> <p>MW presents on validation with GNSS site displacements. The lack of available GNSS stations is, however, a problem in certain areas (e.g. central Africa). LU will assess the quality of the stations and report back on their suitability for validation purposes.</p> <p>FF reports on the viability of validation with Ocean Bottom Pressure (OBP) data. Various corrections need to be applied to OBP data in order to use them for the validation of GRACE results. GFZ has already compared RL04 and 05 with OBP data, but there are still some open issues (equatorial correlations are quite poor). The recommendation is to use OBP as an option for validation. Further automatization and optimizations are expected in 2015/16.</p> <p>SB gives an update about the status of Hydroweb. It is expected to become a Near Real Time service in mid 2015 and will include new satellite missions. The build-up is mainly driven by the SWOT Mission (2020). By the next meeting the already existing website will be updated.</p> <p><i>Complementary Data:</i></p> <p>HS reports about the ongoing work at Lantmäteriet to update the existing land uplift model. First EGSIM GIA Correction could include Ice (ICE6GC) and Earth models, plus observations.</p> <p>SM informs about the compilation of historical flood Situations. ZKI already has existing Flood Masks, which should be suitable for use in EGSIM. If not there is a catalogue of historical flood situations. Underlying EO data is freely available (MODIS etc), and (semi) automatic flood detection services are already freely available as well.</p> |        |
| 8 | <b>WP4: Scientific Service – [Meyer]</b>  |        |
|   | <p><i>See Annex07</i></p> <p>Discussions about data formats are postponed for the next General Assembly (slides are contained in the presentation in annex). An action item has been formulated.</p> <p><i>Combination of monthly gravity field models:</i></p> <p>UM reports that averaging different monthly solutions helps to reduce the noise provided that there are no biases. UM has derived order-dependent weights for the individual AC monthly solutions. Testing may be extended to gridded and filtered models. Comparison with river basins and oceans would be useful to compare the results. JK recommended not introducing weighting of data. TG suggested simulation instead of weighting. FF raised the point that there was too much validation at the moment.</p> <p><i>Level 3 Products:</i></p> <p>FF reports that large errors are seen in unfiltered GRACE data, filtering improves results by a factor of 100, but the optimal filtering is still a matter of investigation. Existing platforms already provide Level 3 data (GIA etc). Level 2 Products can currently be disseminated via GFZ's ICGEM, a Level 3 dissemination service needs developing, but ISDC may provide a basis.</p> <p><i>External Validation:</i></p>   | AI#003 |

|           |  |               |
|-----------|--|---------------|
|           | MW explains that GNSS loading faces several difficulties (GPS displacements, pre-processing etc). Validation could follow from Hydrological models and a possible hydro-meteorological comparison (SLA?)   |               |
| <b>9</b>  | <b>WP5: NRT and Regional Service – [Flechtner]</b>   |               |
|           | <p><i>See Annex08</i></p> <p>FF introduces the topic and outlines that the performance of the service will be tested using historical hydrological data, and then going live in the last 6 months at ZKI. JPL provides Quick look data with 1 day delay (Standard Level 1B data – 11 days delay) during the operational phase (M03-M27)</p> <p>MW informs that for the validation of NRT Solutions the data latency is a general issue. GNSS loading may possibly be used for validation. GNSS loading is sensitive to an area of 20° at maximum. The latency of most current hydrological models is too large, only the NCEP-R-2 model is available within 3-4 days. Unfortunately the currently provided information is unreliable.</p> <p><i>NRT processing @ GFZ:</i></p> <p>A dedicated functional and stochastic model based on RBF has been derived from GRACE data as reported by CG. Validation using GPS station network has been performed (see case study on the Lower Mekong Delta). Kalman filtering provides a robust modeling approach, reduces noise and has been validated internally, but regional modeling will probably increase spatial resolution slightly.</p> <p><i>NRT processing @ TUG:</i></p> <p>AK shows that the gravity field variations can be predicted from previous daily solution as it is not expected to change arbitrarily. The Kalman filter approach is currently only used in the post processing mode. However, the front-to-back filtering method is not applicable for NRT solutions. JML asked whether flooding events could be detected due to the use of a priori information about the day-to-day variations of the gravity field. TMG replied that was TUGs belief and that they were going back over historical data to validate the approach.</p> |               |
| <b>10</b> | <b>WP6: Hydrological Service – [Güntner]</b>   |               |
|           | <p><i>See Annex09</i></p> <p>Surface water storage volumes derived from Gravity-based time series of total water storage anomalies could be used in addition to the existing approaches. Regional flood model for Germany could provide a regional modeling approach (perhaps using the 2013 flooding for validation purposes). WGHM (Global Hydrological Model) provides a good fit with GRACE data, useful for large-scale comparisons. AG recommends the preparation of a flood data catalogue to summarize the suite of multi-method data sets for the selected extreme events. This WP will require the compilation of independent validation data; Flood masks and water levels (WP3), and Flood volumes from a combination of observations. The end goal is to link to existing systems such as EFAS/GloFAS/European Drought Observatory. An evaluation of GRACE daily and monthly solutions following the data assimilation approach developed by UBONN (Eicker) was proposed. Can GRACE-based total water storage anomaly data be used within the EDO. One of the main tasks over the next few months is to define requirements with people such as JRC for integrating the data into existing warning systems.</p>   | <b>AI#004</b> |

|           |  |  |
|-----------|--|--|
|           | <p>HZ explains that for the currently implemented Rapid Mapping Concept the latency for satellite data can be as little as one day owing to the large number of satellites in use. Images (for registered users) can be made available between 6-8 hours. However, this is only triggered by a user request for information. With GRACE 'early warning' data the process or image acquisition may be initiated before the flood peak.</p> <p>TG queries the detail of GRACE data, HZ replied that GRACE data would be mainly useful for the larger floods.</p>   |  |
| <b>11</b> | <b>WP7: Dissemination and Exploitation [Jäggi]</b>   |  |
|           | <p><i>See Annex10</i></p> <p><i>Website &amp; Social Media:</i></p> <p>The draft version of the EGSIEM website is presented by PR. It is based on the Joomla CMS. Further input is still required from the consortium. Since the GRACE Plotter is not yet adapted for mobile devices (response behavior), perhaps a link from the website to the GRACE plotter would be more suitable. User groups and permissions need to be defined, as well as user registration and final targeting of the Forum.</p> <p>JF suggests that Events held at individual institutions could be advertised more prominently. Proposal to show News and Publications as the front page.</p> <p>MW speaks briefly about <i>Picture Content</i>, our own pictures would be preferable to copyrighted material as in some instances the requirements for the use of pictures was heavy, including the responsibility to mail in hard copy proof of usage.</p> <p>JF suggests that for website content a one person per institution responsibility would be needed to ensure that latest news may be found on the website. He also proposed that a Blog would be preferable to a forum.</p> <p>JK strongly advises that when looking at the dissemination activities it is useful to invite a journalist for advice on liaising with the media – JF has a couple of possibilities in mind.</p> <p>MW reminds the consortium that everyone needs to contribute details for the website.</p> <p><i>GRACE Plotter:</i></p> <p>StB introduces the GRACE Plotter. The plotter will host data and results. Partner and EU Logos will now be added. The goal is to create a scientifically accurate but accessible website open to all. Developments to improve accessibility are planned, including information bubbles to assist new users. Data will be included from member groups (Gravity Data). This includes unfiltered results from each individual AC, as well as combined solutions. Data updates will occur when solutions are available. JML found it useful to have a public and private area. FF added that level-3 gridded products were not foreseen as being part of the data provided to the GRACE plotter. This needs to be investigated.</p> <p><i>High School Competitions:</i></p> <p>Designed for High School /University Students and to introduce Geodesy and the EGSIEM project. Prizes could be offered for the competitions (site/institution visits), proposed start of the competition would be from November 2015 (with the possibility of running it more than once).</p> <p>It shall be similar to the NATO competition as outlined by TB, i.e., based on a relatively straightforward set of initial questions (possibly the source of the EGSIEM questions should be the project website) followed by a short project. The geographical scope of</p> |  |

|           |  |               |
|-----------|--|---------------|
|           | <p>the project needs to be looked at. The budget needs to be confirmed. RD suggests that multiple language support of the source information website needs to be taken into account (EGSIEM is currently only planned to be in English). AJ added that teaser lectures could be used to advertise the event.</p> <p><i>Press/Outreach Strategy:</i></p> <p>LUH will circulate a link on TED Talks with additional information on usefulness to EGSIM and key points of the talks. An inventory of such activities should be maintained to be available to the consortium. TG asks about the audience for these activities? AJ envisaged a series of teaser lectures, based on a common framework to be used by all partners.</p> <p><i>Press overview at UL:</i></p> <p>MW explains that the entire process needs good planning. Several iterations of a press release will be required and you will (hopefully) be inundated with questions after the release. UL Press release generated 2 x radio interviews and one TV interview, the level of the questioning was at a personal level – how does this affect an individual.</p> <p>TG recommends a good coordination of press releases. All press material will be sent to the consortium members for further use.</p>                                |               |
| <b>12</b> | <b>Liaison with other projects</b>   |               |
|           | <p><i>See Annex11</i></p> <p>AJ introduces the invited visitors to present a short overview of their projects/institutes. Following the presentation of the ESA's Climate Change Initiative (CCI) at TU Dresden by MH. AJ proposes an SLA, which is approved.</p> <p>HS presents the work undertaken at LM who are already an Associated Member of EGSIM.</p> <p>GloFAS is presented by PS of the EU's Joint Research Centre, he suggests using the various platforms (EFAS/EDO etc) to serve as a dissemination platform of EGSIM. Has access to international aid organizations and large and varied user group. Predict water storage, rather than levels. JF – proposes a PhD topic on utilising GRACE/EGSIM alongside GloFAS. PS advises availability of testing area and AJ proposes organizing a liaison alongside the testing of EGSIM data at the ZKI (eg)</p> <p>JK presents potential collaborations with IGG and other German initiatives. Collaborations on hydrological assimilation models will be attractive. Test regions would need to be defined rather soon to have a good planning.</p> <p>PD gave a presentation current work being undertaken at Delft.</p> <p>JF announces that LUH will update the group on GOQ</p> <p>GH gives a short summary about the LRI investigations.</p> | <b>AI#005</b> |
| <b>13</b> | <b>Meeting Review [Jäggi]</b>  |               |
|           | <p><i>See Annex12</i></p> <p>AJ reiterates the upcoming deliverables and the action items needed to establish the Standards document.</p> <p>AJ summarizes the points of major discussions (see presentation) and briefly recapitulates the original WP descriptions.</p>  |               |



|  |   |               |
|--|---|---------------|
|  | <p>AJ asks for input from the WP managers to set up a publication plan (see action item). He reminds everyone that papers on EGSiEM topics should be announced to all consortium members, wherever possible, within 45 days of publication: Consortium Agreement, Section 8.3.11. FF announces that GFZ is already planning a paper in March.</p> <p><i>Next meeting:</i></p> <p>Location to be decided (probably Bern), but the next meeting of the EGSiEM General Assembly will take place on June 11 &amp; 12<sup>th</sup></p> | <b>AI#006</b> |
|--|---|---------------|

| <b>Action Item Status List (open and new AI's)</b> |                   |                 |  |                 |
|--|-------------------|-----------------|--|-----------------|
| <b>A.I.</b>  | <b>Originator</b> | <b>Actionee</b> | <b>Action Description</b>  | <b>Due Date</b> |
| 001  | EGSIEM            | EGSIEM<br>ACs   | GFZ, UBERN:<br>Review of the comparison table  | 31.01.2015      |
|  |                   |                 | TUG, CNES, UL:<br>Complement the comparison table  | 31.01.2105      |
|  |                   |                 | UBERN:<br>Summarize potential harmonization of Standards   | 08.02.2015      |
|  |                   |                 | UBERN, UL, GFZ, TUG, CNES:<br>Input to other processing details (parametrization, ...)   | 08.02.2015      |
|  |                   |                 | UBERN:<br>Create a draft EGSiEM Standards document, highlight commonalities/differences between EGSiEM ACs   | 15.02.2015      |
|  |                   |                 | UBERN, UL, GFZ, TUG, CNES:<br>Review and finalize the EGSiEM Standards Document  | 28.02.2015      |
| 002  | EGSIEM            | TUG             | Initiate discussion about the proposal to add back the monthly mean of all gravitational accelerations reduced during the processing before combination. Clarify needs for a practical realization, e.g. concerning data gaps. | 31.05.2015      |
| 003  | EGSIEM            | EGSIEM<br>ACs   | Each AC to provide information necessary to incorporate the SINEX format for the exchange of gravity field information   | 31.05.2015      |
| 004  | EGSIEM            | GFZ             | Definition of cooperation with UBONN for integration of new GRACE products into WGHM data assimilation scheme.   | 31.05.2015      |
| 005  | EGSIEM            | UBERN,<br>TUD   | Service Level Agreement with ESA's Climate Change Initiative   | 31.05.2015      |
| 006  | EGSIEM            | WP<br>Managers  | Collect ideas for paper topics to set up a publication plan.   | 31.05.2015      |