

Status report: DGFI Part of PN5

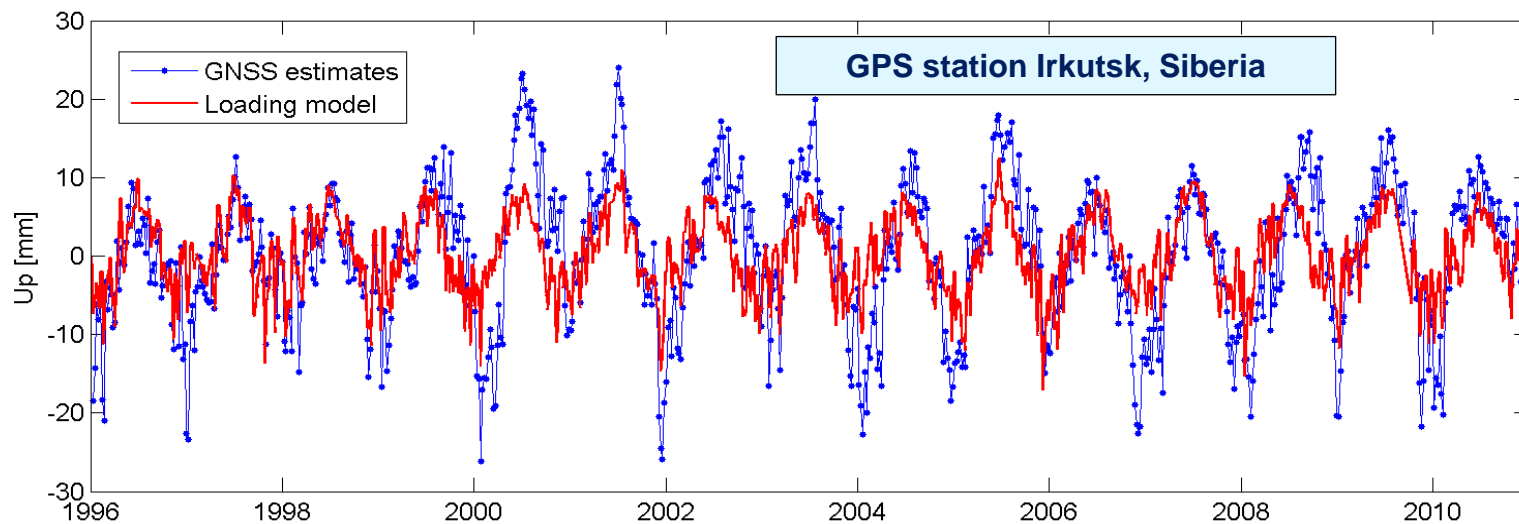
“Consistent celestial and terrestrial reference frames
by improved modelling and combination”

Detlef Angermann and Ralf Schmid

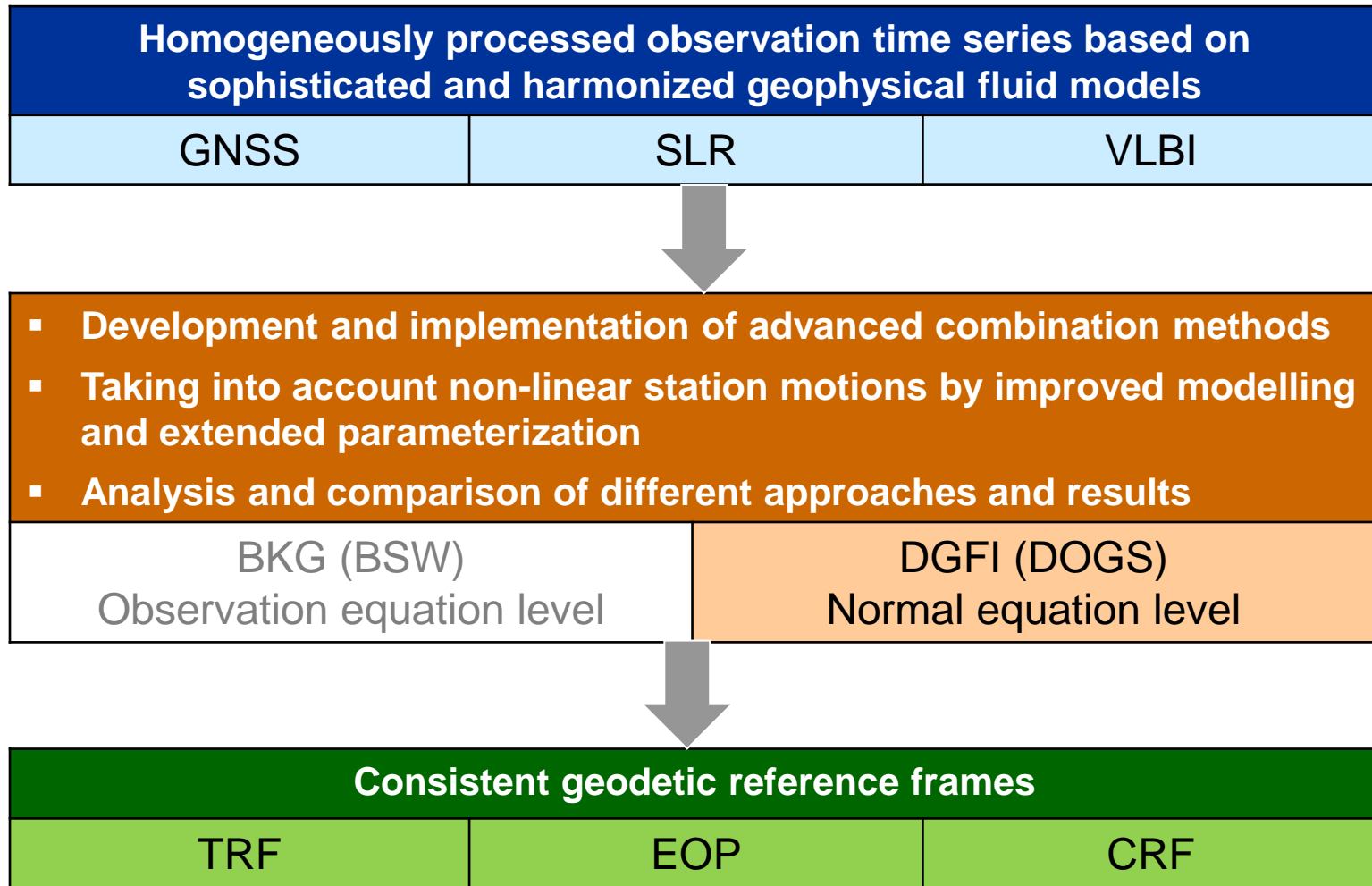
Deutsches Geodätisches Forschungsinstitut, München

Motivation

- Challenges to improve geodetic reference frames ...
 - Sophisticated geophysical background models (BKG)
 - Homogeneously processed observation time series
 - Improved combination strategies
 - > Parameterisation of non-linear station motions
 - > Computation of epoch reference frames (e.g., weekly)
 - > Simultaneous adjustment of CRF, TRF and EOPs
- The final goal is to generate consistent celestial and terrestrial reference frames based on improved modelling and combination.



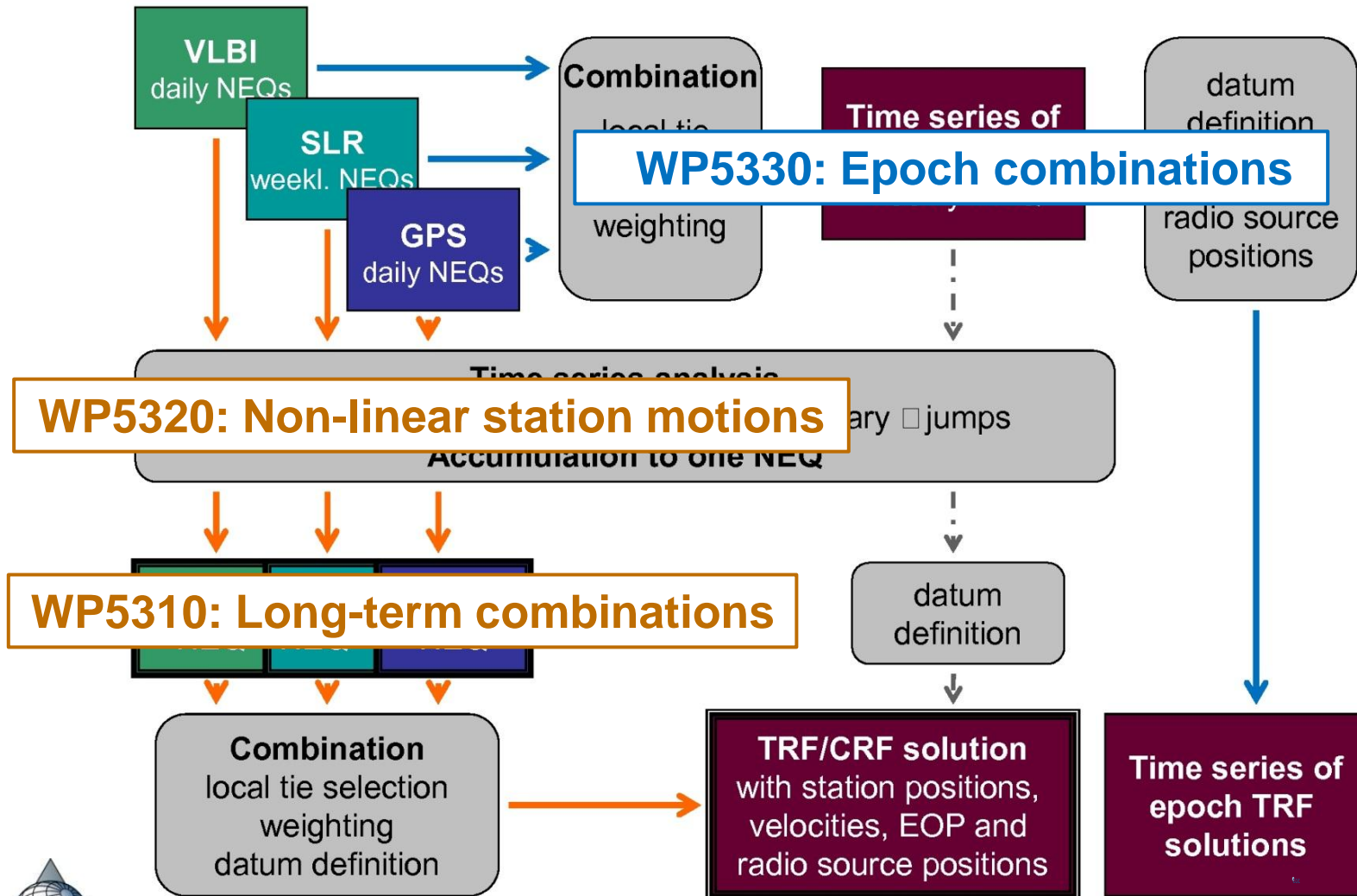
Objectives and general tasks



Work packages and schedule (DGFI part)

Work Packages	1 st Project Year				2 nd Project Year				3 rd Project Year			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
WP5300	<i>Development of refined combination strategies (NEQ level)</i>											
WP5310	■	■	■	□	□	■	■	□	Long-term comb.			
WP5320	□	■	■	■	□	□	□	□	Non-linear motions			
WP5330	□	□	■	■	■	■	□	□	Epoch combination			
WP5400	<i>Homogeneously processed observation time series</i>											
WP5410	□	■	□	□	□	□	■	□	□	□	Definition	
WP5420	□	□	■	■	■	■	□	□	■	■	VLBI	
WP5430	□	□	■	■	■	■	□	□	■	■	SLR	
WP5600	<i>Computation of long-term (LRF) and epoch reference frames (ERF)</i>											
WP5610	□	□	■	■	■	□	□	■	■	■	LRF	
WP5620	□	□	□	□	□	□	■	■	■	■	ERF	
WP5700	<i>Analysis and interpretation of results</i>											
WP5700	□	□	□	□	□	□	□	□	■	■	■	■

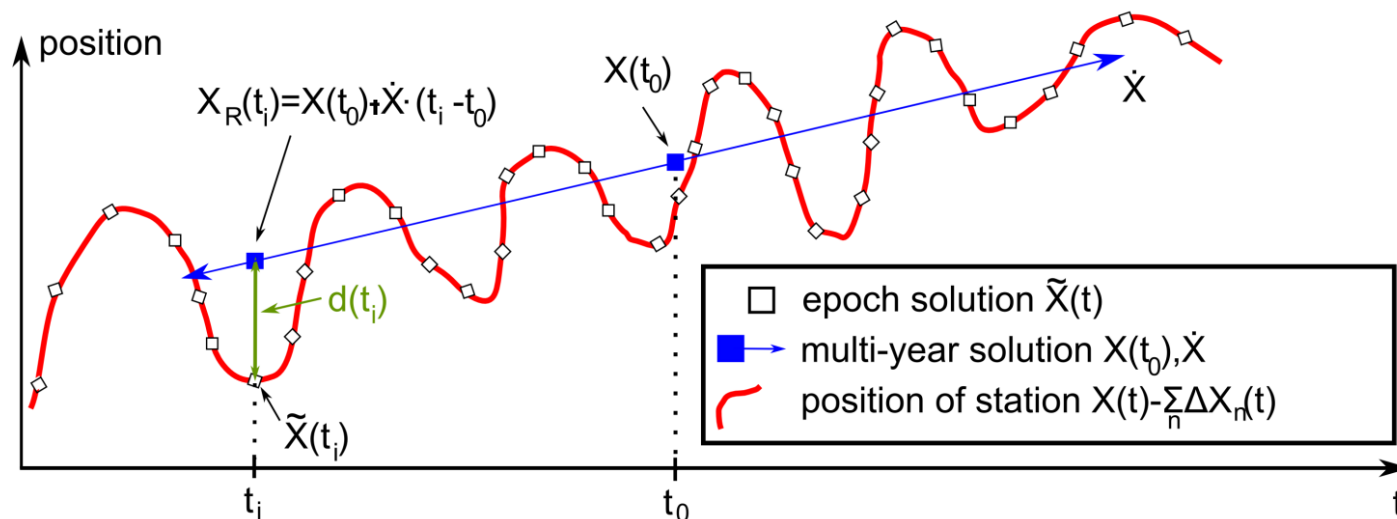
WP5300: Refined combination strategies



WP5320: Non-linear station motions

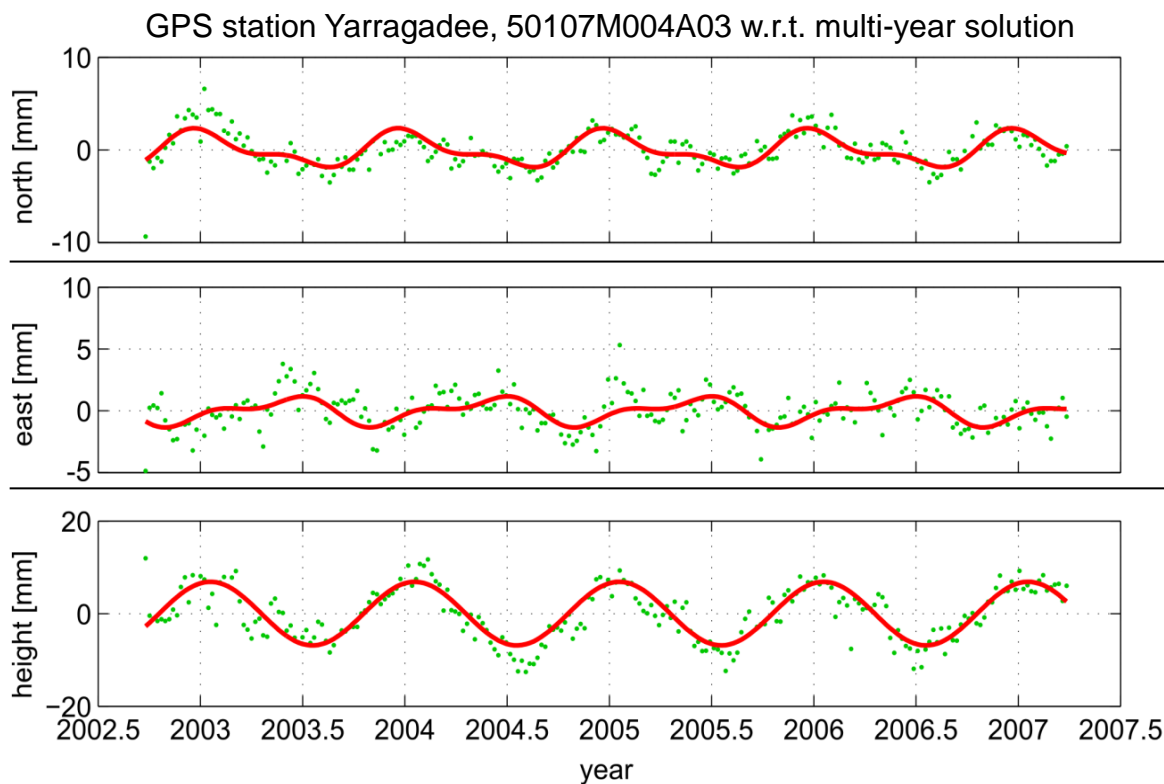
- Different approaches in long-term reference frames ...
 - Extended parameterisation of station motions
$$\vec{X}_R(t) = \vec{X}(t_0) + \dot{\vec{X}} \cdot (t - t_0) + \text{annual/semi-annual terms}$$

=> update of DGFI combination software DOGS-CS
 - Enhanced geophysical background models (BKG)
- Comparisons with „classical approach“ and epoch reference frames



Non-linear station motions (Example 1)

Approximation with annual (a) and semiannual ($a/2$) signals



Amplitudes

	a	$a/2$
north [mm]	1.7 mm	0.8 mm

east [mm]	0.9 mm	0.5 mm
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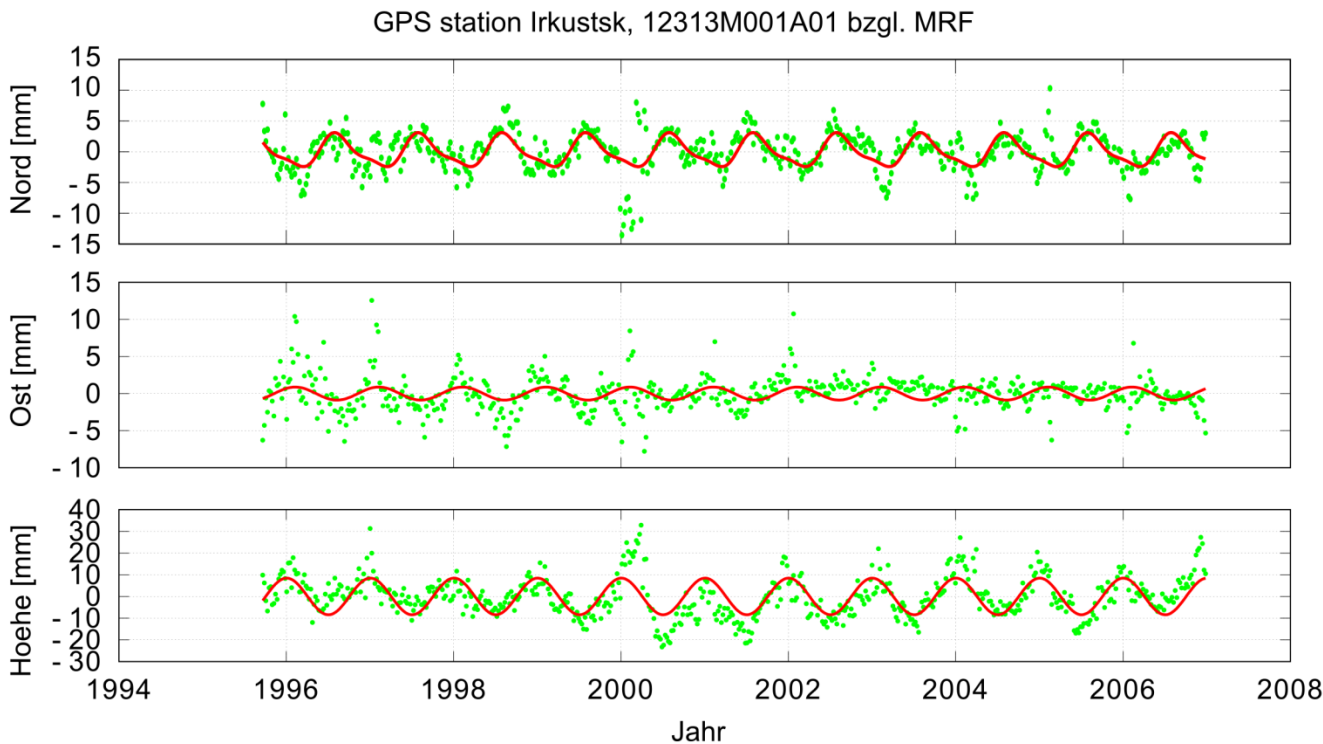
height [mm]	6.9 mm	---
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RMS	North [mm]	East [mm]	Height [mm]	3D [mm]
original	1.9	1.4	5.6	6.1
$a, a/2$ reduced	1.3	1.2	3.0	3.5

Non-linear station motions (Example 2)

Approximation with annual (a) and semiannual ($a/2$) signals



Amplitudes

a	$a/2$
2.5 mm	0.6 mm

0.5 mm	---
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8.5 mm	---
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RMS	North [mm]	East [mm]	Height [mm]	3D [mm]
original	3.2	2.3	9.1	9.9
$a, a/2$ reduced	2.5	2.2	6.8	7.7

WP5400: Homogeneously processed obs. time series

- WP5410: Definition
 - Consistent analysis models (presentation by R. Schmid)
 - Basis for data processing within the research unit
- WP5420: VLBI
 - Software: Conversion OCCAM -> DOGS-RI
 - Update of models according to WP5410
 - Homogeneous processing of VLBI obs. time series
- WP5430: SLR
 - Update of models in DOGS-OC
(identical routines in DOGS-OC and DOGS-RI)
 - Homogeneous processing of SLR data to different satellites
(interaction with PN6, presentation by M. Bloßfeld)
- WP5440: GNSS (not within DGFI part of PN5)
 - Processing with Bernese (BKG_PN5, TUM_PN6)

WP5600: Computation of reference frames

- WP5610: Long-term reference frames (e.g., 10 years)
 - First results with modified GGOS-D are available
 - Non-linear station motions are not considered
 - Processing with new data and refined approach need to be done
- WP5620: Epoch reference frames (e.g., weekly)
 - First results with modified GGOS-D are available
 - PN5 computations need to be done
- Comparison of long-term and epoch reference frames
 - First results are available (based on identical data)
 - > Time series of station positions
 - > Investigations of non-linear station motions (for WP5320)

Team members (DGFI)

- Project scientist: **R. Schmid** (01.07.2012)
 - Definition of consistent analysis models
 - Contributions to VLBI data processing
 - Handling of non-linear station motions
 - Refined computation of long-term reference frames
- Team (DGFI staff of basic configuration)
 - Project leader, DGFI part (**D. Angermann**)
 - DOGS development, updates (**M. Gerstl**)
 - SLR (**H. Müller, M. Bloßfeld**)
 - VLBI/CRF (**M. Seitz**, J. Mora-Diaz)
 - Reference frame computations (**M. Seitz, M. Bloßfeld**)

Collaborations

- Besides the project scientists, PN5 will be supported by the staff of the basic configuration of BKG and DGFI.
- Collaboration with other projects of this research unit:
 - **PN3**: Moon related reference systems, LLR observations
 - **PN4**: Ties between kinematic and dynamic frames (D-VLBI)
 - **PN6**: Datum definition, satellite orbit modelling
 - **PN7**: Integration (co-locations) of space techniques
- Collaborations on the international level, e.g.,:
 - IAG Services (IGS, ILRS, IVS), GGOS
 - IERS Product Centres (ITRS, ICRS, EOP)

Summary

- DGFI part of PN5 started on **01.07.2012**.
- A proposal for „consistent analysis models“ has been prepared by R. Schmid (as basis for the data processing within the research unit).
- DGFI work has been performed according to the work packages specified in the proposal for PN5.
- The progress of the work is consistent with the schedule.
- PN5 is supported by the staff of the basic configuration of DGFI.