

Neue Methoden zur Bilddatenaufbereitung und -auswertung:

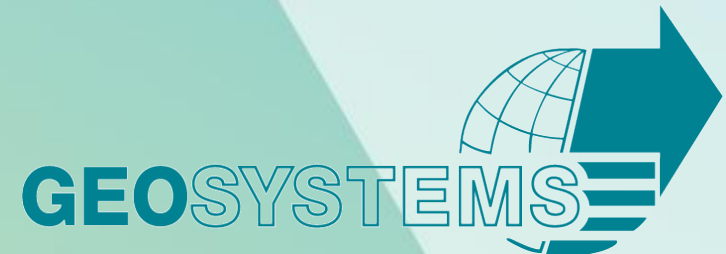
farbtreuer Resolution Merge und flächenscharfer Veränderungsnachweis

Tatjana Koukal, Jörg Heblinski
GEOSYSTEMS GmbH



HEXAGON
GEOSPATIAL

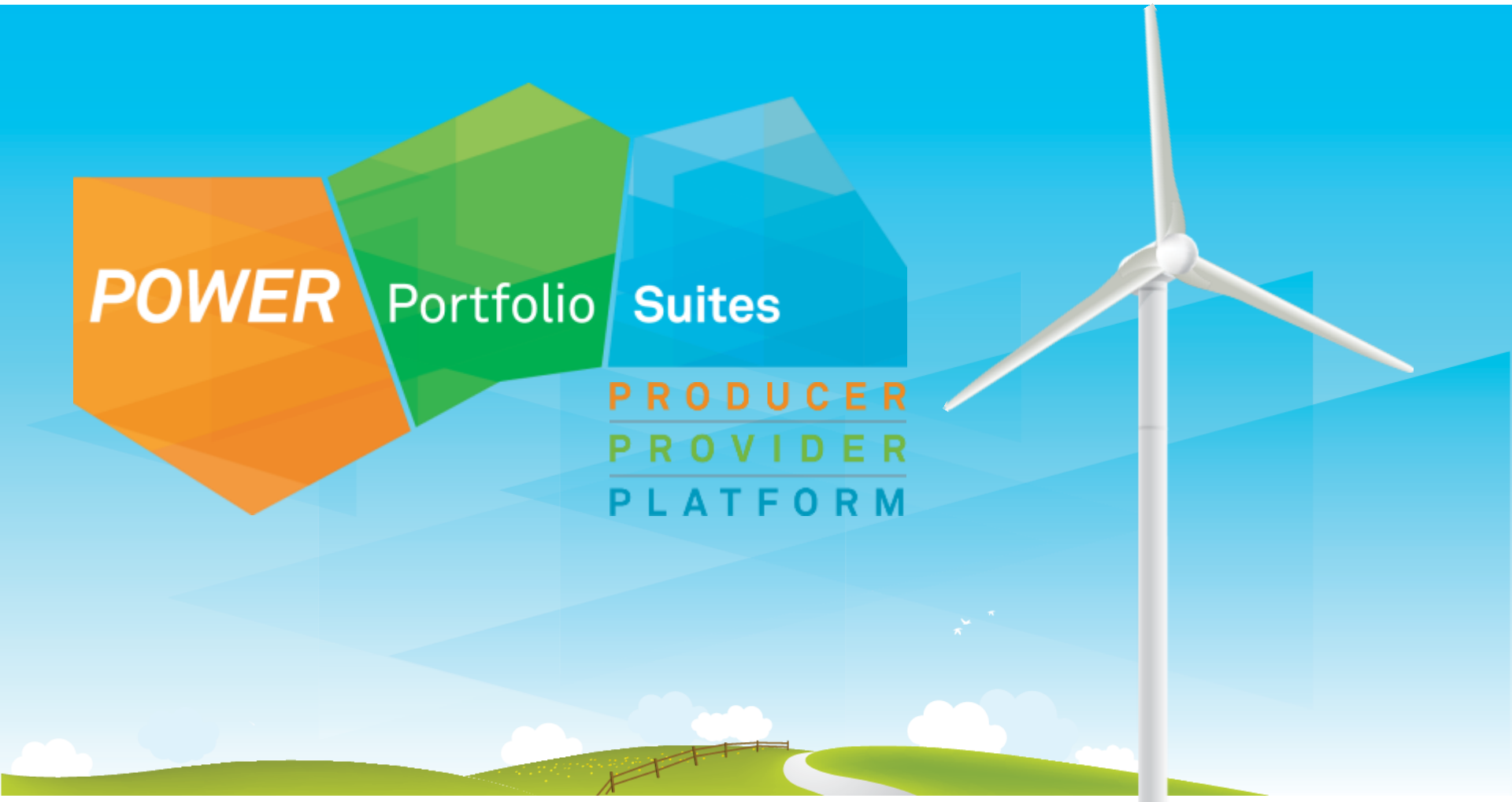
CHANNEL PARTNER



- Vertriebspartner von Hexagon Geospatial
 - Professional Services
 - Lösungsentwicklung
 - Technischer Support
 - Schulungen
-
- ...seit über 25 Jahren
 - Firmensitz in Germering bei München
 - www.geosystems.de



The Geospatial Power Portfolio



GEOSYSTEMS Produktportfolio

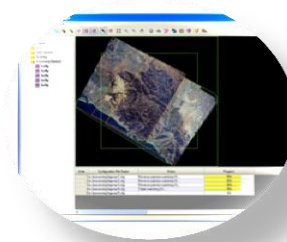
GeoMedia



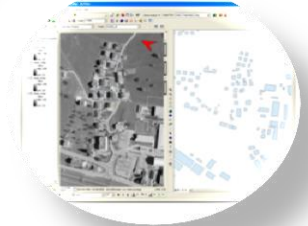
**ERDAS
IMAGE**



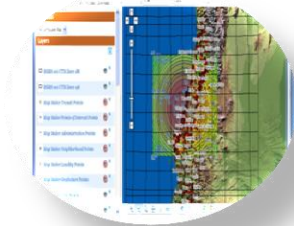
**IMAGINE
Photogrammetry**



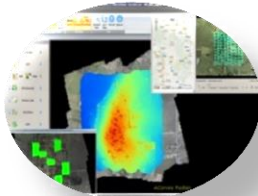
Stereo Analyst



**ERDAS
APOLLO**



**Photogrammetrische Prozessierung
von UAS-Daten**



**3D-Gebäude-
modellierung**

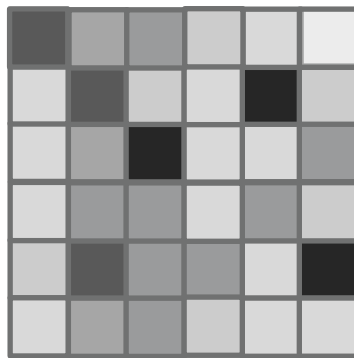


The background of the slide is composed of several overlapping geometric shapes, primarily triangles and quadrilaterals, in various shades of teal, green, and light blue. The shapes are arranged in a way that creates a sense of depth and movement, with some shapes appearing to be in the foreground and others receding into the background. The overall color palette is cool and professional.

Resolution Merge mit ERDAS IMAGINE – What's new?

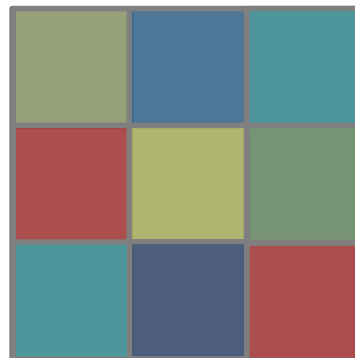
Resolution Merge

- **Synonyme:** Pan-Sharpening, Image Fusion, Sensor Merge, Sensor Fusion, ...
- **Prinzip:**



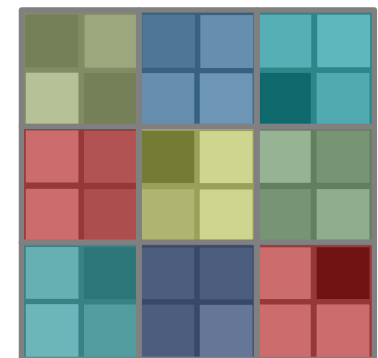
High-resolution
Pan-Bild

+



Low-resolution
Multispektral-Bild

=



High-resolution
Multispektral-Bild

Voraussetzungen:

- gleiche Aufnahmegeometrie und Beleuchtungsverhältnisse (ideal: simultane Aufnahme)
- saubere Co-registrierung der zu kombinierenden Kanäle
- spektrale Überlappung zwischen Pan- und Multispektralkanälen

Resolution Merge

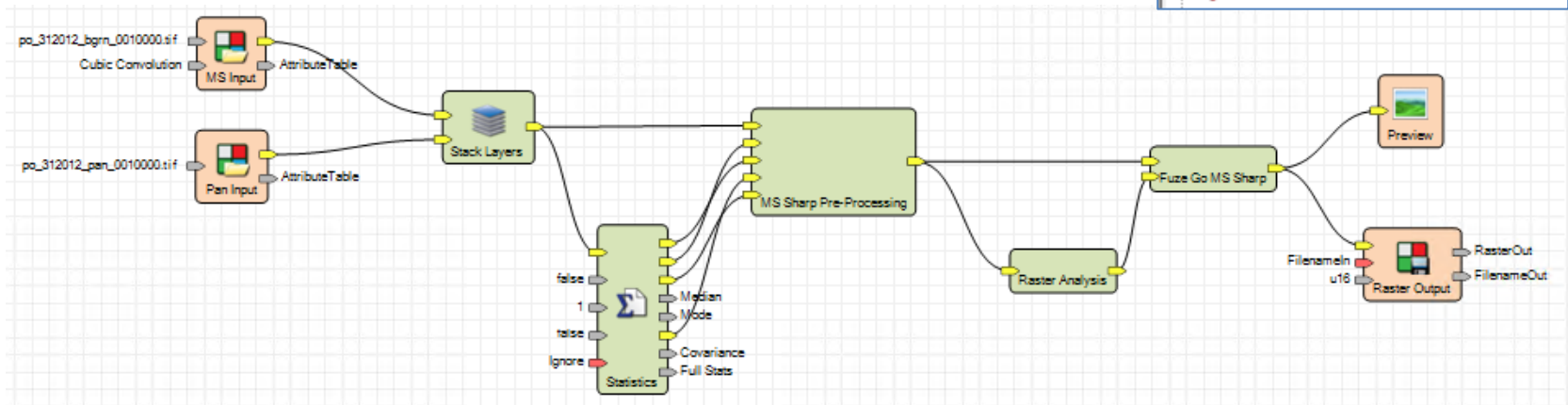
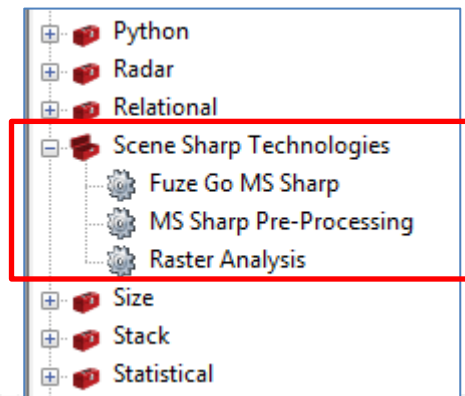
- Ziel:
 - visuell ansprechende Bilder
 - verbesserte Ergebnisse bei Klassifikation, Change detection, etc.
- Methoden (Auswahl)
 - IHS
 - PCA
 - High Pass Filter Merge (HPF)
 - Gram-Schmidt
 - Wavelet
 - Projective Resolution Merge
 - u.a.
- Anforderungen:
 - „Farbtreue“ (Bildstatistik soll nicht verändert werden) - wichtig bei Weiterverwendung für Bildanalyse, wie z.B. Change Detection
 - keine Artefakte (z.B. am Rand heller Objekte)
 - Robustheit (d.h. Erfolg unabhängig von Bildinhalt und Sensor)

Resolution Merge mit Fuze Go™

- UNB PanSharp Algorithmus
(Zhang 2004), z.B. von DigitalGlobe eingesetzt
- implementiert von *Scene Sharp Technologies Inc.* (USA)
unter dem Namen *Fuze Go*
- basierend auf Korrelationen zwischen Pan-Kanal und den
Multispektral-Kanälen (least-square best fit)
- voll-automatische Prozessierung,
keine Parametereingabe erforderlich
- geeignet für eine große Anzahl an Spektralkanälen
- gute Ergebnisse spektral (Farbe) und räumlich
- Erfolg unabhängig von Sensor, Spektralkanälen und Bildinhalt

Resolution Merge mit Fuze Go™

- Stand-alone Tool (für optische und Radar-Daten)
- Erweiterung für ERDAS IMAGINE:
 - Fuze Go™ MS Sharp Model
 - zusätzliche Operatoren im Spatial Modeler
 - nicht im GUI



(derzeit nur für optische Daten verfügbar)

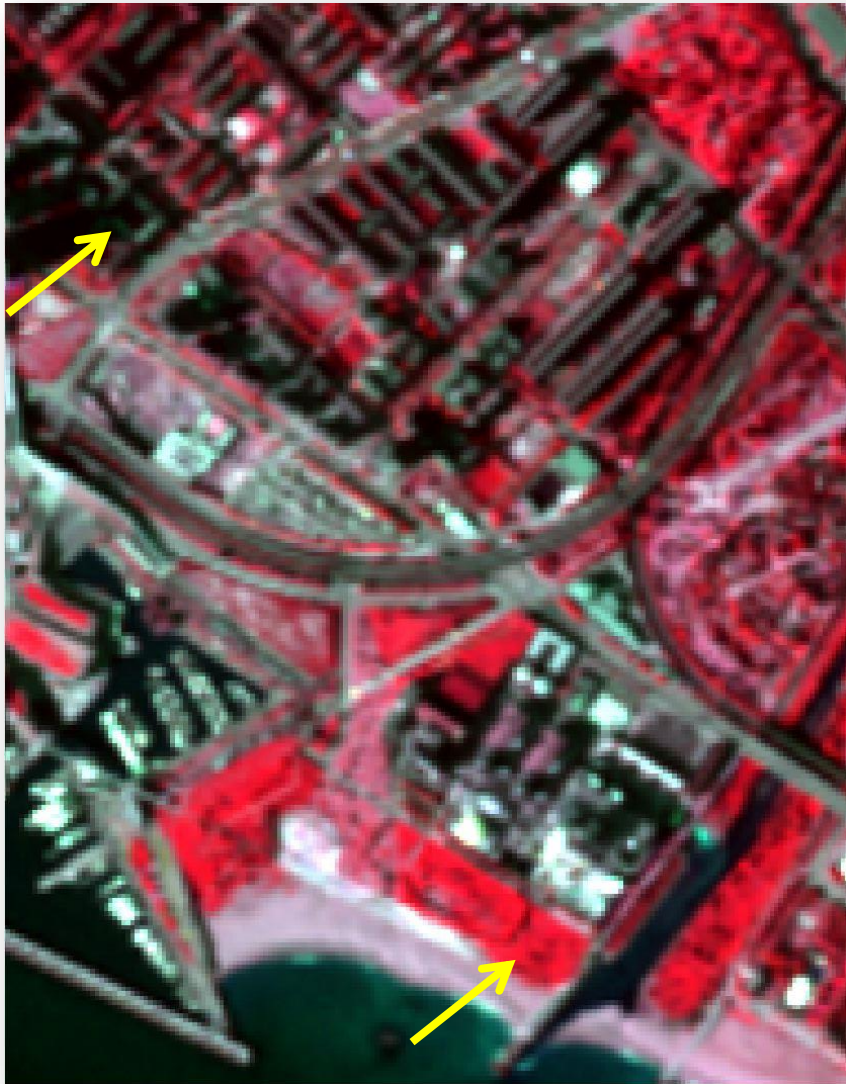
Vergleich Pleiades | RGB

Original MS

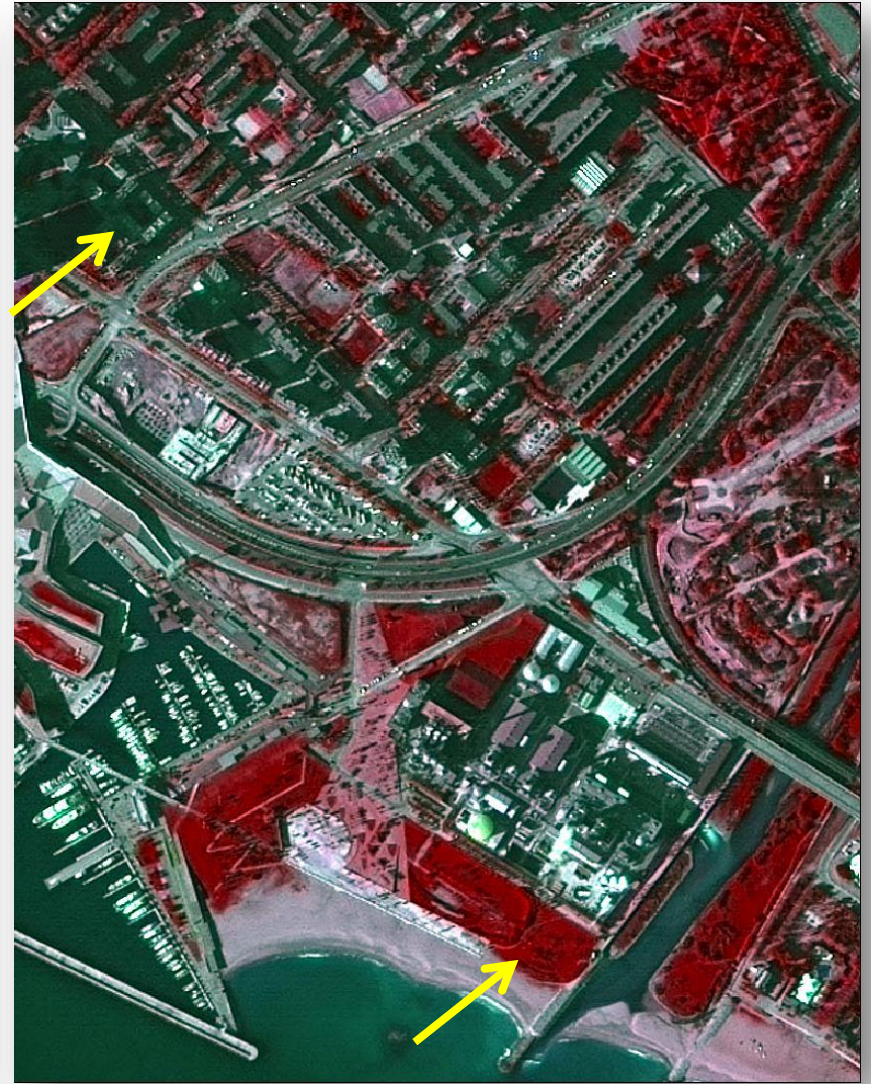
Fuze Go



Vergleich SPOT-6 | CIR



Original

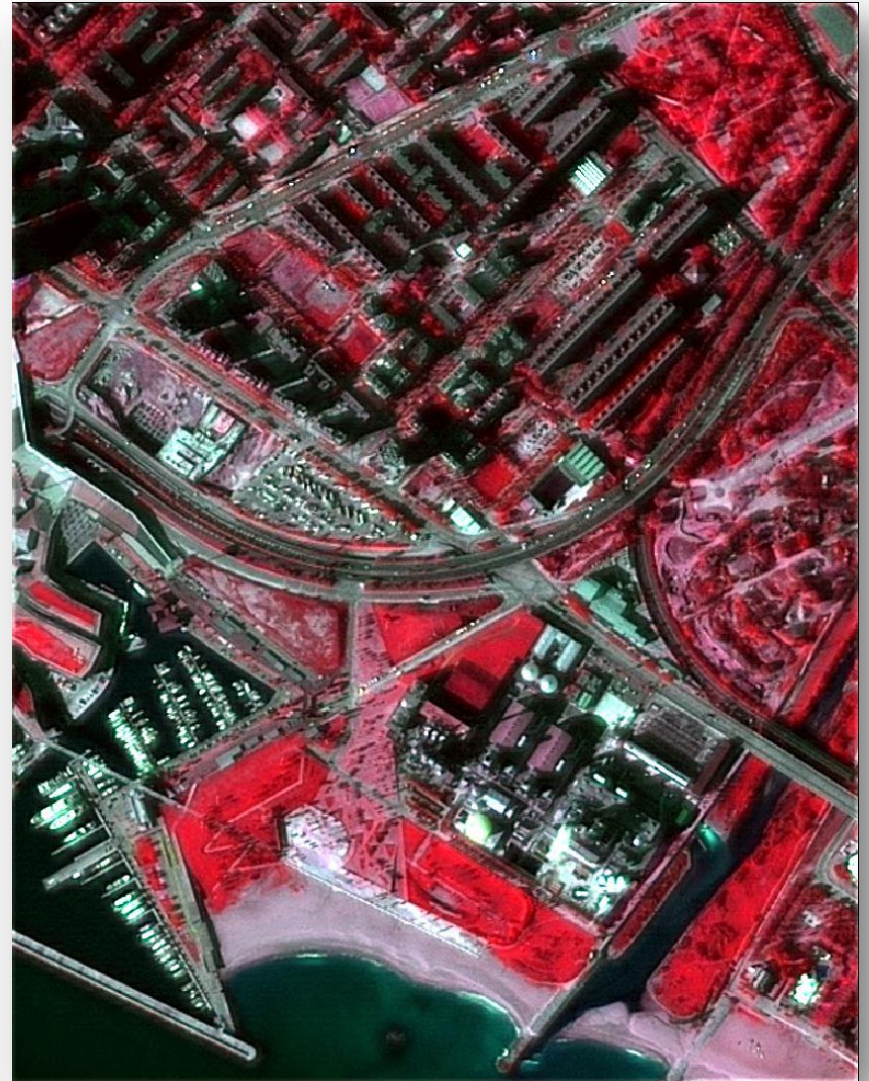


Subtractive Resolution Merge

Vergleich SPOT-6 | CIR



Original

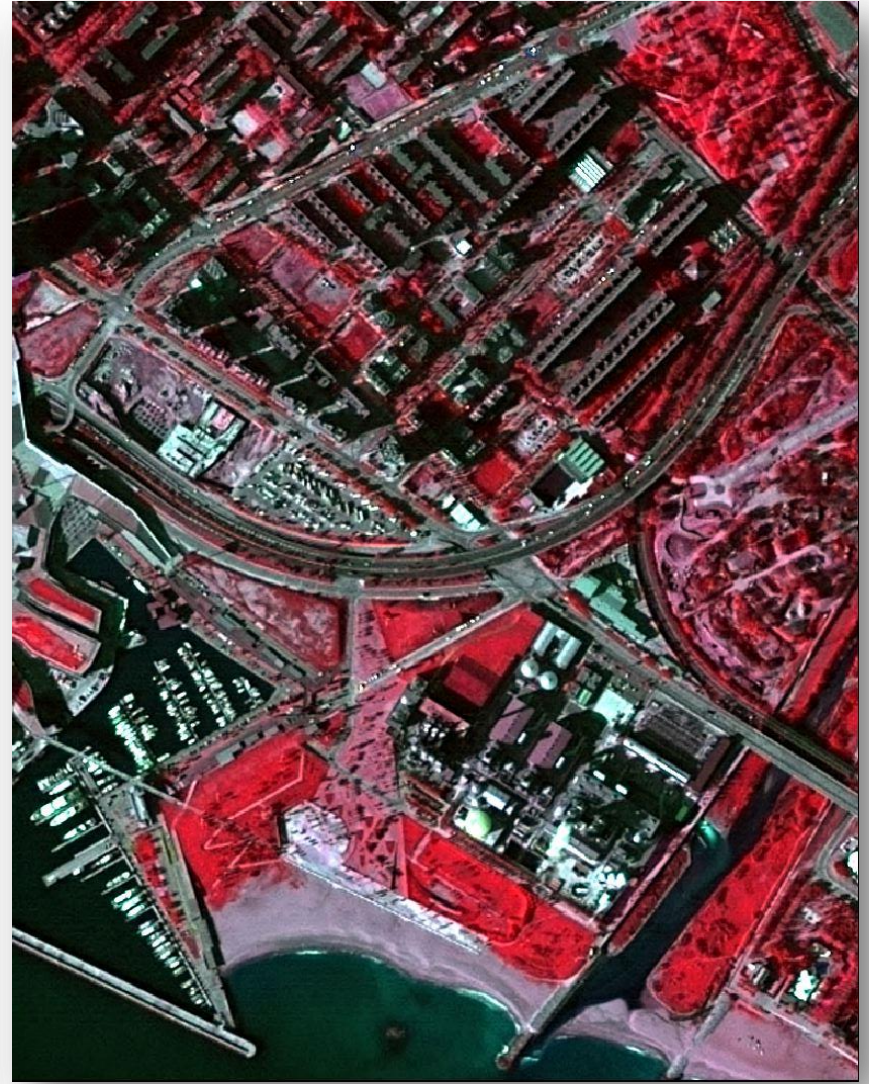


High Pass Filter Merge

Vergleich SPOT-6 | CIR



Original

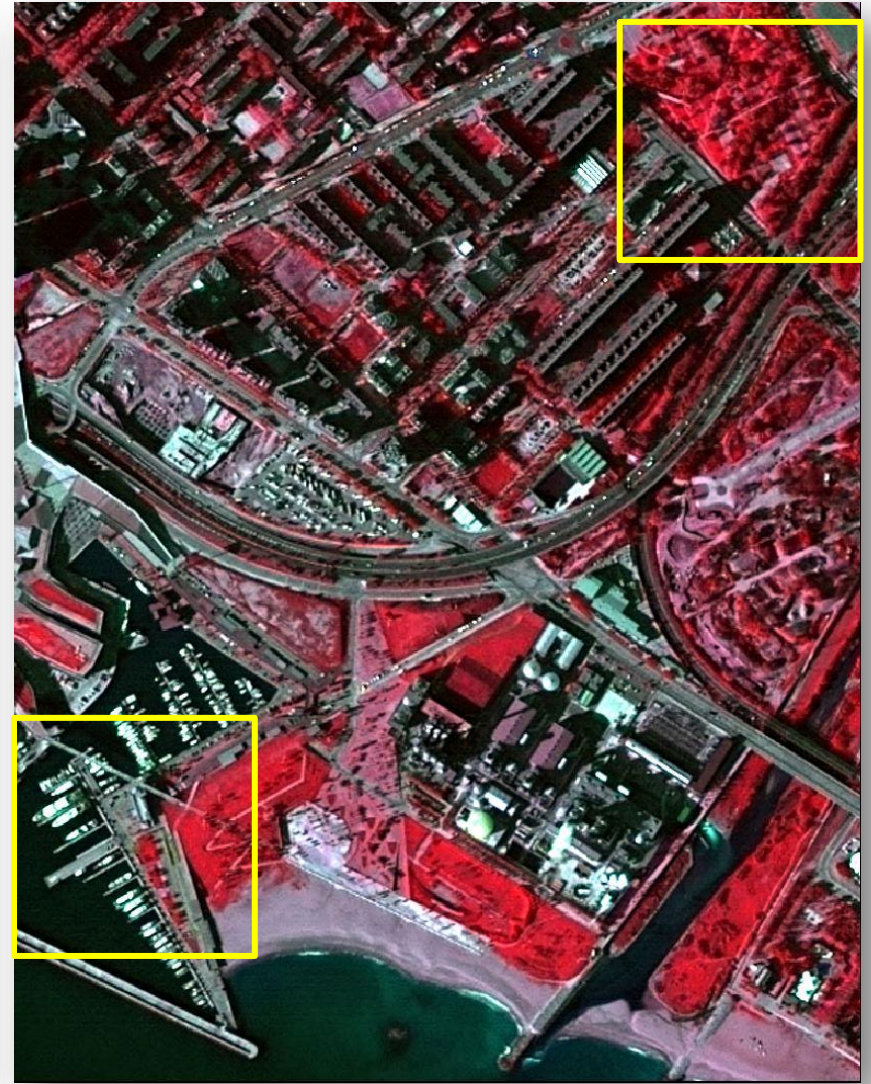


FuzeGo

Vergleich SPOT-6 | CIR

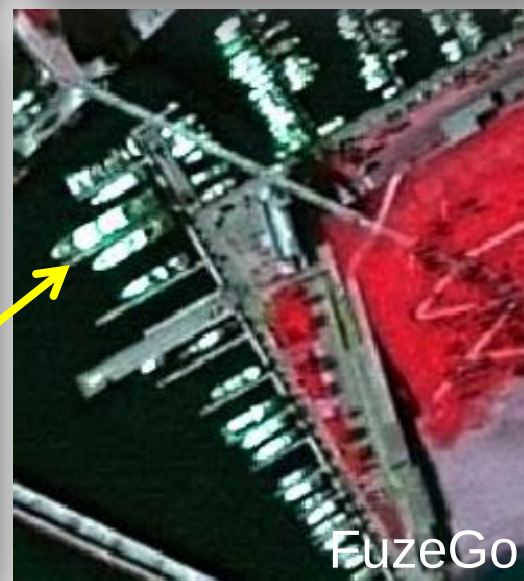


Original

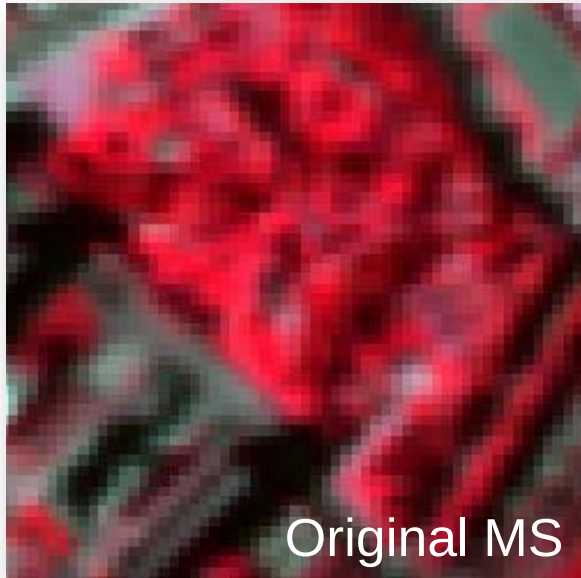


FuzeGo

Vergleich SPOT-6 | CIR



Vergleich SPOT-6 | CIR



Vorteile von Fuze Go in ERDAS IMAGINE

- Farbtreue
- Detailreichtum von Pan-Kanal sehr gut im Multispektralbild wiedergegeben
- Keine Artefakte (Halo-Effekt-etc.)
- Einfache Handhabung
- nahezu keine Einschränkung bezüglich Anzahl der Spektralkanäle
- Einbindung des Pansharpening-Prozesses in Prozessierungsketten über den Spatial Modeler
- geplant: SWIR-Kanäle, Radar



Flächenscharfer Veränderungsnachweis mit ERDAS IMAGINE und GeoMedia



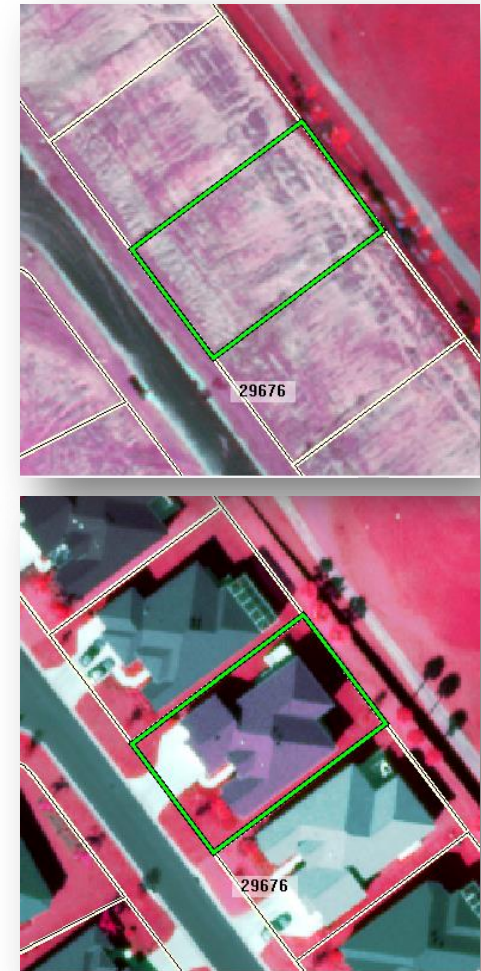
Ziel – Daten – Workflow

■ Ziel:

- Auf welchen Flurstücken haben Veränderungen (Bauvorhaben) stattgefunden?
- Welche Baumaßnahmen davon sind illegal?

■ Daten:

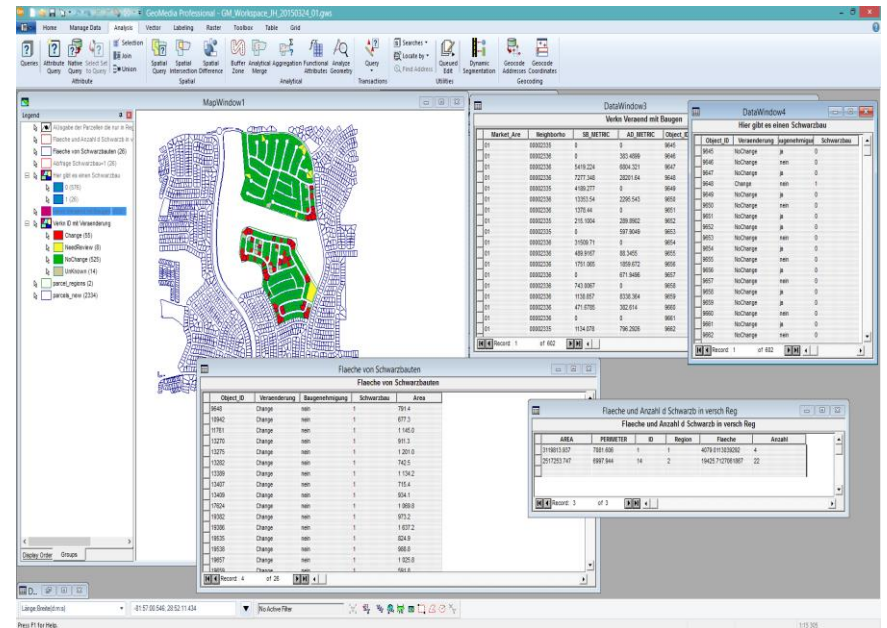
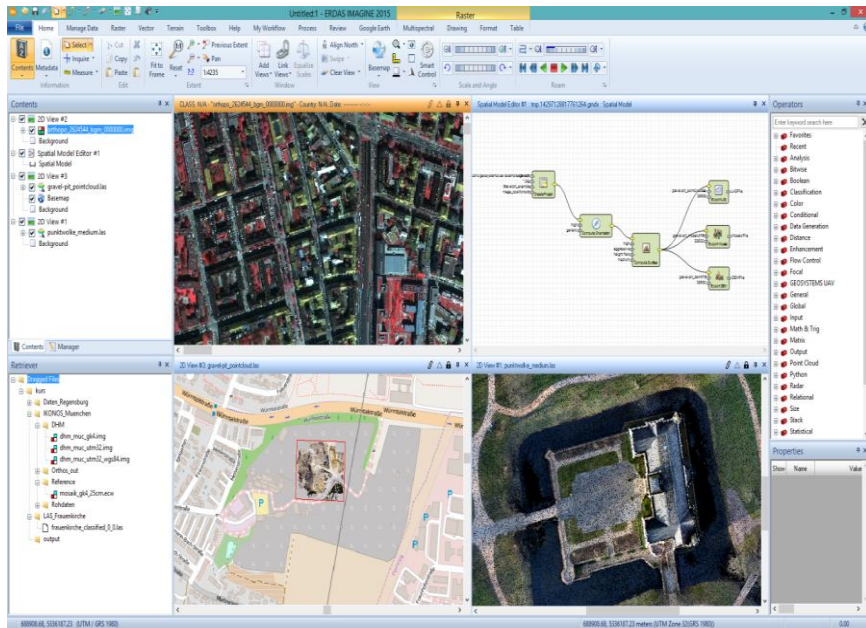
- Bilder von 2 versch. Aufnahmezeitpunkten
- Flurstücksgrenzen (Vektor-Format)
- Liste der bewilligten Bauvorhaben



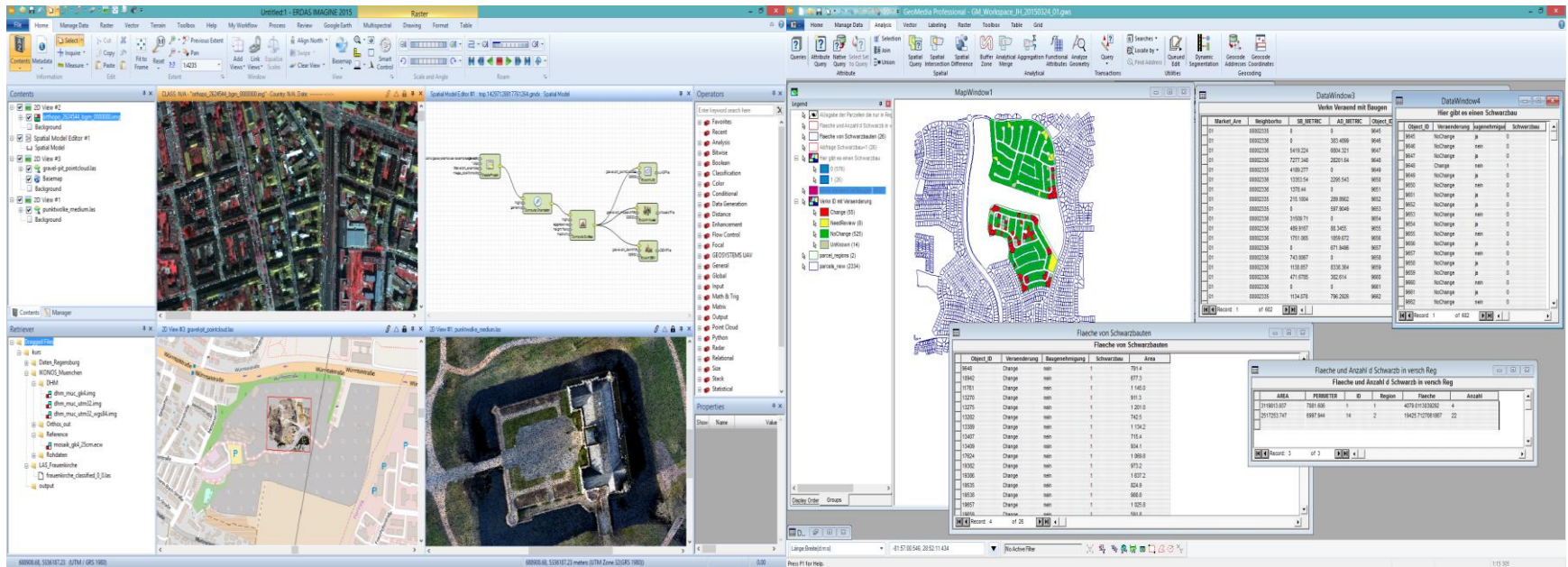
Rasterverarbeitung mit ERDAS IMAGINE



Vektorverarbeitung mit GeoMedia



Workflow



Rasterverarbeitung mit
ERDAS IMAGINE



Vektorverarbeitung mit
GeoMedia

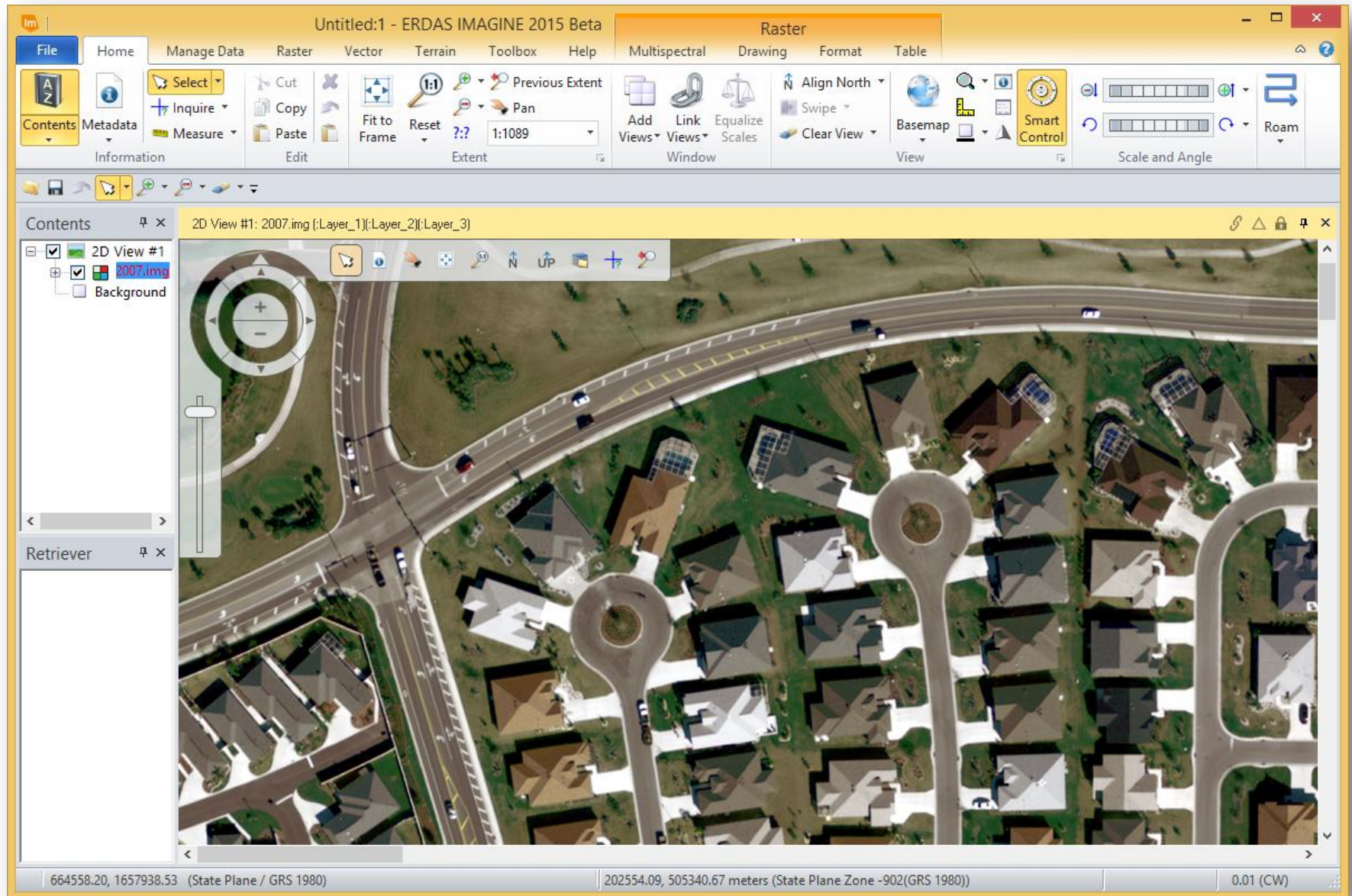


Workflow im Detail

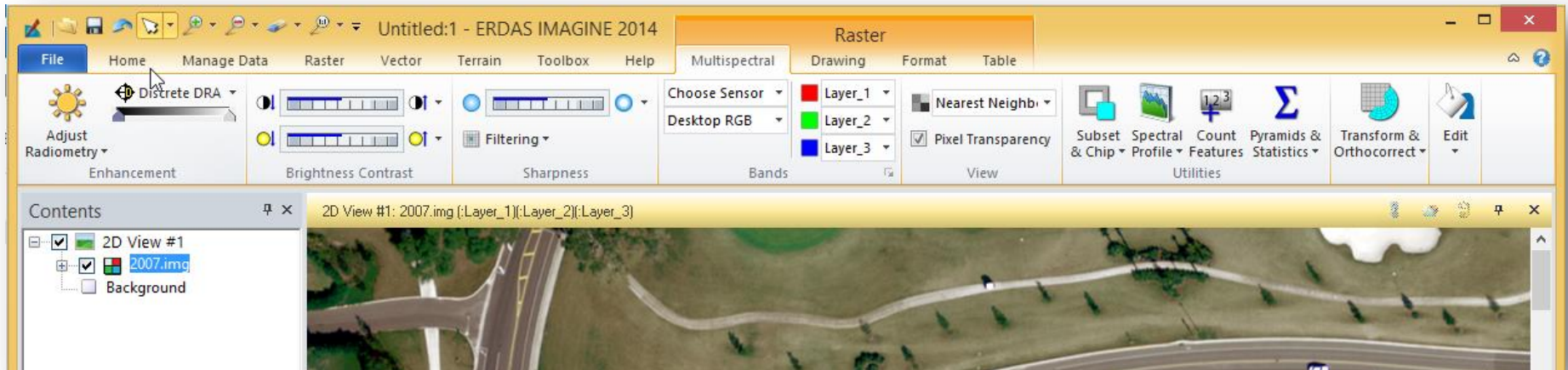
Teil 1 - Veränderungsnachweis mit IMAGINE



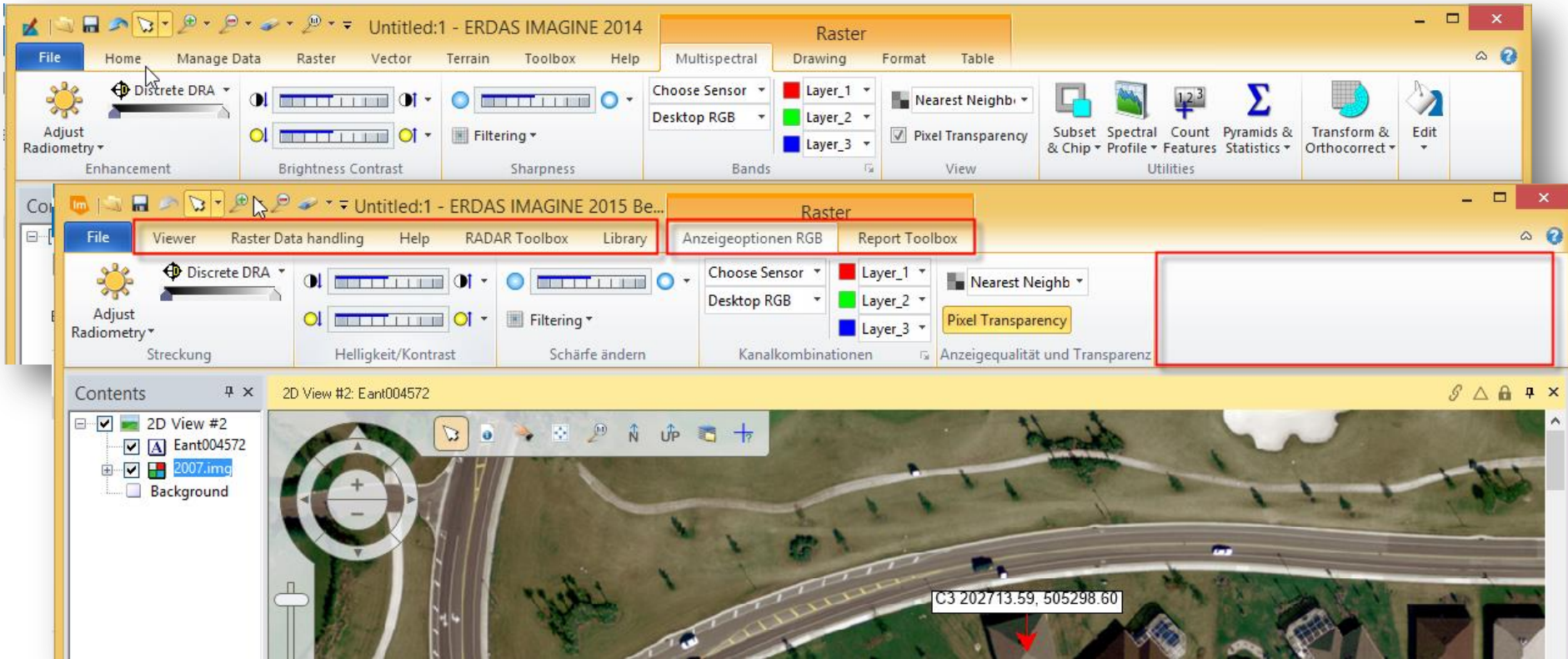
ERDAS IMAGINE



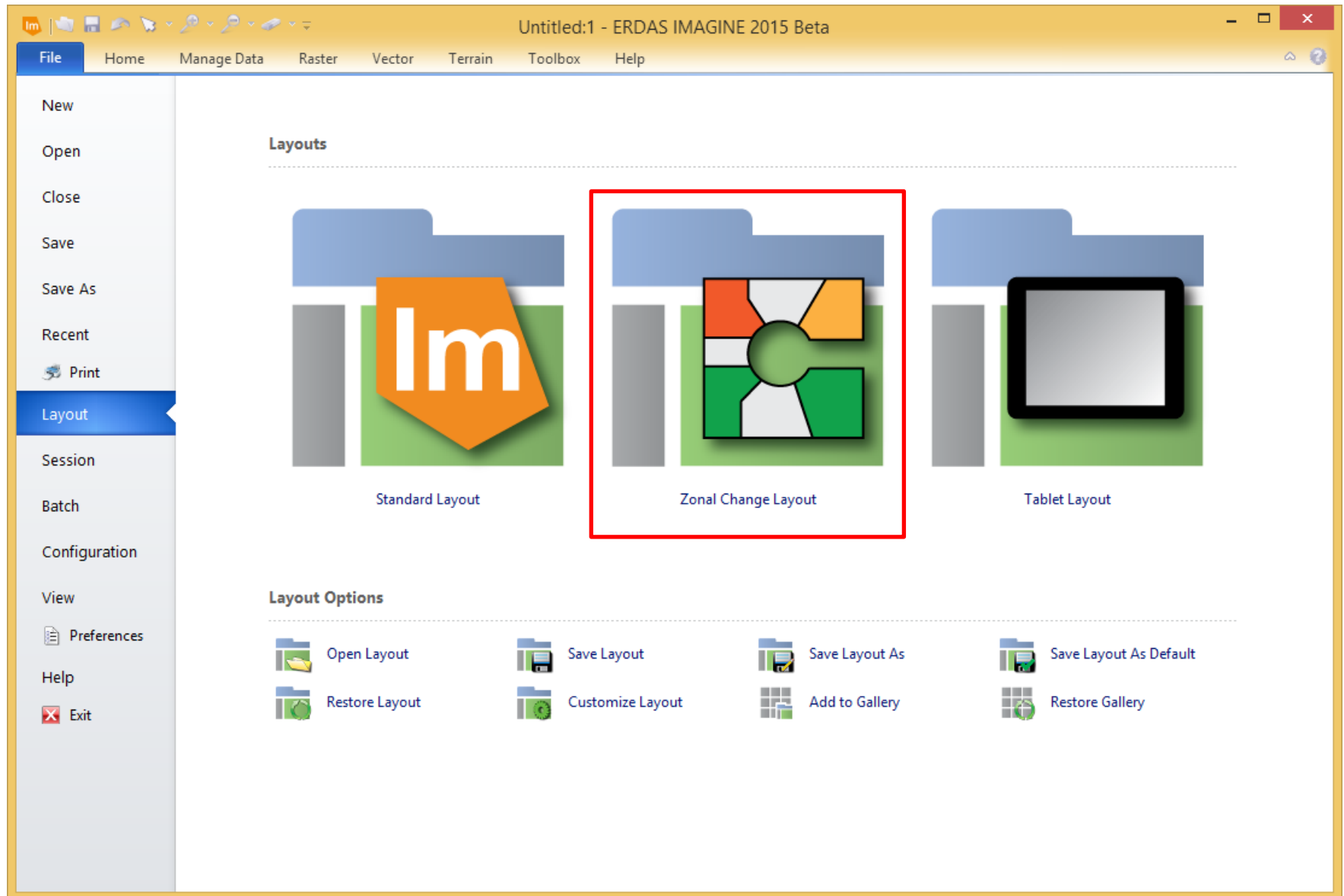
IMAGINE – Standard-Layout



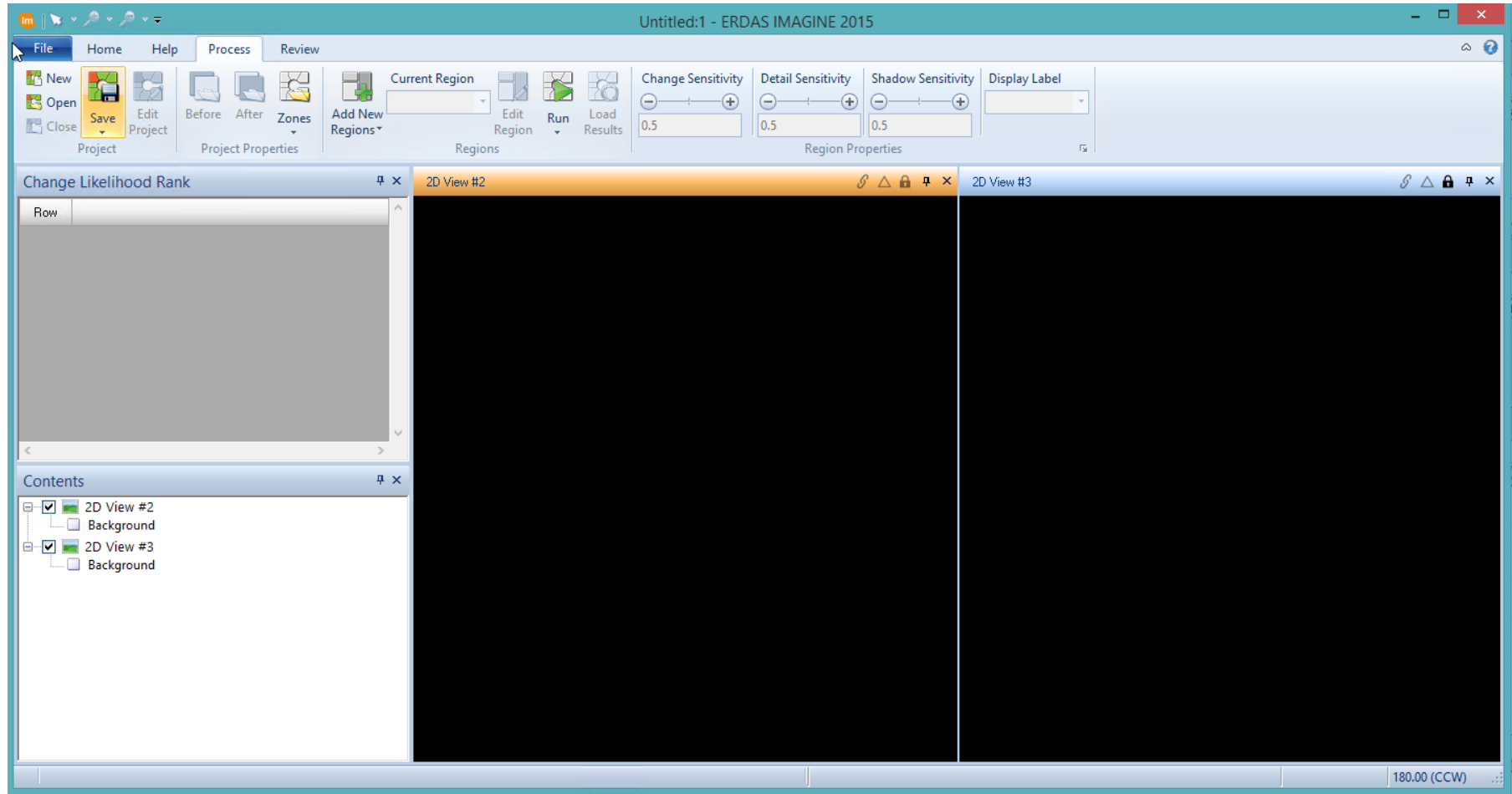
IMAGINE – angepasstes Layout



IMAGINE – angepasstes Layout

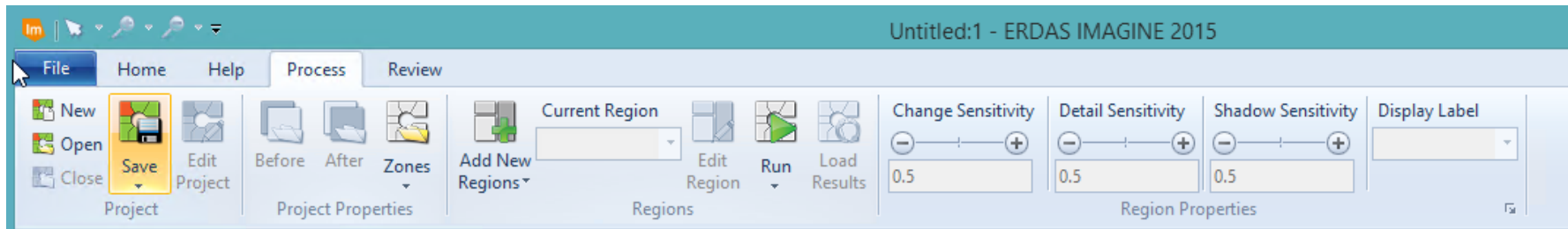


IMAGINE – Zonal Change Layout

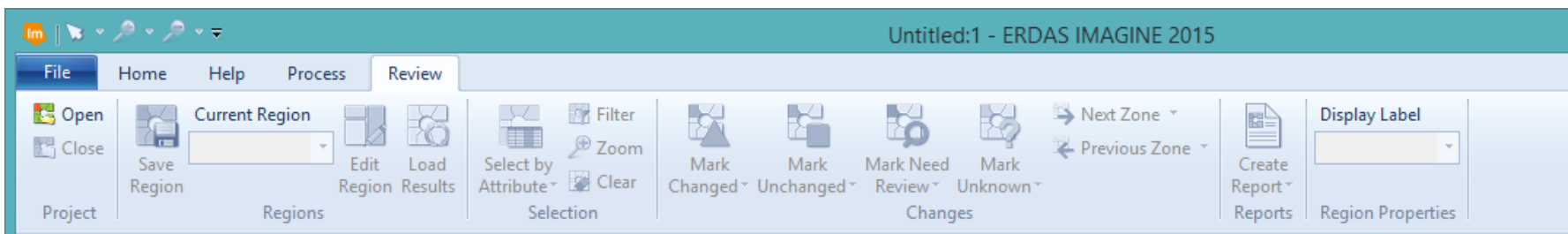


Zonal Change

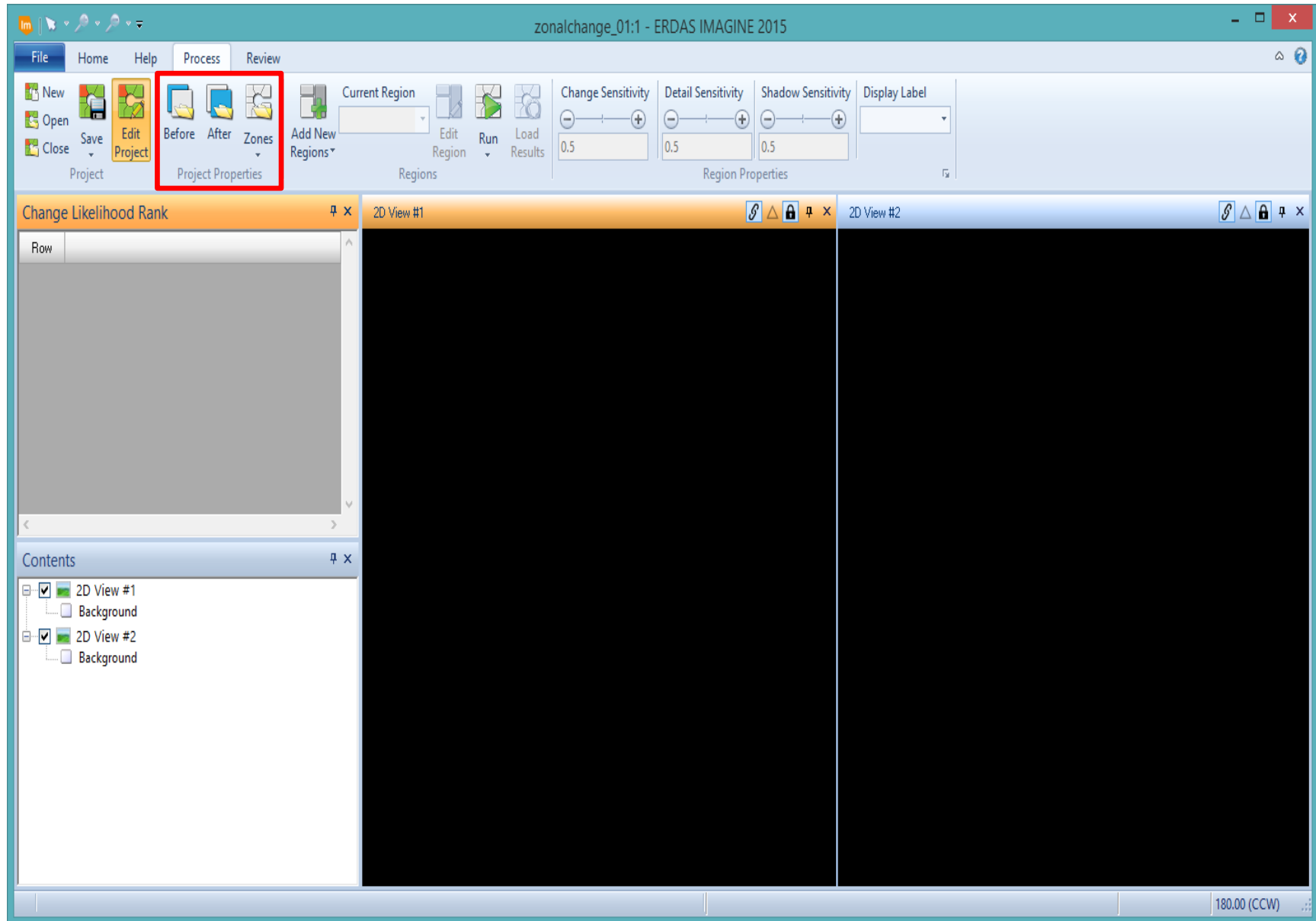
■ Process-Tab



■ Review-Tab



Zonal Change – Setup



Zonal Change – Setup

zonalchange_01:1 - ERDAS IMAGINE 2015

File Home Help Process Review

New Open Save Edit Project Before After Zones Add New Regions Current Region All Zones Edit Region Run Load Results Change Sensitivity 0.5 Detail Sensitivity 0.5 Shadow Sensitivity 0.5 Display Label OBJECTID

Change Likelihood Rank

Row	>	Data ID	Label	Status	Change
1	▶	1	19645		
2		2	19646		
3		3	19647		
4		4	19648		
5		5	19649		
6		6	19650		
7		7	19651		
8		8	19652		

Contents

- 2D View #1
 - parcels_new.shp
 - 2007.img
 - Background
- 2D View #2
 - parcels_new.shp
 - 2008.img
 - Background

Before Image: parcels_new.shp After Image: parcels_new.shp

parcels_new.shp

Record	OBJECTID	PIN	OBJECTID_1	County_Cod	PIN_1	Roll_Type	Roll_Year	P_Use_1	Special_As	Total_Just	Change_Jus	Change_J_1	School_Ass	Total
1	19645.D25L03		23876.70		D25L033	R	2013	00100		124370.00000000	0.00000000		123770.00000000	1249
2	19646.D25M0		23925.70		D25M026	R	2013	00100		216650.00000000	0.00000000		215150.00000000	2166
3	19647.D25M2		24110.70		D25M211	R	2013	00100		218480.00000000	0.00000000		216880.00000000	2184

203347.12, 505113.21 meters (State Plane Zone -902(GRS 1980)) 0.00

Zonal Change – Setup

zonalchange_01:1 - ERDAS IMAGINE 2015

File Home Help Process Review

New Open Save Edit Project Before After Zones

Current Region: All Zones

Change Sensitivity: 0.5 Detail Sensitivity: 0.5 Shadow Sensitivity: 0.5 Display Label: OBJECTID

Region Properties

Change Likelihood Rank

Row	>	Data ID	Label	Status	Change
1	▶	1	19645		
2		2	19646		
3		3	19647		
4		4	19648		
5		5	19649		
6		6	19650		
7		7	19651		
8		8	19652		

Contents

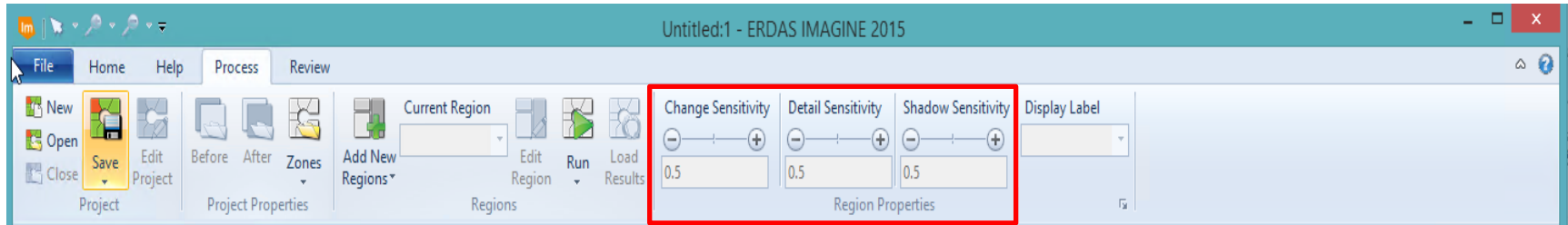
- 2D View #1
 - parcels_new.shp
 - 2007.img
 - Background
- 2D View #2
 - parcels_new.shp
 - 2008.img
 - Background

parcels_new.shp

Record	OBJECTID	PIN	OBJECTID_1	County_Cod	PIN_1	Roll_Type	Roll_Year	P_Use_1	Special_As	Total_Just	Change_Jus	Change_J_1	School_Ass	Total
1	19645 D25L03		23876 70		D25L033	R	2013	00100		124970.00000000	0.00000000		123770.00000000	1249
2	19646 D25M0		23925 70		D25M026	R	2013	00100		216650.00000000	0.00000000		215150.00000000	2166
3	19647 D25M2		24110 70		D25M211	R	2013	00100		218480.00000000	0.00000000		216880.00000000	2184

0.00

Zonal Change – Setup



Berechnung der **Veränderungswahrscheinlichkeit**:

	--	+
Change Sensitivity	nur extreme Grauwert-Veränderungen werden berücksichtigt	auch geringe Grauwert-Veränderungen werden berücksichtigt
Detail Sensitivity	nur großflächige Veränderungen werden berücksichtigt	auch kleinräumige Veränderungen werden berücksichtigt
Shadow Sensitivity	Schattenbereiche werden nicht berücksichtigt	Schattenbereiche werden berücksichtigt

Tipp: Bei stark unterschiedlichen Sonnenständen einen niedrigen Shadow-Sensitivity-Wert wählen!

Zonal Change – Run

zonalchange_01:1 - ERDAS IMAGINE 2015

File Home Help Process Review

New Open Save Edit Project Before After Zones Add New Regions Current Region Region 1 Edit Region Run Load results Change Sensitivity 0.67 Detail Sensitivity 0.2 Shadow Sensitivity 0.86 Display Label OBJECTID

Change Likelihood Rank

Row	>	Data ID	Label	Status	Change
1	▶	1	19645		
2		2	19646		
3		3	19647		
4		4	19648		
5		5	19649		
6		6	19650		
7		7	19651		
8		8	19652		

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 - parcels_new.shp
 - 2008.img
 - Background

Before Image: parcels After Image: parcels_new.shp

parcels_new.shp

Record	OBJECTID	PIN	OBJECTID_1	County_Cod	PIN_1	Roll_Type	Roll_Year	P_Use_1	Special_As	Total_Just	Change_Jus	Change_J_1	School_Ass	Total
1	19645	D25L03	23876 70	D25L033	R	2013	00100			124970.00000000	0.00000000		123770.00000000	1249
2	19646	D25M0	23925 70	D25M026	R	2013	00100			216650.00000000	0.00000000		215150.00000000	2166
3	19647	D25M2	24110 70	D25M211	R	2013	00100			218480.00000000	0.00000000		216880.00000000	2184

0.00

Zonal Change – Results

Untitled:1 - ERDAS IMAGINE 2015

File Home Help Process Review

New Open Close Save Edit Project Before After Zones Add New Regions Current Region Edit Region Run Load Results Change Sensitivity Detail Sensitivity Shade

Project Project Properties Regions Region Properties

Change Likelihood Rank

Row	>	Data ID	Label	Status	Change
143		245	21753	?	
475		1236	29676	?	
490		1251	29743	?	
164		266	21774	?	
174		311	23282	?	
229		669	27400	?	
150		252	21760	?	
28		28	19908	?	

Before Image: parcels_new.shp

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 - 2008.img
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parcels_new.shp

Record	OBJECTID	PIN	OBJECTID_1	County_Cod	PIN_1	Roll_Type	Roll_Year	P_Use_1	Special_As
1235	29675	D25P11	24603 70		D25P119	R	2013	00100	
1236	29676	D25P06	24545 70		D25P061	R	2013	00100	
1237	29677	D25P10	24584 70		D25P100	R	2013	00100	

Change Likelihood Rank

Row	>	Data ID	Label	Status	Change
143		245	21753	?	
475		1236	29676	?	
490		1251	29743	?	
164		266	21774	?	
174		311	23282	?	
229		669	27400	?	
150		252	21760	?	
28		28	19908	?	
505		1459	31806	?	
16		16	19660	?	
128		203	21611	?	
630		1937	35721	?	
537		1708	35112	?	
474		1235	29675	?	
276		989	29326	?	
274		987	29324	?	
497		1451	31627	?	
594		1839	35312	?	
483		1244	29684	?	
522		1691	35095	?	
533		1703	35107	?	
159		261	21769	?	
168		305	23271	?	
325		1038	29383	?	
17		17	19661	?	
396		1109	29547	?	

Zonal Change - Review

File Home Help Process Review

Open Close Current Region Region 1 Edit Region Load Results Select by Attribute

Project Regions Select

Change Likelihood Rank

Row	Data ID	Label	Status	Change
143	245	21753	▲	
475	1236	29676	?	
490	1251	29743	?	
164	266	21774	?	
174	311	23282	?	
229	669	27400	?	
150	252	21760	?	
28	28	19908	?	

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Mark Changed ▾
 Mark Unchanged ▾
 Mark Need Review ▾
 Mark Unknown ▾
 Next Zone ▾
 Previous Zone ▾

Changes

29676

29676

parcels_new.shp

Record	OBJECTID	PIN	OBJECTID_1	County_Cod	PIN_1	Roll_Type	Roll_Year	P_Use_1	Special_As	Total_Just	Change_Jus	Change_J_1	School_Ass	Total
1235	29675	D25P11	24603.70		D25P119	R	2013	00100		184220.00000000	0.00000000		182920.00000000	1842
1236	29676	D25P06	24545.70		D25P061	R	2013	00100		279640.00000000	0.00000000		277940.00000000	2796
1237	29677	D25P10	24584.70		D25P100	R	2013	00100		280720.00000000	0.00000000		279120.00000000	2807

0.00

Zonal Change - Review

Change Likelihood Rank				
Row	>	Data ID	Label	Status
236		681	17627	
533		1719	25123	
455		1188	19626	
328		1041	19386	
174		311	13282	
177		316	13389	
151		253	11761	
172		309	13275	
406		1119	19557	
134		209	11653	
386		1099	19537	
166		303	13269	
324		1037	19382	
167		304	13270	
133		208	11652	
147		249	11757	
383		1096	19534	
384		1097	19535	
29		29	9909	
397		1110	19548	
161		263	11771	
399		1112	19550	
286		999	19336	
175		312	13283	
186		325	13409	
402		1115	19553	
472		1227	19685	
573		1843	25316	
74		105	10924	
4		4	9648	
487		1249	19741	
262		975	19288	
387		1100	19538	
148		250	11758	
520		1697	25101	

 Mark
Changed

 Mark
Unchanged

 Mark Need
Review

 Mark
Unknown

 Next Zone

 Previous Zone

Changes

Change Likelihood Rank				
Row	>	Data ID	Label	Status
43		58	10765	
31		31	9911	
30		30	9910	
364		1077	19498	
367		1080	19513	
508		1470	21853	
84		115	10943	
8		8	9652	
239		952	19241	
87				
42				
7				
8				
27				
23				
44				
3				
432		1183	19623	
192		565	15877	
2		2	9646	
379		1092	19530	
222		596	16455	
299		1012	19349	
217		591	16450	
363		1076	19497	
75		106	10925	
339		1052	19430	
34		34	9914	
375		1088	19526	
380		1093	19531	
381		1094	19532	
382		1095	19533	
602		1937	25721	

Zonal Change – Report

zonalchange_01:1 - ERDAS IMAGINE 2015

File Home Help Process Review

Open Close Current Region Region 1 Edit Region Load Results Select by Attribute Zoom Clear

Project Regions Selection

Change Likelihood Rank

Row	Data ID	Label	Status	Change
143	245	21753	▲	
475	1236	29676	?	
490	1251	29743	?	
164	266	21774	?	
174	311	23282	?	
229	669	27400	?	
150	252	21760	?	
28	28	19908	?	

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parcels_new.shp

Record	OBJECTID	PIN	OBJECTID_1	County_Cod
1235	29675	D25P1	24603 70	D2
1236	29676	D25P0	24545 70	D2
1237	29677	D25P1	24584 70	D2

Region ID	Data ID	Label	Status	LastUpdatedDateTime	LastUpdatedBy	ChangeLikelihood
1	1	9645	NoChange	2014-11-12.10:10:51	rguggenmos	26.070900
1	2	9646	NoChange	2014-11-12.10:10:51	rguggenmos	19.016700
1	3	9647	NoChange	2014-11-12.10:22:59	rguggenmos	81.764300
1	4	9648	Change	2014-11-12.10:07:32	rguggenmos	199.715000
1	5	9649	NoChange	2014-11-12.10:10:51	rguggenmos	27.396100
1	6	9650	Unknown	2014-11-07.10:57:45	rguggenmos	51.158700
1	7	9651	NoChange	2014-11-12.10:22:59	rguggenmos	79.438400
1	8	9652	NoChange	2014-11-12.10:10:51	rguggenmos	23.158600
1	9	9653	NoChange	2014-11-12.10:10:51	rguggenmos	43.385400
1	10	9654	NoChange	2014-11-12.10:22:59	rguggenmos	94.627700
1	11	9655	Unknown	2014-11-07.10:57:46	rguggenmos	68.966500
1	12	9656	Unknown	2014-11-07.10:57:46	rguggenmos	68.944200
1	13	9657	Unknown	2014-11-07.10:57:46	rguggenmos	56.166300
1	14	9658	NoChange	2014-11-12.10:10:51	rguggenmos	22.620000
1	15	9659	NoChange	2014-11-12.10:22:59	rguggenmos	89.477000
1	16	9660	NoChange	2014-11-12.10:22:59	rguggenmos	91.937000
1	17	9661	NoChange	2014-11-12.10:10:51	rguggenmos	27.958300
1	18	9662	NoChange	2014-11-12.10:10:51	rguggenmos	31.954800
1	19	9663	NoChange	2014-11-12.10:22:59	rguggenmos	107.419000
1	20	9775	NoChange	2014-11-12.10:10:51	rguggenmos	38.052000
1	21	9776	NoChange	2014-11-12.10:10:51	rguggenmos	34.638200
1	22	9777	NoChange	2014-11-12.10:10:51	rguggenmos	22.775800
1	23	9778	Unknown	2014-11-07.10:57:48	rguggenmos	51.444300
1	24	9779	NoChange	2014-11-12.10:10:51	rguggenmos	42.631700
1	25	9780	NoChange	2014-11-12.10:22:59	rguggenmos	167.931000
1	26	9906	NoChange	2014-11-12.10:10:51	rguggenmos	42.649900
1	27	9907	NoChange	2014-11-12.10:22:59	rguggenmos	108.032000
1	28	9908	NoChange	2014-11-12.10:22:59	rguggenmos	89.692000

0.00

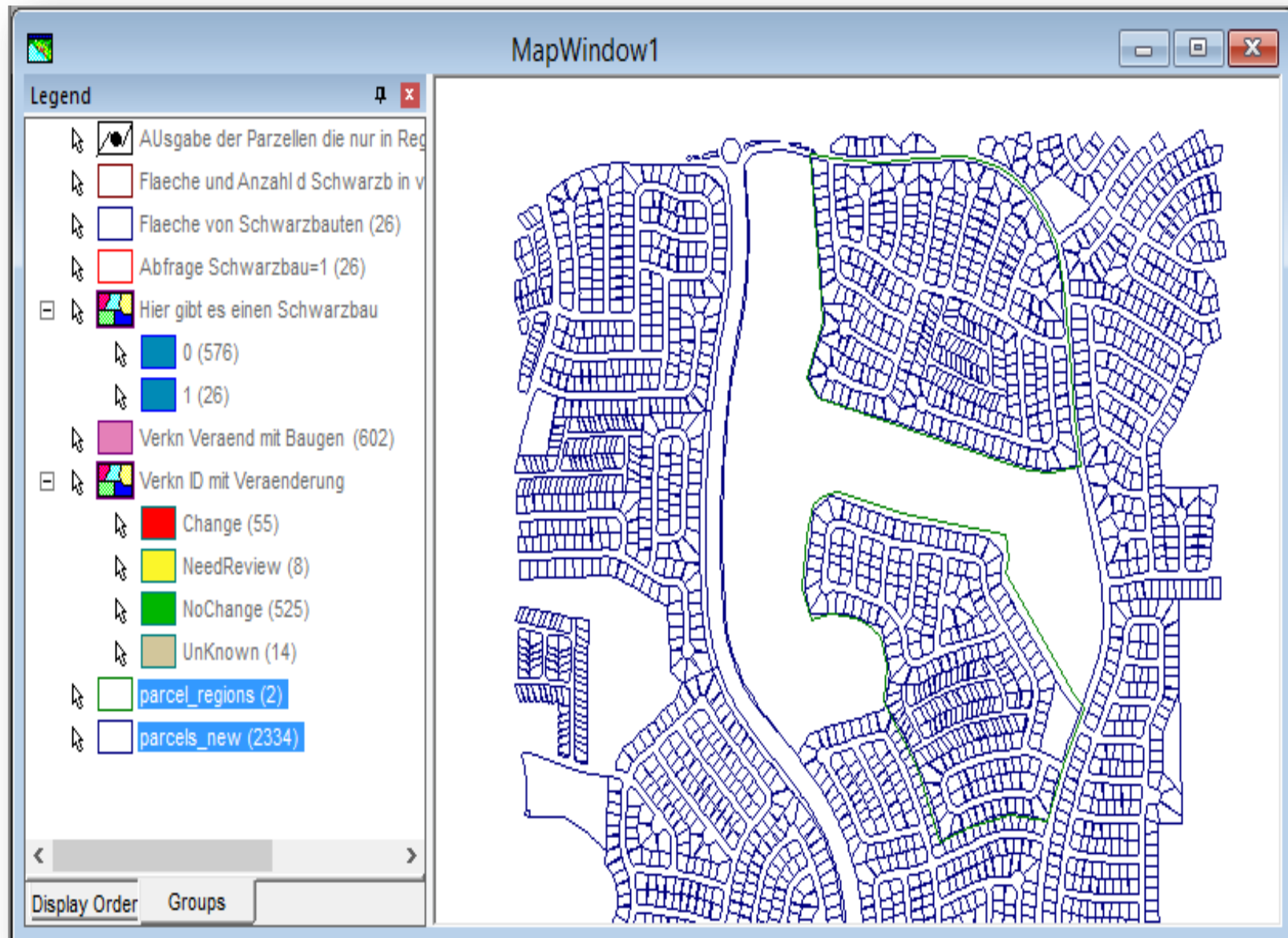


Workflow im Detail

Teil 2 – Veränderungsanalyse mit GeoMedia

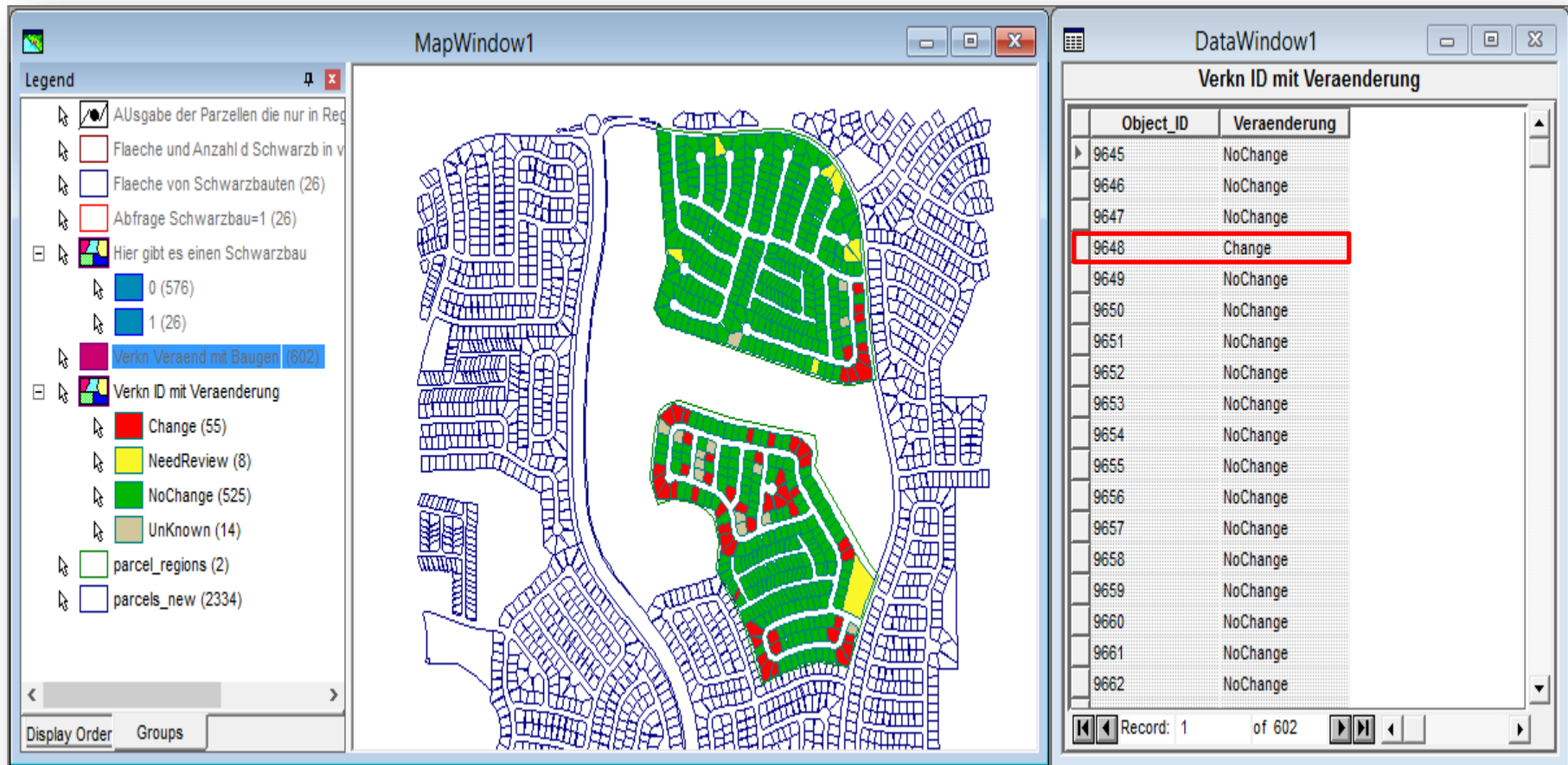


Zonal Change – Analyse



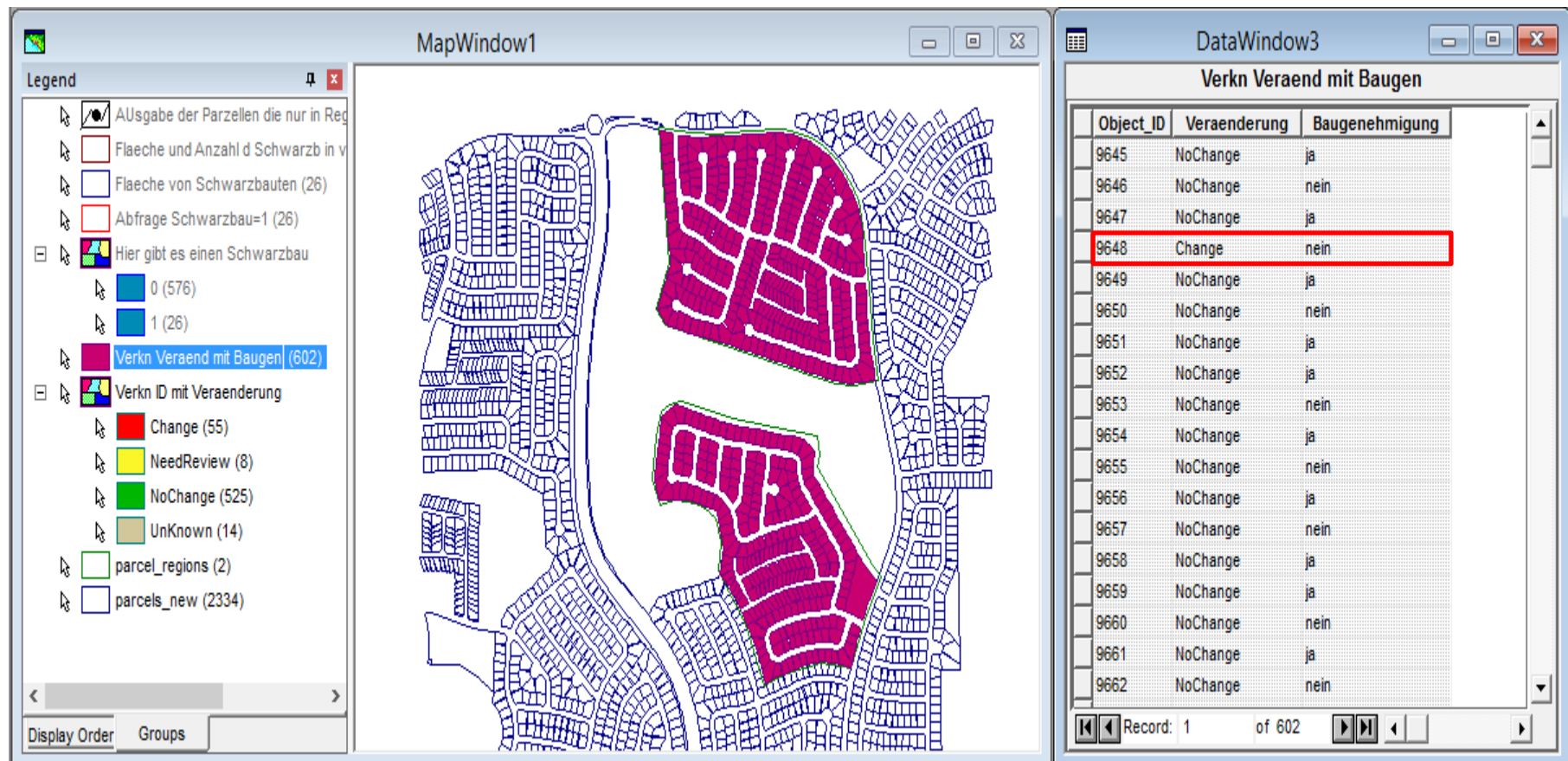
Zonal Change – Analyse

- Change / No Change / Need Review / Unknown aus dem Report



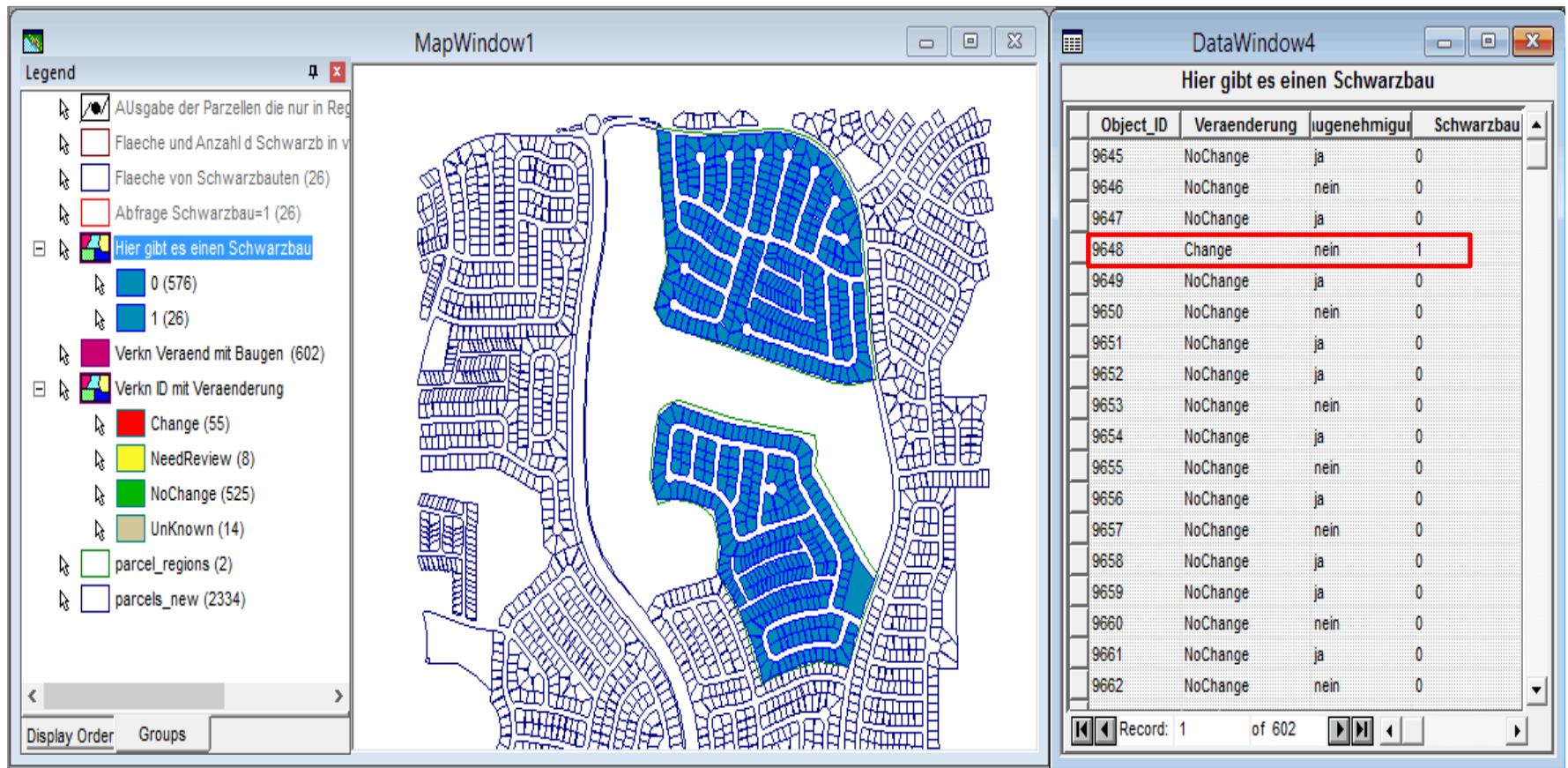
Zonal Change – Analyse

- Verknüpfung mit der Information zur Baugenehmigung



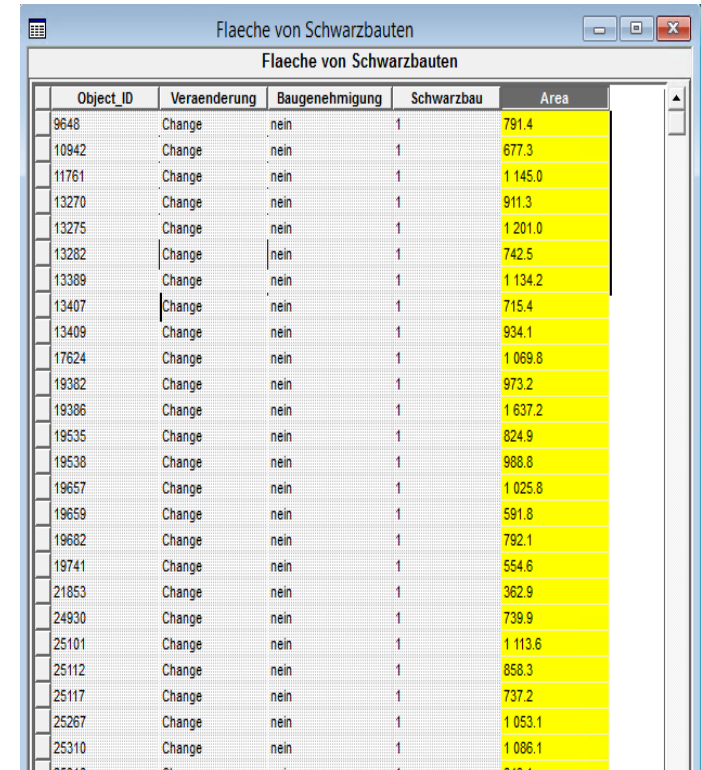
Zonal Change – Analyse

- Legaler Bau oder Schwarzbau ?

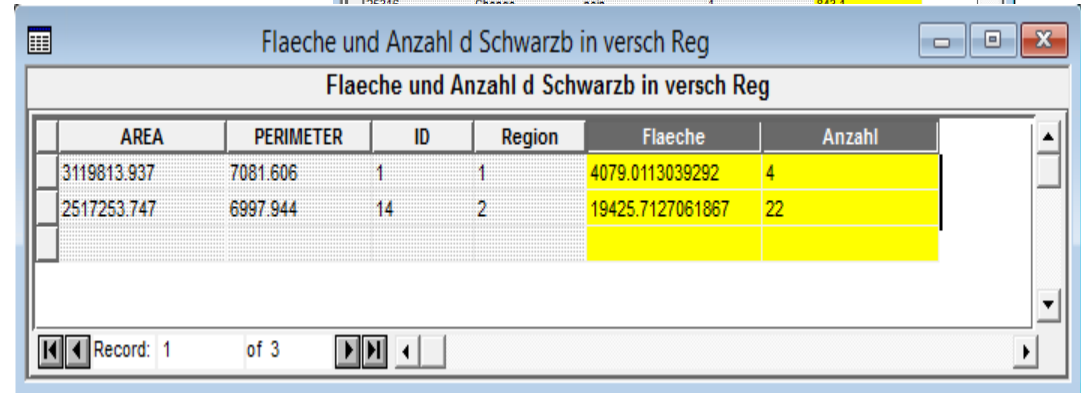


Zonal Change – Analyse

- Abfragen der Größe
- Ermittlung der Anzahl
- ...
- Hinterlegen von Gebühren
- Verknüpfung mit Adressen
- USW.

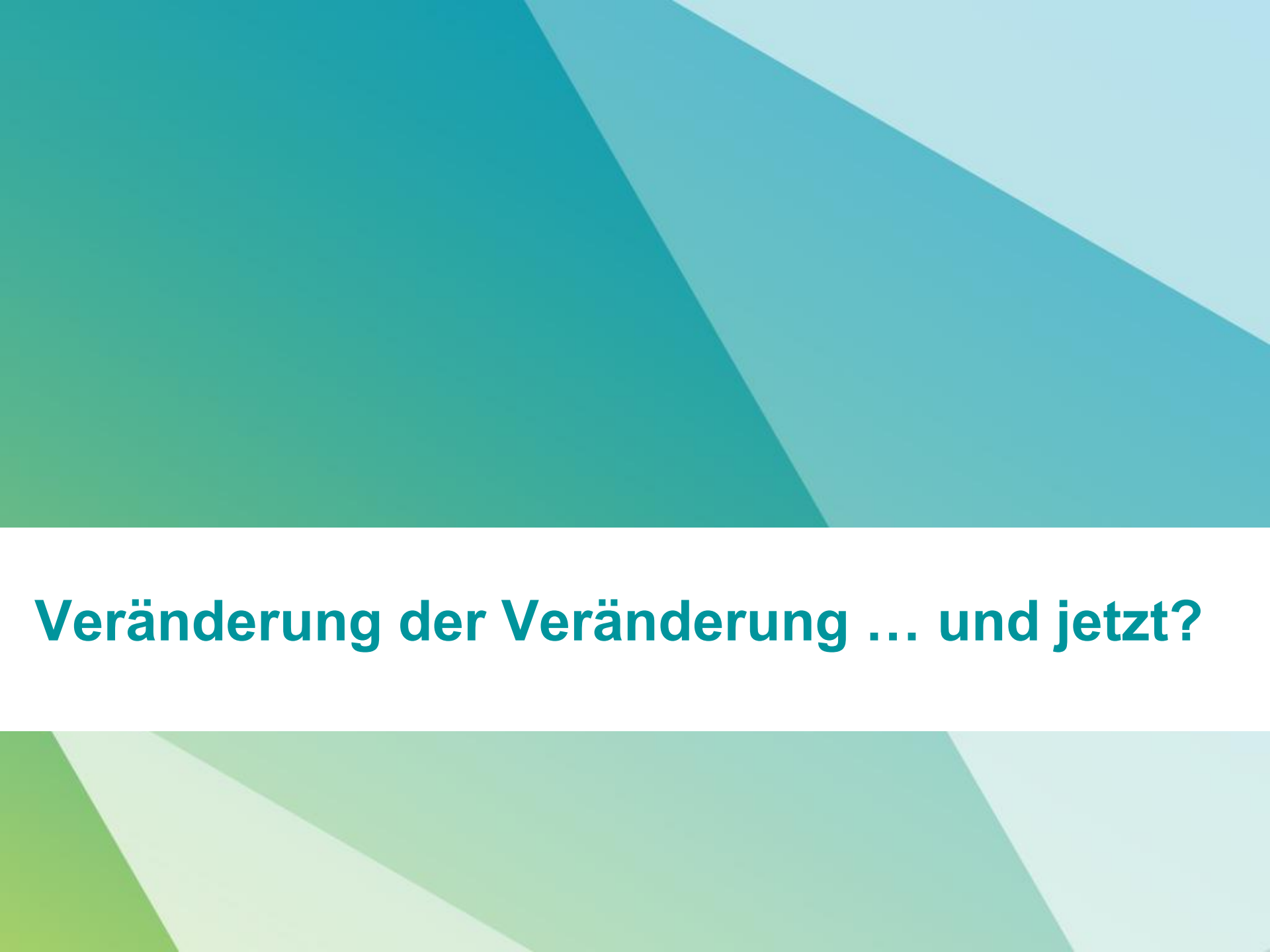


Object_ID	Veraenderung	Baugenehmigung	Schwarzbau	Area
9648	Change	nein	1	791.4
10942	Change	nein	1	677.3
11761	Change	nein	1	1 145.0
13270	Change	nein	1	911.3
13275	Change	nein	1	1 201.0
13282	Change	nein	1	742.5
13389	Change	nein	1	1 134.2
13407	Change	nein	1	715.4
13409	Change	nein	1	934.1
17624	Change	nein	1	1 069.8
19382	Change	nein	1	973.2
19386	Change	nein	1	1 637.2
19535	Change	nein	1	824.9
19538	Change	nein	1	988.8
19657	Change	nein	1	1 025.8
19659	Change	nein	1	591.8
19682	Change	nein	1	792.1
19741	Change	nein	1	554.6
21853	Change	nein	1	362.9
24930	Change	nein	1	739.9
25101	Change	nein	1	1 113.6
25112	Change	nein	1	858.3
25117	Change	nein	1	737.2
25267	Change	nein	1	1 053.1
25310	Change	nein	1	1 086.1



AREA	PERIMETER	ID	Region	Flaeche	Anzahl
3119813.937	7081.606	1	1	4079.0113039292	4
2517253.747	6997.944	14	2	19425.7127061867	22

Record: 1 of 3

The background of the slide is composed of several overlapping triangles in various shades of teal, green, and light blue. The top half features a large dark teal triangle on the left and a medium blue triangle on the right. The bottom half features a light green triangle on the left and a very light blue triangle on the right. A white horizontal band runs across the middle of the slide, containing the text.

Veränderung der Veränderung ... und jetzt?

Verknüpfung über den Report

The screenshot displays two software interfaces side-by-side. The left interface is ERDAS IMAGINE 2015, showing a 'Change Likelihood Rank' table with columns for Row, DateID, Label, Status, and Change. It also features a map window with a green polygon overlay on a satellite image. The right interface is GeoMedia Professional - GM Workspace, showing a map window with a green polygon overlay on a street map. Below the map windows, there are several data tables and reports, including a 'Fläche von Schwarzstraßen' report and a 'Fläche und Anzahl d Schwarz in versch Reg' report.



Rasterverarbeitung mit
ERDAS IMAGINE



Vektorverarbeitung mit
GeoMedia

Datenaustausch



Rasterverarbeitung mit
ERDAS IMAGINE



Vektorverarbeitung mit
GeoMedia



Datenmanagement mit
ERDAS Apollo

Vielen Dank !



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