Technically supported by:





Federation: The Next Key Innovation After ARD

EarthServer Side Event, ESA Phi-Week, 2021-10-14 Peter Baumann Jacobs University | rasdaman GmbH



-rwxx 1	rasdata	users	1485	Oct			4251NW.ASC
-rwxx 1	rasdata	users	216	Oct	13	2004	4251NWGR.tfw
-rwxx 1	rasdata	users	640432	0ct	13	2004	4251NWGR.tif
-rwxx/1	rasdata	users	216	0ct	13	2004	4251NWGW.tfw
-rwxx 1	rasdata	users	779368	0ct	13	2004	4251NWGW.tif
-rwxx 1	rasdata	users	216	0ct	13	2004	4251NWRL.tfw
- rwxx 1	rasdata	users	712492	Oct	13	2004	4251NWRL.tif
-rwxx 1	rasdata	users	216	0ct	13	2004	4251NWWL.tfw
-rwxx 1	rasdata	users	62830	0ct	13	2004	4251NWWL.tif
-rwxx 1	rasdata		1498	0ct	13	2004	4251S0.ASC
-rwxx 1	rasdata		216	0ct	13 ^U	2004	4251S0GR.tfw
-rwxx 1	rasdata	users	1076750	0ct	13	2004	4251S0GR.tif
-rwxx 1	rasdata	users	216		13	2004	4251S0GW.tfw
-rwxx 1	rasdata		197142	0ct	13	2004	4251S0GW.tif
-rwxx 1	rasdata	users	216	0ct	13	2004	4251SORL.tfw
-rwxx 1	rasdata	users	936348		13	2004	4251SORL.tif
- rwxx 1	rasdata		216		13	2004	4251S0WL.tfw
-rwxx 1	rasdata		119990	0ct	13	2004	4251S0WL.tif
-rwxx 1	rasdata		1485		13	2004	4251SW.ASC
-rwxx 1	rasdata	users	216	0ct	13	2004	4251SWGR.tfw
-rwxx 1	rasdata		577868	0ct	13	2004	4251SWGR.tif
-rwxx 1	rasdata	users	216	0ct	13	2004	4251SWGW.tfw
-rwxx 1	rasdata	users	352188	0ct	13	2004	4251SWGW.tif
-rwxx 1	rasdata	users	216	0ct	13	2004	4251SWRL.tfw
-rwxx 1	rasdata	users	913032	0ct	13	2004	4251SWRL.tif
-rwxx 1	rasdata		216		13	2004	4251SWWL.tfw
-rwxx 1	rasdata		74152	0ct	13	2004	4251SWWL.tif
-rwxx 1	rasdata		1485		13	2004	4252N0.ASC
-rwxx 1	rasdata	users	FID 216	0ct	13	2004	4252N0GR.tfw
-rwxx 1	rasdata		355774	0ct	13	2004	4252N0GR.tif
-rwxx 1	rasdata		216	0ct	13	2004	4252N0GW.tfw
-rwxx 1	rasdata	users	49046	0ct	13	2004	4252N0GW.tif
-rwxx 1	rasdata	users	216	0ct	13	2004	4252N0RL.tfw
-rwxx 1	rasdata	users	600964	0ct	13	2004	4252NORL.tif
-rwxx 1	rasdata		216		13	2004	4252NOWL.tfw
-rwxx 1	rasdata		46714	Oct	13	2004	4252NOWL.tif
-rwxx1	rasdata	users	1485		13	2004	4252NW.ASC
	rasdata		216		13	2004	4252NWGR.tfw
			1445064		13	2004	4252NWGR.tif
-rwxx 1 -rwxx 1	rasdata		216		13	2004	4252NWGK.tfw
	rasdata			0ct 0ct	13	2004	4252NWGW.tif
	rasdata		410426 216	0ct	13	2004	
- rwx x 1	rasdata	users					4252NWRL.tfw
- rwx x 1	rasdata	users	655374	0ct	13	2004	4252NWRL.tif
-rwxx 1	rasdata	users	216		13	2004	4252NWWL.tfw
-rwxx 1	rasdata	users	108612	0ct	13	2004	4252NWWL.tif
-rwxx 1	rasdata		1485	0ct		2004	4252S0.ASC
-rwxx 1	rasdata	users	216	0ct	13	2004	4252S0GR.tfw
-rwxx 1	rasdata	users	607646	0ct	13	2004	4252S0GR.tif
- rwxx 1	rasdata	users	216	0ct	13	2004	4252S0GW.tfw
-rwxx 1	rasdata	users	685092	0ct	13	2004	4252S0GW.tif
-rwxx 1	rasdata	users	216	0ct	13	2004	4252SORL.tfw
-rwxx1	rasdata	users	632172	0ct	13	2004	4252SORL.tif

Datacubes?

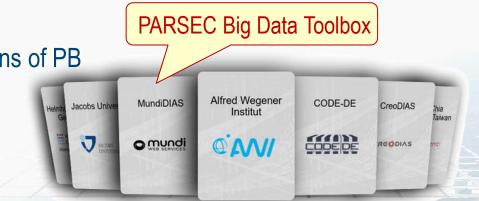
- Sensors & simulations
 → gridded ("raster") data
- Datacubes are the natural paradigm to interact with spatio-temporal, n-D data
- Pioneered by EarthServer since 2011



EarthServer Datacube Federation

141010 011101 01101

- spatio-temporal analytics & fusion, dozens of PB
 - location-transparent
 - open standards, coding-free
 - Open for code & data
- Open, free, transparent, democratic
 - Open & private, free & commercial
 - quickly growing community
 - DIASs; NASA, EURAC to join
- Powered by rasdaman



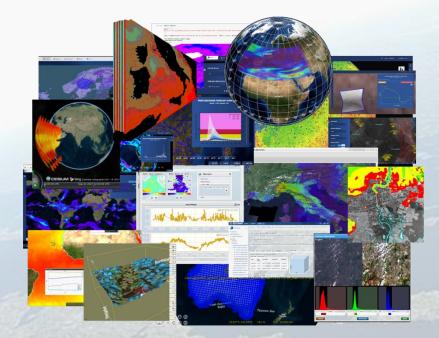


ΒY

EarthServer Key Innovation Components



- Strictly standards
 - powerful datacube analytics with EU/INSPIRE WCPS
- Federation
 - single information space, 100% location transparent
- Array DBMS power backend
 - Flexibility, scalability, security
 - performance 300x, 400x reported
- Zero-coding
 - Democratization of data insight
- Clients, clients, clients





- "raster data manager" pioneered actionable datacubes: 160+ publications
- High-level datacube query language (now ISO SQL/MDA) + coverage QL (WCPS)
- massively scalable Datacube Management & Analytics engine, full-stack implementation

TechConnect

INNOVATION

AWARD

2019

- Dozens of PB; 1000x parallelization, planetary-scale federation
- Intelligent ETL: automated datacube maintenance & optimization
- Reference implementation, multi-award winning

DATA SCIENCE TECHNOLOGY INNOVATION OF THE YEAR



altoring Com

opernicus

WINNER

T-SYSTEMS BIG DATA CHALLENGE

2014

T · · Systems

mosters

THE EUROPEAN INFORMATION TECHNOLOGY

PRIZE

Winner



When the world agrees

Defence

Innovation

Challenge

iso International Organization for Standardization

Information technology database languages -- SQL -- Part 15: Multi-dimensional arrays

NITEC

ISO/IEC 9075-15:2019 • Preview

GEOSPATIAI

WORLD

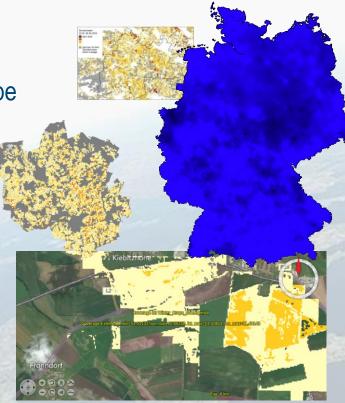
FORUM

Optimized Distributed Processing + avg(B.green) + max((C.red + C.green + C.blue) / 3) + max((D.nir + D.red) / 2) 1 query \rightarrow 1,000+ cloud nodes [ACM SIGMOD, VLDB] EarthServer :: ESA Phi-Week :: ©2021 earthserver





- Rule-based classification of field health, per crop type
 - In-field anomalies, frost, drought
 - complex criteria on timeseries: Sentinel-2a, CORINE land cover, soil data, climate water balance
- Lead: Spatial Business Integration, Germany
- Using rasdaman in realtime; Germany ~1h







Radio Networks Planning



Telefonica: series of 3D x/y/t datacubes of their German mobile networks

- original ground resolution
- space/time coverage analysis
- Analytics & marketing (!)

[o2online.de/netz]



Über 44 Mio. Mobilfunkanschlüsse. Das O₂ Netz verbindet die meisten Menschen in Deutschland.

Warum wollen wir über das Netz sprechen? Das O₂ Netz ist so gut wie noch nie.

Beim größten 4G-Ausbau der Unternehmensgeschichte hat O, alleine im Jahr 2020 11.000 zusätzliche 4G-Sender installiert.

Dank dieser Investitionen versorgt das O, Netz bundesweit zusätzliche 7 Millionen Menschen mit schnellem 4G und erreicht insgesamt 99 Prozent der Haushalte in Deutschland.

Überzeuge dich selbst und sieh hier die Entwicklung der LTE-Versorgung über alle Frequenzen, die Telefónica für LTE einsetzt. Die Daten beziehen sich auf den Zeitraum vom Januar 2020 bis April 2021. Je dunkler die Flächen desto länger liegt LTE-Verfügbarkeit vor.

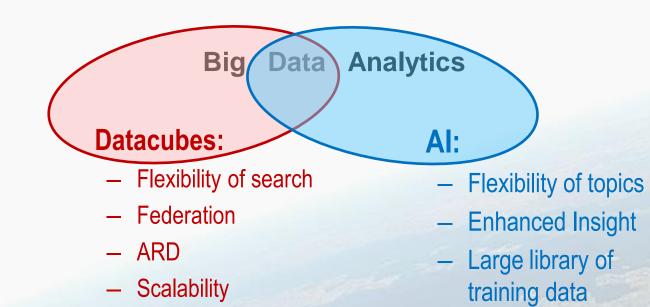


📕 Jan.'20 📕 Juli '20 📕 Dez.'20 📕 April '21



AI + Datacubes





- Tech: disruptive QL-based tensor algebra approach
- User benefit: easier, faster, flexible → basis for Digital Twins: any-time analysis, what-if, ...

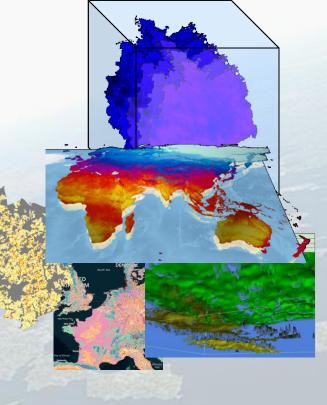


Conclusion

- Datacubes accepted ARD cornerstone
 - Single datacube = homogeneous = ARD
 - *Federations* heterogeneous → EarthServer as enabler
- EarthServer: Critical mass, continuously growing
 - Multi-dozen PB of data, function rich, extensible
 - location-transparent, open standards, coding-free
- Open, free, transparent, democratic
 - quickly growing community
 - Have data? Join! Wanna benefit from data? Join!







Side Event Program



- 17:30 17:45 **Federation: the Next Key Innovation After ARD** Peter Baumann
- 17:45 18:00 **A Federated National Datacube Repository** Chen-Yu Hao, GIS Taiwan
- 18:00 18:15 **Datacubes: a Cloud Operator's Perspective** Jurry del la Mar, T-Systems
- 18:15 18:30 **The Geospatial Data Infrastructure of AWI's Observation to Analytics & Archive Framework** Tilman Dinter, Alfred-Wegener-Institut
- 18:30 18:45 **Datacubes + Al Knowledge Packs = New Service Types** Taras Matselyukh, OPT/NET
- 18:45 19:00 LANDSUPPORT: Towards a Free Integrated Land Decision Support System Fabio Terribile, Universita di Napoli

