TOWARDS TRACEABILITY AND TRANSPARENCY



Rob Roebeling and Joerg Schulz Thanks to CORE-CLIMAX Team

Motivation

•What is at stake?

 History shows that weather observations became useful for society after a lexicon was agreed to
 ✓ The Beaufort scale did this for wind climatology and maritime commerce in the 19th century

•For the Climate Service to benefit society, it must adopt a lexicon that sets expectations, accessible to the public, for openness, process and transparency

✓ How might we define a climate record lexicon useful to both scientists and general public in the 21st century?





Common Climate Observations Building upon Best Practices

Steps to long-term monitoring

- Over the last 20-30 years many investigators have developed methods for seaming together observations with evolving coverage and accuracies
- From these experiences, common elements are emerging on how climate scientists do business
- How do we capture and make available these best practices?





Examples of steps that can be taken

- To evaluate if the Production System follows Best Practices;
- To provide infrastructure to compare the specifications of Data Records (e.g. ECV inventory: http://ecv-inventory.com);
- **To work towards using standards cross different Data Records** (e.g. data format, doi's, aggregation methods, multiple algorithm ensembles..);
- To improve the consistency between Data Records of different ECVs (e.g. clouds, precipitation, temperature and water vapor profiles, ..)
- To identify and address requirements brought up by operational and scientific users

(e.g. nowcasting, numerical weather prediction, climate and weather model analysis, climate monitoring)

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Evaluation of the

Data Record Production Process

- EU Core Climax -

- NOAA-NCDC -

- ESA-CCI -



Three step approach to classify the maturity of ECV CDRs: System Maturity Matrix (SMM)

Evaluates if the production of the ECV CDR follows best practices for science, engineering and utilization;

Data Record Inventories (DRI)

Contains the Product Specification Tables and links to documented information on quality, calibration and inter-calibration *(e.g. ecv-inventory.com);*

Application Performance Metric (APM)

Evaluates the performance of an ECV CDR with respect to a specific application.



Concept - System Maturity Matrix

Has the Are the data Is the Are the data trueness of well used and software and methods robust and the data been user feedback well systematically maintainable? taken care of? documented ? assessed?

Software readiness	Metadata	User documentation	Uncertainty Characterization	Public Access, Feedback, Update	Usage
Are the codes compliant with standards, stable, portable and reproducible?	Do the metadata meet international standards, and allow provenance tracking?	Are the formal documents and peer-reviewed papers up-to-date and public?	Are the uncertainties assessed systematically in a standard manner?	Are the data, source code, and documents publicly available and regularly updated?	Are the data wildly used in the scientific, and decision and policy making communities?



Concept – Application Performance Matrix



Coverage	Sampling	Uncertainty	Stability
Are the record length and spatial coverage meeting the application's requirements?	Do the spatial and temporal sampling meet the applications requirements?	Do the random and systematic uncertainties meet the specifications?	Do the temporal and spatial stability meet the specifications?



Core-Climax System Maturity Matrix Concept

Acknowledgement

We thank ESA CCI, DWD, and CMSAF for testing earlier versions of the maturity matrices and Chris Merchant, University of Reading and John Bates, NOAA/NCDC for useful suggestions.



Core-Climax: System Maturity Matrix

Maturity	SOFTWARE READINESS	METADATA	USER DOCUMENTATION	UNCERTAINTY CHARACTERISATION	PUBLIC ACCESS, FEEDBACK, UPDATE	USAGE
1	Conceptual development	None	Limited scientific description of the methodology available from PI	None	Restricted availability from PI	None
2	Research grade code	Research grade	Comprehensive scientific description of the methodology, report on limited validation, and limited product user guide available from PI; paper on methodology is sumitted for peer- review	Standard uncertainty nomenclature is idenitified or defined; limited validation done; limited information on uncertainty available	Data avaliable from PI, feedback through scientific exchange, irregular updates by PI	Research: Benefits for applications identified DSS: Potential benefits identified
3	Research code with partially applied standards; code contains header and comments, and a README file; PI affirms portability, numerical reproducibility and no security problems	Standards defined or identified; sufficient to use and understand the data and extract discovery metadata	Score 2 + paper on methodology published; comprehensive validation report available from PI and a paper on validation is submitted; comprehensive user guide is available from PI; Limited description of operations concept available from PI	Score 2 + standard nomenclature applied; validation extended to full product data coverage, comprehensive information on uncertainty available; methods for automated monitoring defined	Data and documentation publically available from PI, feedback through scientifc exchange, irregular updates by PI	Research: Benefits for applications demonstrated. DSS: Use occuring and benefits emerging
4	Score 3 + draft software installation/user manual available; 3rd party affirms portability and numerical reproducibility; passes data providers security review	Score 3 + standards systematically applied; meets international standards for the data set; enhanced discovery metadata; limited location level metadata	Score 3 + comprehensive scientific description available from data provider; report on inter comparison available from PI; paper on validation published; user guide available from data provider; comprehensive description of operations concept available from PI	Score 3 + procedures to establish SI traceability are defined; (inter)comparison against corresponding CDRs (other methods, models, etc); quantitative estimates of uncertainty provided within the product characterising more or less uncertain data points; automated monitoring partially implemented	Data record and documentation available from data provider and under data provider's version control; Data provider establishes feedback mechanism; regular updates by PI	Score 3 + Research: Citations on product usage in occurring DSS: societal and economical benefits discussed
5	Score 4 + operational code following standards, actions to achieve full compliance are defined; software installation/user manual complete; 3rd party installs the code operationally	Score 4+ fully compliant with standards; complete discovery metadata; complete location level metadata	Score 4 + comprehensive scientific description maintained by data provider; report on data assessment results exists; user guide is regularly updated with updates on product and validation; description on practical implementation is available from data provider	Score 4 + SI traceability partly established; data provider participated in one inter- national data assessment; comprehensive validation of the quantitative uncertainty estimates; automated quality monitoring fully implemented (all production levels)	Score 4 + source code archived by Data Provider; feedback mechanism and international data quality assessment are considered in periodic data record updates by Data Provider	Score 4+ Research: product becomes reference for certain applications DSS: Societal and economic benefits are demonstrated
6	Score 5 + fully compliant with standards; Turnkey System	Score 5 + regularly updated	Score 5 + journal papers on product updates are and more comprehensive validation and validation of quantitative uncertainty estimates are published; operations concept regularly updated	Score 5 + SI traceability established; data provider participated in multiple inter- national data assessment and incorporating feedbacks into the product development cycle; temporal and spatial error covariance quantified; Automated monitoring in place with results fed back to other accessible information, e.g. meta data or documentation	Score 5 + source code available to the public and capability for continuous data provisions established (ICDR)	Score 5 + Research: Product and its applications becomes references in multiple research field DSS: Influence on decision and policy making demonstrated



Core-Climax: Main Matrix and Sub Matrices

	SOFTWARE READINESS	METADATA	USER DOCUMENTATION	UNCE CHARAT	RTAINTY ERISATION	PUBLIC ACCESS, FEEDBACK, UPDATE	USAGE		
	Coding standar	ds	Software Documen	tation	Numerio an	cal Reproducibility d Portability	Security		
0	No coding standard or g identified or define	uidance ed	No documentatio	n	٦	Not evaluated	Not evaluated		
2	Coding standard or guid identified or defined, but n	lance is ot applied	Minimal documenta	tion	PI affirms reproducibility under identical conditions		PI affirms no security problems		
3	Score 2 + standards are partially applied and some compliance results are available		Header and process description (comments) in the code, README complete		PI affirm	ns reproducibility and portability	Submitted for data provider's security review		
4	Score 3 + compliance is sys checked in all code, but compliant to the stand	stematically not yet dards.	Score 3 + a draft Soft Installation/User Ma	tware nual	3rd party af	firms reproducibility and portability	Passes data provider's security review		
5	Score 4 + standards are systematically applied in all code and compliance is systematically checked in all code. Code is not fully compliant to the standards. Improvement actions to achieve full compliance are defined.Score 4 + enhanced process descriptions throughout the code; software installation/user manual completeScore 4 + 3rd party can install the complete			Continues to pass the data provider's review					
6	Score 5 + code is fully com standards.	pliant with	As in score 5		Score 5	5 + Turnkey system	As in score 5		



Main Matrix and Sub Matrices

	SOFTWARE READINESS	METADATA	USER DOCUMENTATION	UNCERTAINTY CHARATERISATION	PUBLIC ACCESS, FEEDBACK, UPDATE	USAGE		
	Stand	lards	Collect	ion level	File level			
0	No standard considered		N	one	None			
2	No standard	considered	Lir	nited	Limited			
3	Metadata standards identified and/or defined but not systematically applied		Sufficient to use data independ assistance; Suffici to extract discov meta data	and understand the dent of external ent for data provider ery metadata from repositories	Sufficient to use and understand data independent of external assistance			
4	Score 3 + standards systematically applied at file level and collection level by data provider. Meets international standards for the dataset		atically tion level Score 3 + Enhanced discovery national metadata set		Score 3 + Limited location (pixel, station, grid-point, etc.) level metadata			
6	Score 4 + meta data standard compliance systematically checked by the data provider		Score 4 + Cor metadata mer star	nplete discovery ets international ndards	Score 4 + Complete locat station, grid-point, etc metadata	ion (pixel, .) level		
6	Scor	re 5	Score 5 + Re	gularly updated	Score 5			



Main Matrix and Sub Matrices

	SOFTWARE READINESS	METAD	ATA	USER DOCUMENTATION	UNCE CHARAT	RTAINTY ERISATION	PUBLIC ACCI FEEDBACK, UP	ESS, PDATE	USAGE
	Formal description scientific methodol	of ogy	Fo	ormal Validation Re	eport	Formal P G	roduct User uide	Forma opera	l description o tions concept
0	Limited scientific description of methodology available from PI		None		None		None		
2	Comprehensive scientific description available from PI and Journal paper on methodology submitted		Report on limited validation available from PI		Limited product user guide available from PI			None	
3	Score 2 + Journal paper on methodology published		Report on comprehensive validation available from PI; Paper on product validation submitted		Comprehensive User Guide available from PI		Limite operatior	ed description of is concept availab	
4	Score 3 + Comprehensive scientific description available from Data Provider		Repo CDRs, Prov	rt on inter-comparison etc. Available from PI ider; Journal paper on validation published	to other and data product	Score 3 + data	available from provider	Comprehe operatior	ensive description is concept availab
6	Score 4 + Comprehensive s description maintained by provider	omprehensive scientific n maintained by data provider Score 4 + Report on data assessment results exists		sessment	Score 4 + regularly updated by data provider with product updates and/or new validation results		Operat descri implem	ions concept and ption of practical entation available	
6	Score 5 + Journal papers on product updates published			ore 5+ Journal papers rehensive validation, e riance, validation of qu certainty estimates pul	more .g., error alitative plished	Sc	core 5	Score 5 + reg	Operations conce ularly updated



Main Matrix and Sub Matrices

	SOFTWARE READINESS ME	ETADATA	USER DOCUMENTATION	UNCERTAINTY CHARATERISATION	PUBLIC A FEEDBACK,	CCESS, UPDATE	USAGE
	Standards	۱	/alidation	Uncertainty quant	tification	Auton M	nated Quality onitoring
0	None		None	None			None
2	Standard uncertainty Va nomenclature is identified or refere defined		Standard uncertaintyValidation using externalLimited information on uncertaintynomenclature is identified or definedreference data done for limited locations and timesLimited information on uncertaintyeffects in the measurement		Limited information on uncertainty arising from systematic and random effects in the measurement		None
8	Score 2 + Standard uncertainty nomenclature is applied	Validati reference and temp locat	ion using external data done for global poral representative tions and times	Comprehensive information on uncertainty arising from systematic and random effects in the measurement		Methods fo moni	or automated quality toring defined
4	Score 3 + Procedures to establish SI traceability are defined	Score 3 - against c (other me	+ (Inter)comparison corresponding CDRs ethods, models, etc)	Score 3 + quantitative uncertainty provided product characterising uncertain data p	estimates of within the more or less points	Score 3 + a partial	utomated monitoring ly implemented
6	Score 4 + SI traceability partly established	Score 4 particip nationa	4 + data provider bated in one inter- l data assessment	Score 4 + temporal and spatial error covariance quantified		Score 3 implemer	+ monitoring fully ited (all production levels)
6	Score 5 + SI traceability established	Score 4 participat national d incorporati product	4 + data provider ed in multiple inter- lata assessment and ng feedbacks into the development cycle	Score 5 + comprehensive validation of the quantitative uncertainty estimates and error covariance		Score 5 + a in place wit other access meta data	utomated monitoring h results fed back to sible information, e.g. a or documentation



		SOFTWARE READINESS	METADATA	US DOCUME	ER ENTATION	UNCERTAINTY CHARATERISATION	PUBL FEEDBA	IC ACCESS, ACK, UPDATE	USAGE	
	Pu	blic Access/Archive	Versi	on	Usei	r Feedback Mechani	ism	Updat	es to Record	
0	C t	Data may be available Through request to PI	None	None		None		None		
2	Da	ta available through PI	Preliminary v by P	Preliminary versioning by PI		cts and evaluates feedback from scientific community		Irregularly by PI following scientific exchange and progress		entific
8	Da arch	ata and documentation ived and available to the public from PI	Versioning	Versioning by PI		PI and Data provider collect and evaluate feedback and from scientific community		Irregularly by exchang	PI following sci ge and progress	entific
4	Da arch pu	ata and documentation ived and available to the blic from Data Provider	Version c institutior	ontrol nalised	Data p mechani advisory utilis	a provider establishes feedback anism such as regular workshops, ry groups, user help desk, etc. and tilises feedback jointly with PI		Regularly by established f	PI utilising input eedback mecha	: from nism
6	S arc	icore 4 + source code chived by Data Provider	Fully establish control consi aspec	Fully established version control considering all aspects		shed feedback mechanism and tional data quality assessment are considered in periodic data record updates		Regularly operationally by data provider as dictated by availability o new input data or new methodology following user feedback		lata pility of dology
6	S ava	icore 5 + source code ilable to the public from Data Provider	Not us	Not used		Established feedback m national data quality ass re considered in continuo s (Interim Climate Data	echanism essment ous data Records)	Score 5 + improvemen provisions e Climate	capability for fa ts in continuous established (Inte e Data Records)	ıst data erim



SOFTV READI	VARE NESS	METADATA	USER DOCUMENTATION	UNCERTAINTY CHARATERISATION	PUBLIC ACCESS, FEEDBACK, UPDATE	USAGE
		Resear	ch	Decision S	Support System	
0		None			None	
2	Benefits for research applications identified			Potential b	enefits identified	
8	Benefits f	or research applic by publica	cations demonstrated ation	Use occurring a		
4	Score 3 +	 Citations on pro 	duct usage occurring	Score 3 + societal di	and economical benefits iscussed	
6	Score 4 + product becomes reference for certain applications			Score 4 + societal den		
6	Score 5 + Product and its applications becomes references in multiple research field			Score 5 + influence o making	n decision (including polic demonstrated	;y)



Examples of Typical Maturity Matrices



USER

UNCERTAINTY

PUBLIC ACCESS,

USAGE

MATURITY SOFTWARE

METADATA

Fig: Typical SMM for a dataset from an operational provider (e.g. FCDR)

Fig: Typical SMM for a dataset from an scientific provider(e.g. TCDR)



Maturing Takes Time!



Fig: Evolution of the SMM levels with time

		ESA SST CCI AV	WHRR L2P long-term p	roduct version 1.0		maturity level as of 201/2014				
		COR	E-CLIMAX System Maturity M	latrix						
Maturity	SOFTWARE READINESS	METADATA	USER DOCUMENTATION	UNCERTAINTY CHARACTERISATION	PUBLIC ACCESS, FEEDBACK, UPDATE	USAGE				
1	Conceptual development	None	Limited scientific description of the methodology available from PI	Non	Restricted availability from PI	Neee				
2	Research grade code	Research grade	Comprehensive scientific description of the methodology, orport on limited validation, and limited product user gaide available from PL paper on methodology is samitted for peer-enview	Standard moertainty accessibilities is identified or defined; limited validation does; limited information on uncertainty available	Data analable from PL, fordback through scientific exchange, irregular spectors by Pl	Research: Benefits for applications identified DSS: Potential benefits identified				
3	Research code with partially applied standards; code contains header and comments, and a README file. PI affirms portability, numerical reproducibility and no security problems	Standards defined or identified; sufficient to use and understand the data and extract discovery metadata	Score 2 + paper on methodology published; comprehensive validation report available from P1 and a paper on validation is solvaitible; comprehensive soor gaide is available from P1; Limited description of operations occept available from P1	Score 2 + standard nonsexchater applied; validation estended to full product data coverage, comprehensive information on uncertainty available; methods for automated monitoring defined	Data and documentation publically available from PI. Seeback through scientific outhange, imputer updates by PI	Research: Benefits for applications demonstrated. DSS: Use occuring and benefits enserging				
4	Score 3 - draft software installation/over manual available; 3rd party affirms portability and numerical reproducibility; passes data providen security review	Score 3 + standards systematically applied; metri international standards for the data set; enhanced discovery metadata; limited location level metadata	Score 3 + comprehensive scientific description available from data previder, report en inter comparisen available from PC, paper es validation published, une guide available from data previder, comprehensive description of operations concept available from P1	Score 3 – procedures to establish 51 traceability are defined; (inter/comparison against corresponding CDRs (other methods, models, ecc); quantitative estimates of accentativy periode within the product characterising more or less uncertain deta points; automated monitoring partially implemented	Data record and documentation evailable from data provider and under data provider's vession control; Data provider establishes feedback mechanism; regular updates by Pl	Score 3 + Research: Citations on product usage in occurring DSS: societal and economical benefits discussed				
5	Score 4 = operational code following standards, actions to achieve full compliance are defined, software installation tour manual complete; 3rd party installs the code operationally	Soere 4+ fully compliant with standards; complete discovery metadata; complete location level metadata	Score 4 + comprehensive scientific description maintained by data provider, report on data assessment results sosists, user guide is regularly updated with updates on product and validations, description on practical implementation is available from data provider	Score 4 + 31 traceability partly established; data provider participated in one inter-national data suscement; comprehensive validation of the quantitative uncertainty estimates, automated quality nomining fully implemented (all production levels)	Score 4 + soure code archived by Data Provider; feedback mechanism and notemational data quality assessment are considered in periodic data record updates by Data Provider	Score 4+ Research: product becomes reference fo certain applications D83: Societal and economic benefits are demonstrated				
6	Score 5 + fully compliant with standards, Turnkoy System	Score 5 + septiarly updated	Score 5 + journal papers on product updates are and more comprehensive validation and validation of quantitative uncertainty estimates are published, operations concept regularly updated	Score 5 + 51 traceability established; data provider participated in multiple inter-antional data assessment and accorporating feedbacks into the produce development, you've, temporal and spatial error covariance quantified; Automated monitoring in place with results fod back to other accessible information, e.g., place with results fod back to other accessible information, e.g.,	Score 5 + source code scalable to the public and capability for continuous data provisions established (ICDR)	Score 5 + Research: Product and its applications becomes references in multiple research field DSS: Influence on decision and policy malarie deconstrated				

TCDR $FSA_CCI SST (~5 vers)$

TCDR CM-SAF Clouds (~12 years)

CLARA-AI Cloud Properties									
	CORE-CLIMAX System Maturity Matrix								
Maturity	SOFTWARE READINESS	METADATA	USER DOCUMENTATION	UNCERTAINTY CHARACTERISATION	PUBLIC ACCESS, FEEDBACK, UPDATE	USAGE			
1	Conceptual development	Nose	Limited scientific description of the methodology realiable from Pl	Nces	Restricted availability from Pl	Nasa			
2	Research grade code	Research grade	Comprehensive scientific description of the methodology, report on limited wildation, and limited product user paids available from PC paper on methodology is samitted for per-environ	Szaskad montainty nonenclature is identified er defined; limited valdation doer, limited information on uncertainty available	Data available from PE, fiedback through scientific exchange, integrale updates by PE	Research: Benefits for applications identified DSS: Potential benefits identified			
3	Research code with partially applied standards, code contains header and comments, and a README file, PI affirms portability, numerical reproducibility and no security problems	Standards defined or identified; sufficient to use and understand the data and extract discovery metadata	Scere 2 + paper on methodology published, comprehensive validation report available from PI and a paper on validation is solvnithed, comprehensive scer- guide is available from PI, limited description of operations occept available from PI	Score 2 + standard non-sectionce applied, validation entended to full product data coverage, comprehensive information on uncertainty available, methods for sutremand monitoring defined	Data and documentation publically available from PI, SeeBack through scientific exchange, impdate topdates by PI	Research: Benefits for applications demonstrated. DSS: Use occurring and benefits enserging			
4	Score 3 – draft software installation toor manual available; 3rd party affirms portability and manerical reproducibility; passes data providens security review	Score 3 + standards systematically applied; meets international standards for the data set; enhanced discovery metadata; limited location level metadata	Score 3 + compositencies scientific description available from data previder, report en inter occupariosa available from PD; paper en validation published; saor guide available from data previder; orcuperbennirve description of operations concept available from PD	Scare 3 – procedures to establish 51 traceability are defined, (introlomparison against corresponding CDRs (other methods, models, mc); quantitative estimates of accentrainty pervided within the product characterising more or less susceinia data poents; automated monitoring partially implemented	Data record and documentation available from data provider and under data provider's version control; Data pervider establishes feedback mechanism; regular updates by Pi	Score 3 + Research: Citations on product usage in occarring DSS: societal and economical benefits discussed			
5	Score 4 + operational code following standards, actions to achieve full compliance are distinct for the in- installation to the manual complex; 3rd party installs the code operationally	Scere 4+ fully compliant with standards; complete discovery metadata; complete location level metadata	Score 4 + comprehensive scientific description maintained by data provider, report on data assessment results mistis, sam gude is regularly updated with updates on product and wildeline, description on practical implementation is available from data provider	Score 4 + SI traceability partly established; data provider participated in one inter-eational data assessment; comprehensive validation of the quantizative ascertainty estimates, automated quality somitoing Bibly implemented (all production levels)	Score 4 + soure code archived by Data Provider; feedback mechanism and international data quality assessment are considered in periodic data record updates by Data Provider	Score 4+ Protect becomes reference for certain applications D83: Scointal and economic benefits are demonstrated			
6	Score 5 + fally compliant with standards; Turnicey System	Score 5 + regularly updated	Scew 5 - journal papers on product taplates are and more comprehensive validations and validation of quantizative nontrianty estimates are published, operations concept regularly updated	Score 5 + 51 transhility established, data provider participated in multiple inter-antienal data suscenses and accorporating feedbacks into the product development cycle, temporal and spatial enco-contrast quantified, Automation denoisioning place with results fod back to other accountible information, e.g. meta data or documentation	Score 5 + source code available to the public and capability for continuous data provisions established (JCDR)	Score 5 + Research: Product and its applications becomes references in multiple research field D33: Influence on decision and policy making demonstrated			



Transparency of the available Data Records Application Performance Metric Concept

Acknowledgement

We thank ESA CCI, DWD, and CMSAF for testing earlier versions of the maturity matrices and Chris Merchant, University of Reading and John Bates, NOAA/NCDC for useful suggestions.



Concept of APM





Target Application Requirements (TAR)

General Query Parameters	Input
Essential Climate Variable (ECV)	<ecv name=""></ecv>
Temporal Sampling	<threshold><break through=""><optimum></optimum></break></threshold>
Horizontal Sampling	<threshold><break through=""><optimum></optimum></break></threshold>
Vertical Sampling	<threshold><break through=""><optimum></optimum></break></threshold>
Temporal Coverage	<threshold><break through=""><optimum></optimum></break></threshold>
Spatial Coverage	region of interest (e.g. Global, Europe, Africa, etc)

Specific Query Parameters	Input
Uncertainties	<threshold><break through=""><optimum></optimum></break></threshold>
Stability	<threshold><break through=""><optimum></optimum></break></threshold>
Statistics	quantities (e.g. mean, error estimate, histograms, etc)
Sensitivity to auxiliary data (Purity)	%
Consistency with other ECVs	<>
Continuity	<>
<other suggestions=""></other>	



Example: Product Specification Table (PST)

ORGANISATION INFORMATION	
Indicator	Example Input
Respondent name	Rainer Hollmann (DWD)
Respondent e-mail	rainer.hollmann@dwd.de
etc	etc

CLIMATE DATA RECORD SPECIFICATIONS	
Indicator	Example Input
Essential Climate Variable (ECV)	cloud water path
Systematic uncertainty (bias)	15%
Random uncertainty (rms)	30%
Temporal Stability	15 g/m2
etc	etc

DOCUMENTATION & DATA ACCESS		
Indicator	Example Input	
Algorithm Theoretical Baseline Document (ATBD) (link)	http://wui.cmsaf.eu/safira/action/viewProduktDetails?id=20288	
etc	etc	



Discussion Common Data Format Common Coding Standards



Common Data Formats and Common Metadata







Common Data Formats and Common Grids



* TCDR: Thematic Climate Data Record

* ECV: Essential Climate Variable



Common grid

Courtesy of Ulrich Hamann , KNMI





Common Coding Standards and I/O concepts





Summary



Summary

- International programs ask transparency and assessments of product production facilities and specifications of product data records (ESA, EU, NCDC, EUMETSAT)
- There is consensus on manner of assessing the maturity of production system
- A pilot on manners of assessing the applicability of data records is starting
- Users ask for more coordination on sharing data formats and metadata





Any Questions?

