



TIGGE-LAM archive development in the frame of GEOWOW

Richard Mladek (ECMWF)

- The group on Earth Observations (GEO) initiated the Global Earth Observation System of Systems (GEOSS)
- GEOWOW, short for “GEOSS interoperability for Weather, Ocean and Water” supports this objective
- GEOWOW’s main challenge is to improve Earth observation data discovery, accessibility and exploitability, and to evolve GEOSS in terms of interoperability, standardization and functionality
- GEOWOW is an EU-funded FP7 (09/2011 – 08/2014)
- Predecessors GENESI-DEC, EuroGEOSS



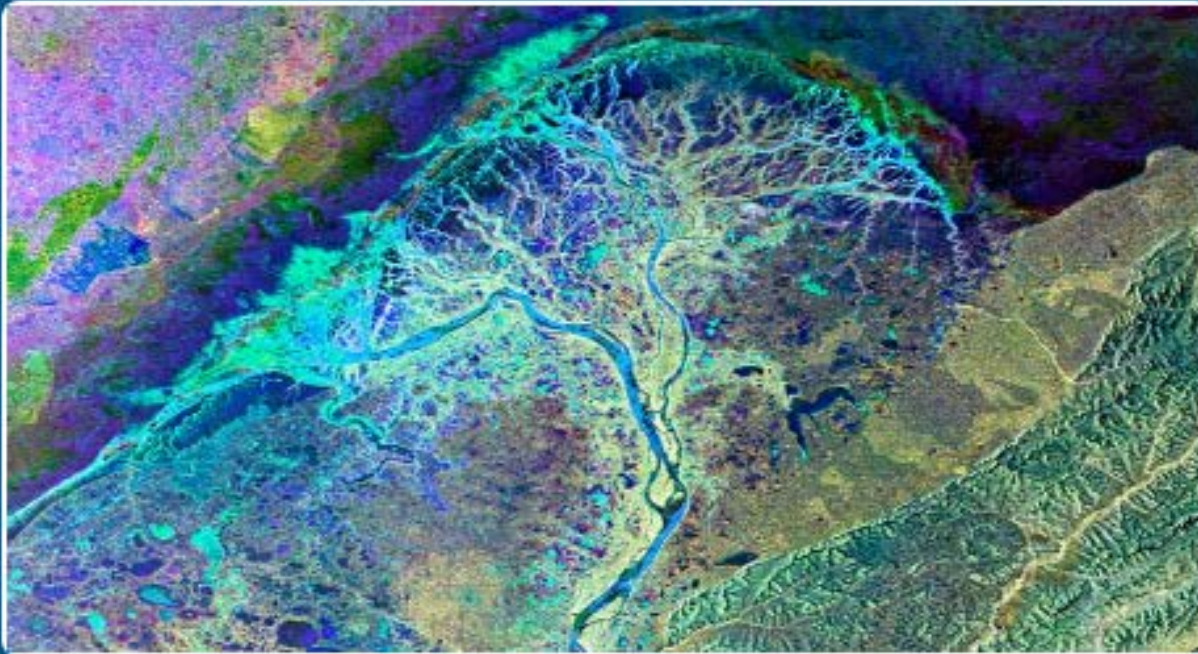
Weather, Ocean, Water SBAs



Related to the Weather Societal Benefit Area (SBA), the THORPEX



The EcoSystems (Oceans) Societal Benefit Area deals with a very fragile environment such as the oceans.



Within the Water Societal Benefit Area, a very heterogeneous landscape of data sources exists. Water related (sensor) data are served through a large variety of interfaces and data formats ranging from CSV files to proprietary web service interfaces based on organisational specific XML formats.

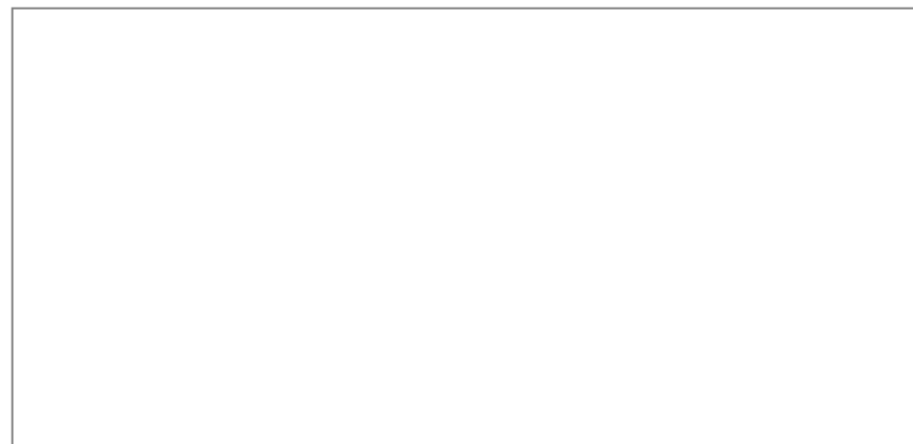


provided by:

provided by:

Geographic Extent

South	-90
West	-180
North	90
East	180



Temporal Extent

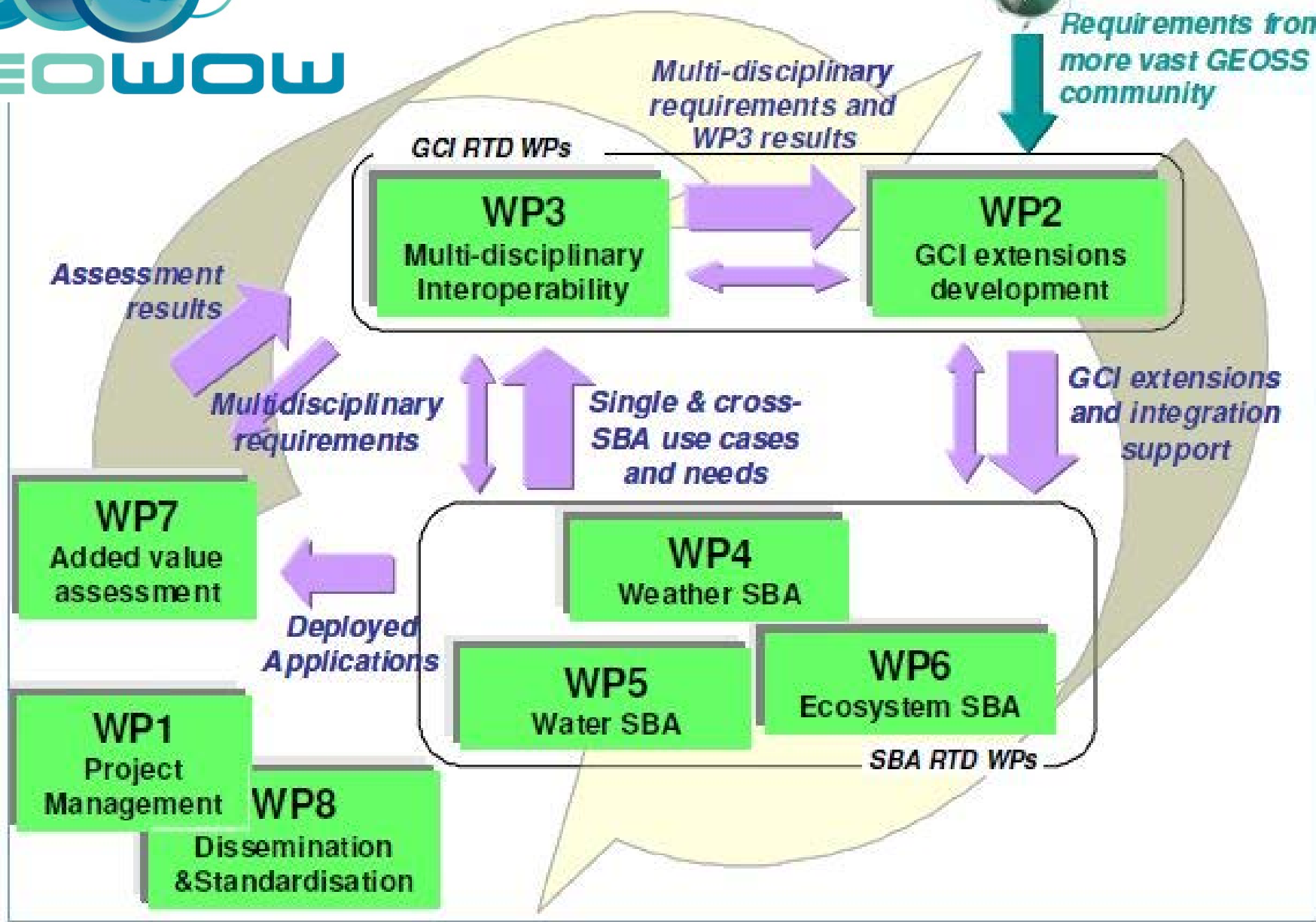
Distribution Information

Linkage	http://apps.ecmwf.int/webmars/data/tiqqe_lam/
Protocol	WWW:LINK-1.0-http--link
Name	THORPEX Interactive Grand Global Ensemble - Local Area Model
Function	information

ER

La

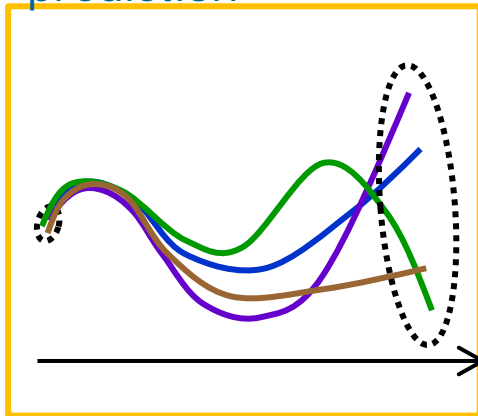
Requirements from more vast GEOSS community



Showcase development

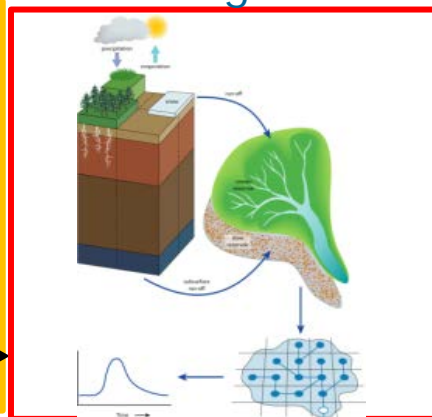
- Demonstrate benefits of improved interoperability
- Enhanced GCI to enable interoperable exchange of (hydrological) observation data, model data; interfaces (e.g. WaterML 2.0) and the Sensor Observation Service (hydrology SOS profile)
- GCI based visualization of discharge forecasts and observations in combination for different forecast ranges, different river catchments, and different ensemble models

EPS Weather prediction



18.-20.11.2013

Hydrological modeling

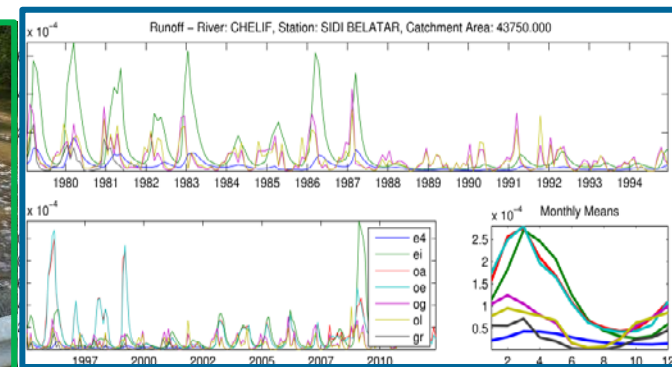


Discharge observations



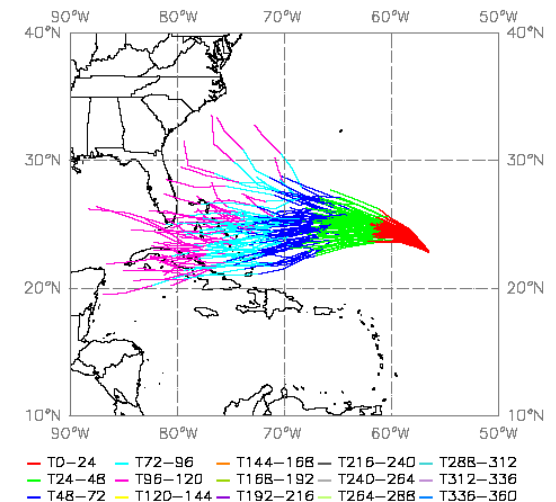
MOS meeting, ECMWF

Validation / visualisation



WP4 (Weather SBA)

- 1. Enhancement of the TIGGE archive** at ECMWF (register data in GCI; adding LAM-EPS outputs; creating time-series archive)
- 2. TIGGE data quality** (bias, calibration, combination)
- 3. Develop and demonstrate EPS-based forecast products** for high-impact weather events
 - tropical cyclones, heavy rainfall, extra-tropical cyclones
 - WMO Severe Weather Forecast Demonstration Project
 - where feasible multidisciplinary use across different GEO Societal Benefit Areas
 - education and training





The THORPEX Interactive Grand Global Ensemble (TIGGE)

- Since 2006 - archival of regular ensemble weather forecasts from 10 leading global Numerical Weather Prediction (NWP) centres
- TIGGE after 7 years - 1 Petabyte of data, 2500 registered users, over 50 peer-reviewed scientific papers

TIGGE Objectives:

- Enhance collaboration on ensemble prediction, both internationally and between operational centres & universities.
- Facilitate research on ensemble prediction methods, especially methods to combine ensembles and to correct systematic errors
- Enable evolution towards a prototype operational system, the “Global Interactive Forecast System”



TIGGE-LAM archive

- The idea to extend the TIGGE archive with ensemble weather forecasts from limited area models has started around 2008, but only recently came to life thanks to **GEOWOW**
- Genealogy of TIGGE-LAM name => TIGGE – Limited Area Modelling
 - TIGGE = THORPEX Interactive Grand Global Ensemble
 - THORPEX = The Observing-System Research and Predictability Experiment
- **ECMWF assignee for GEOWOW & TIGGE-LAM archive**

Florian Pappenberger (accountable), Baudouin Raoult (technical lead), Richard Mladek (archive development), Manuel Fuentes (MARS related development), Shahram Najm (GRIB-API related modifications)



TIGGE-LAM archive

- **10 European data providers confirmed** (MOGREPS , COSMO-LEPS, ALADIN-LAEF, DMI-HIRLAM, GLAMEPS, COSMO-DE-EPS, PEARP, AEMET-SREPS, SRNWP-PEPS, HUNEPS)
- **Archive specification:**
 - Data format: WMO-GRIB2
 - Time step frequency: 3h
 - Grid: original model grid
 - Parameters: mostly so called High Priority surface parameters
 - Model runs: up-to 4 main available (00, 06, 12, 18UTC)
 - Forecast types: perturbed and control (if available)



TIGGE-LAM archive

List of archived parameters

- Instant fields

10m U-velocity, 10m V-velocity, CAPE (not HP), CIN (not HP), MSLP, 2mT, 2m dewpointT

- Accumulated fields

total and large scale precipitation, 10 metre wind gust (in the last 3 hours)

- Static fields

Orography, LSM



TIGGE-LAM archive

Model	Organisation	Approval status	Technical/scientific contact	Coordination contact
MOGREPS	UK Met Office / UK	<u>confirmed</u>	Warren Tenant Thomas Green	Richard Schwinbank
COSMO-LEPS	ARPA-SIM / Italy	<u>confirmed</u>	Andrea Montani	Tiziana Paccagnella
ALADIN LAEF	ZAMG / Austria	<u>confirmed</u>	Florian Weidle	Yong Wang
DMI - HIRLAM	DMI / Denmark	<u>confirmed</u>	Henrik Feddersen	Xiaohua Yang
GLAMEPS	DNMI /Univ Oslo + HIRLAM + ALADIN	<u>confirmed</u>	Inger-Lise Frogner	Xiaohua Yang
COSMO-DE-EPS	DWD / Germany	<u>confirmed</u>	Andreas Roepnack	Christoph Gebhardt
PEARP	Meteo-France / France	<u>confirmed</u>	Philippe Arbogast	
COSMO-SREPS	ARPA-SIM / Italy	currently out of scope	Chiara Marsigli	Tiziana Paccagnella
SREPS	AEMET / Spain + HIRLAM	<u>confirmed</u>	Carlos Santos Burguete	José García-Moya
SRNWP PEPS	DWD / Germany	<u>confirmed</u>	Sebastian Trepte	Michael Buchhold
HUNEPS	OMSZ / Hungary	<u>confirmed</u>	Mile Máté	






TIGGE-LAM archive

Data provider progress status information

Model	Data status	Next milestone	When
MOGREPS	Data checking & tuning.	Complete development phase.	Sep-2013
COSMO-LEPS	Fully operational archiving.	Go for a wine..	
ALADIN-LAEF	Fully operational archiving.	Go for a beer..	
DMI-HIRLAM	Development phase finished.	Start test phase.	Sep-2013
GLAMEPS	Data checking & tuning.	Complete development phase.	Oct-2013
COSMO-DE-EPS	Regular archiving in test mode.	Complete test phase.	Sep-2013
PEARP	Receive the first data sample.	Start development phase.	ASAP
COSMO-SREPS	Discontinued.	Use COSMO-HYBEPS instead.	TBD
AEMET-SREPS	Receive the first data sample.	Start development phase.	ASAP
SRNWP-PEPS	Data checking & tuning.	Complete development phase.	Oct-2013
HUNEPS	Development phase finished.	Start test phase.	Sep-2013

- 1st operationally stored dataset in production mode is COSMO-LEPS (from 01.01.2013)
- 2nd ALADIN-LAEF
- 3rd ? (tough fight)
(COSMO-DE-EPS, HUNEPS, GLAMEPS, PEPS...)

	COSMO-LEPS Andrea Montani	
		
ALADIN-LAEF Florian Weidle		???
		



TIGGE-LAM archive

Challenges

- To archive multi-model ensembles like GLAMEPS or especially PEPS (missing parameters for some models; varying forecast lengths; different model domains; varying EPS size for different run times etc.)
- To achieve homogeneity in TIGGE-LAM archive without major or often repeated gaps (impossibility to re-process all EPS forecasts from the past for some systems = major difference to TIGGE global datasets).



TIGGE-LAM archive

- **Processing and archiving** of LAM data follow the way the TIGGE global archive works
- **Used technologies**
 - Shell / C / python code for data processing and verification
 - SMS(Supervisor Monitor Scheduler) for running of TIGGE-LAM (quasi)operational suite
 - MARS(Meteorological Archive and Retrieval System) for data storage
 - Web or MARS batch interface for data access



TIGGE-LAM archive

Main new developments

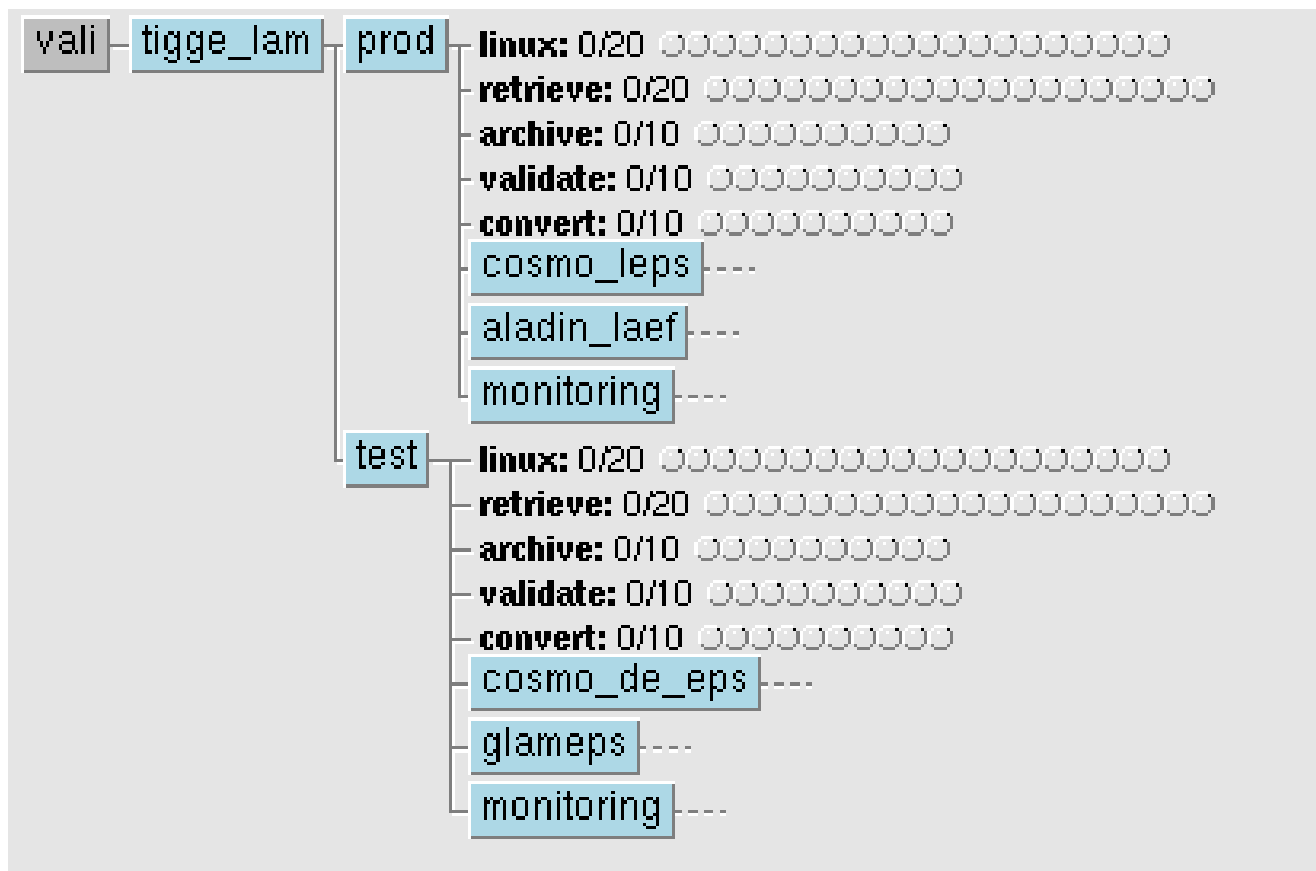
- New conversion tool (using python GRIB-API) used for input LAM-EPS data conversion from GRIB1 to GRIB2
- Update of the GRIB_API tool (development version 11.1.0) to be able to produce GRIB files in TIGGE compliant format (continuity with TIGGE global data format)
- Upgrade of monitoring and data checking tools to avoid data loses and to keep datasets as homogeneous as possible
- Upgrade of user web interfaces allowing well arranged overview of available products and their quick and reliable retrieval



TIGGE-LAM archive

Operational TIGGE-LAM suite

(run at ECMWF as the 1st operational suite under ECFLOW – successor of SMS)





TIGGE-LAM archive

http://apps.ecmwf.int/datasets/data/tigge_lam/



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TIGGE LAM

Note Note: In order to retrieve data from this server, you first have to accept the [conditions of use](#).

Select a date in the interval 2013-01-01 to 2013-09-20

Start date:

End date:

[Reset](#)

Select origin and time

	aladinlaef-zamg-eu	cosmoleps-arpasimc-eu
00:00:00	<input type="checkbox"/>	<input type="checkbox"/>
12:00:00	<input type="checkbox"/>	<input type="checkbox"/>

[Select All](#) or [Clear](#)

Select number

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

[Select All](#) or [Clear](#)

Select step

0 3 6 9 12 15 18 21 24 27 30 33 36 39 42
 45 48 51 54 57 60 63 66 69 72 75 78 81 84 87
 90 93 96 99 102 105 108 111 114 117 120 123 126 129 132

[Select All](#) or [Clear](#)

Select parameter

10 metre U wind component 10 metre V wind component 10 metre wind gust in the last 3 hours
 2 metre dewpoint temperature 2 metre temperature Convective available potential energy
 Convective inhibition Land-sea mask Large scale precipitation
 Mean sea level pressure Orography Total Precipitation

[Select All](#) or [Clear](#)

Note Note: In order to retrieve data from this server, you first have to accept the [conditions of use](#).



TIGGE-LAM archive

<http://tigge.ecmwf.int/tigge/d/inspect/tigge/tigge/monitoring/lam/prod>

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Perturbed forecast

Forecast type
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Parameter **Step (-> valid time)**

Run
12

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[Step \(-> valid time\)](#)
[Run](#)

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2 metre temperature (sfc), step 0, run 0 UTC, level 2, 20130919, pf1, PROD

aladinlaef-zamg-eu [262.787 , 299.928]

cosmoleps-arpasimc-eu [270.938 , 301.785]



TIGGE-LAM archive

http://tigge.ecmwf.int/tigge/d/tigge_lam_history

	aladinlaef-zamg-eu 00Z	aladinlaef-zamg-eu 12Z	cosmoleps-arpasimc-eu 00Z	cosmoleps-arpasimc-eu 12Z
2013-01-01			starting 7184 fields	starting 7184 fields
2013-06-03	starting 3521 fields	starting 3521 fields		
2013-06-26	1054 missing fields	1054 missing fields		
2013-06-27	1054 missing fields	1054 missing fields		
2013-06-28	1054 missing fields	1054 missing fields		
2013-06-29	1054 missing fields	1054 missing fields		
2013-06-30	1054 missing fields	1054 missing fields		
2013-07-01	1054 missing fields	1054 missing fields		
2013-07-02	1054 missing fields	1054 missing fields		
2013-07-03	1054 missing fields	1054 missing fields		
2013-07-04	1054 missing fields	1054 missing fields		
2013-07-05	1054 missing fields	1054 missing fields		
2013-07-09		680 new fields		
2013-07-10	680 new fields			
2013-09-20				



TIGGE-LAM T-S archive

Building a multi-model EPS time-series dataset (Global and LAM)

- The aim is significantly increase the accessibility of the TIGGE and TIGGE-LAM archives for a wider community
- Currently it's not easy to perform research on long time-series without retrieving all the original fields
- Only selection of points (SYNOP, METAR, etc.) and a subset of original TIGGE parameters will be archived
- All global TIGGE data will be back-archived since 2006



TIGGE-LAM T-S archive

Important decisions before building the T-S archive (still open for discussion)

- **Location list:** GTS synop locations (for global data) + selected special points of interest (mainly for HR LAM-EPS datasets)
- **Method for getting model forecast for given location:** current proposal is to archive halo of 4 surrounding nearest model grid point values sorted according to their distance to the point location + some additional information (land-sea mask, orography, distance from the point location)
- **Parameter list:** current proposal is to archive basically all surface parameters as in TIGGE-LAM i.e. mostly so called High Priority parameters
- **Data archival format** - NetCDF format is currently being tested and is the most probable candidate



TIGGE-LAM followers

- **UERRA** project ("Uncertainties in Ensembles Regional Re-Analyses")
 - 2014-2018
 - follow up EURO4M (European Reanalysis and Observations For Monitoring)
- **S2S** (Sub-seasonal To Seasonal prediction project)
 - 2013-2018



Summary

- Since October 2006, the TIGGE archive has been accumulating regular ensemble forecasts from leading global NWP centres.
- TIGGE provides the basis for research and development projects targeted at specific applications of severe weather forecasts (health, energy, flood warning, wind storms, fire weather, etc...).
- GEOWOW will extend TIGGE archive with limited area ensemble forecasts
- GEOWOW will improve access to TIGGE data to wider user community (registration in GCI; T-S archive)
- GEOWOW will develop EPS based products for early warnings of severe weather; collaboration with WMO SWFDP



Links

General information

- <http://www.geowow.eu>
- <http://tigge.ecmwf.int>
- <https://software.ecmwf.int/wiki/display/TIGGE/TIGGE-LAM>
- <https://software.ecmwf.int/wiki/display/TIGGE/TIGGE+EPS+time-series+archive>

Geo portal (GCI interface)

- http://www.geoportal.org/web/guest/geo_home

TIGGE-LAM Data portal

- http://apps.ecmwf.int/datasets/data/tigge_lam/

Thank you!

