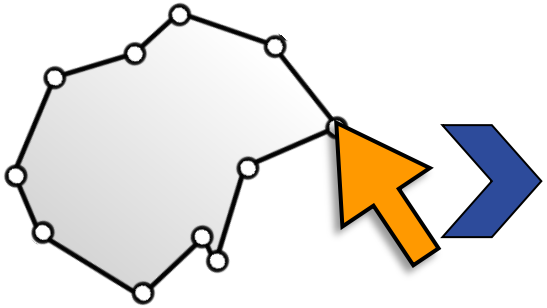
CAP Implementation Workshop 2018

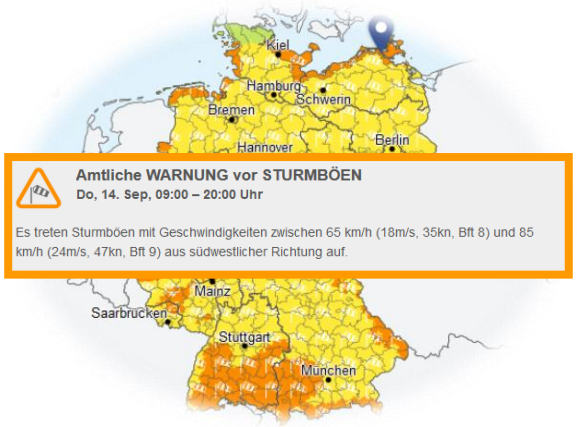
CAP
Implementation at Deutscher Wetterdienst

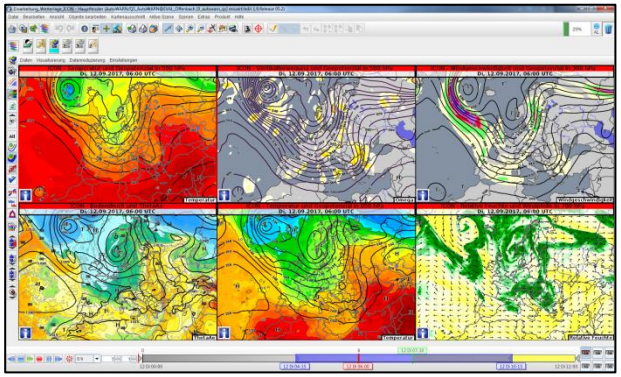
Martin Klink

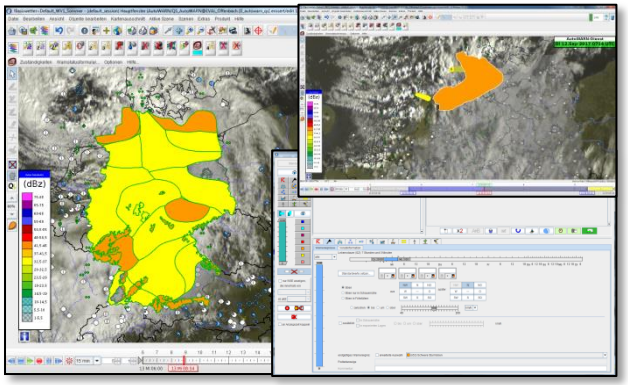
German National Weather Service (DWD)

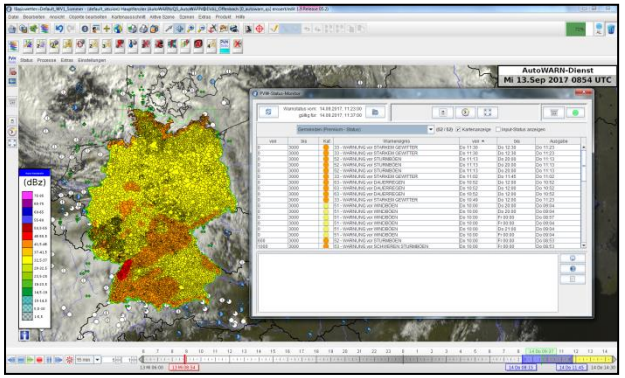
Warning System of the DWD







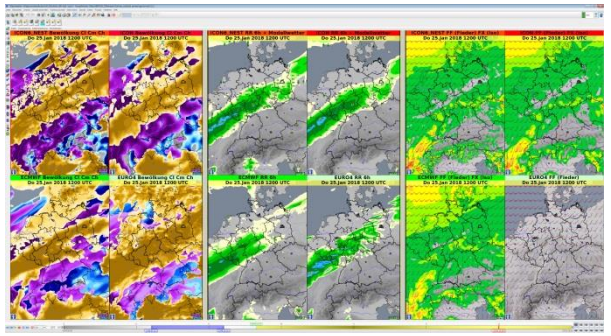


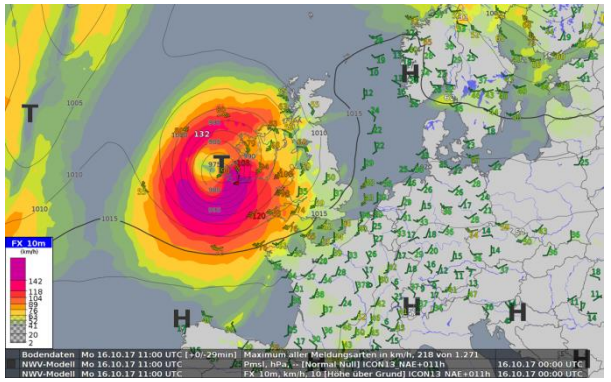


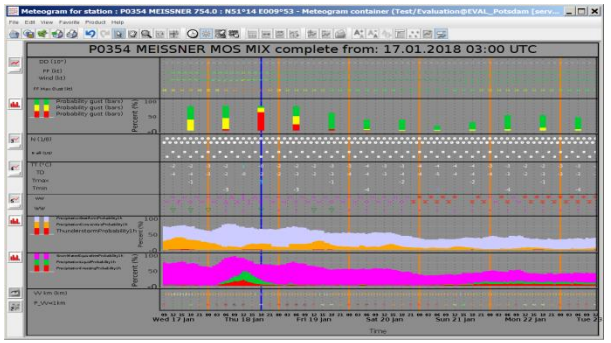
Warning System of the DWD

based on the NinJo Meteorological Workstation:

- observation data
- satellite data
- radar measurements
- nowcasting products (e.g. NowCastMix),
- numerical weather prediction (ICON, ECMWF-IFS, COSMO-DE, GFS, …)
- …



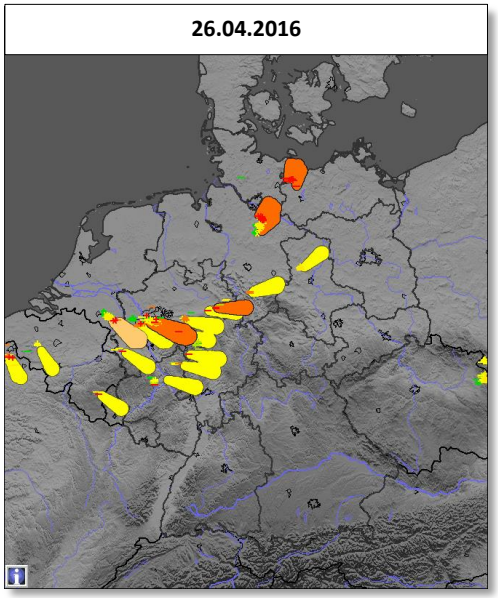




Warning System of the DWD

automatic warning proposal generation:

- proposals are alert like data units which are used as aid or basis for warning creation
- proposals are integrated into the meteorological workstation and used by the forecasters
- proposals are generated from:
  - numerical model data
  - nowcasting
  - observation data



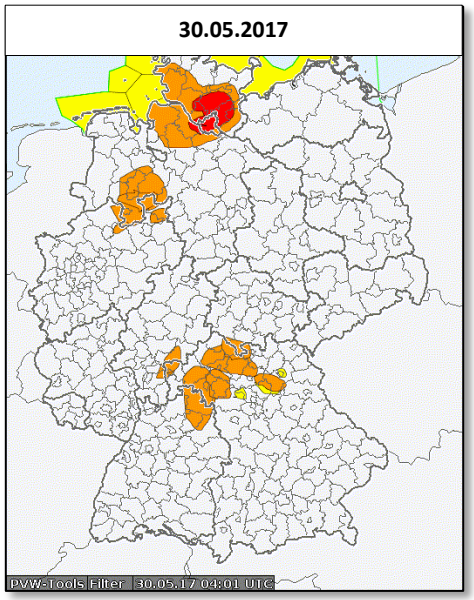
automatic proposals

Warning proposals are exchanged using CAP

Warning System of the DWD

DWD forecaster - warning status editing :

- national warning center in Offenbach (nationwide guidance)
- 6 regional centers (Hamburg, Potsdam, Essen Leipzig, Stuttgart, Munich)
- integrated into the meteorological workstation
  - modification of proposals
  - manual creation of warning data
- resulting in a complete status over Germany containing structured information/data about potential hazards („polygons with meteorological attributes and alert attributes“)

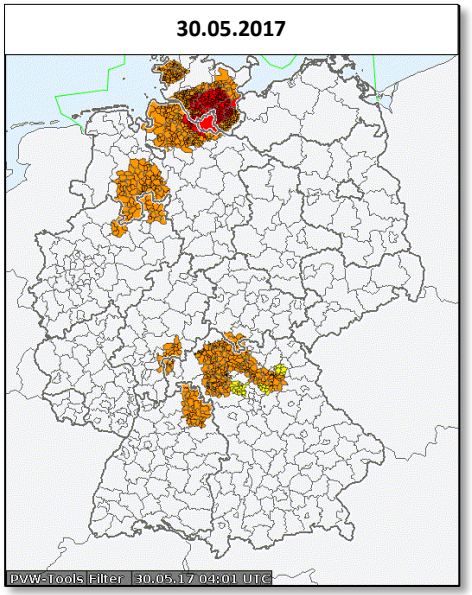


semi-automatic warning status

Warning System of the DWD

automatic product generation and distribution:

- automatic transformation of the warning status and warnings from legacy sources
- resulting in the representation of a warning for a specific audience/purpose (e.g. an image on a website, CAP Alert, …)
- automatic distribution to DWD WarnWetter app, FAX/SMS customers, DWD CAP feeds, DWD OpenData server (https://opendata.dwd.de/) , DWD WFS/WMS (https://maps.dwd.de), other applications



automatic warning products

CAP is the most important exchange format for warning products in DWD

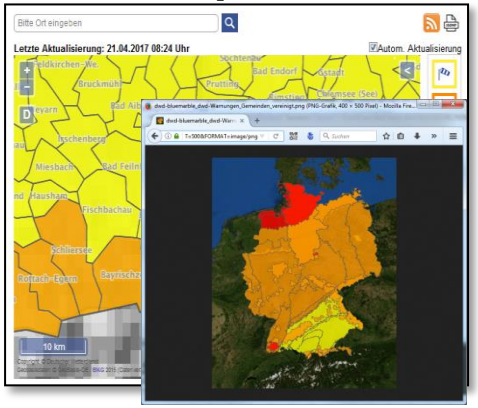
CAP usage for Warnings at DWD

visualizations / apps

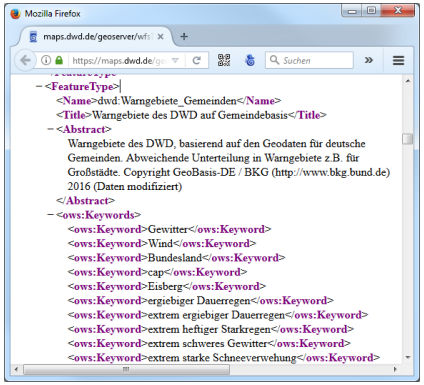
CAP feeds

public service broadcasting

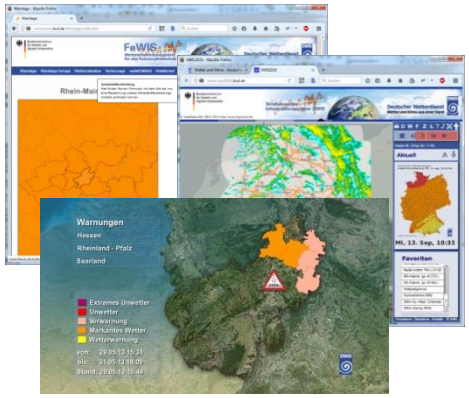
Web Map Service



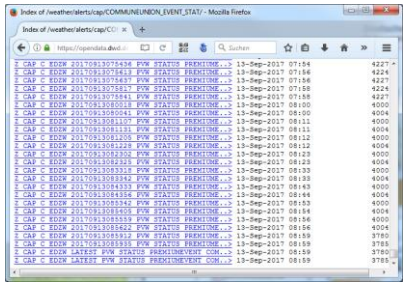
Web Feature Service



FeWIS / SWIS / TriVis



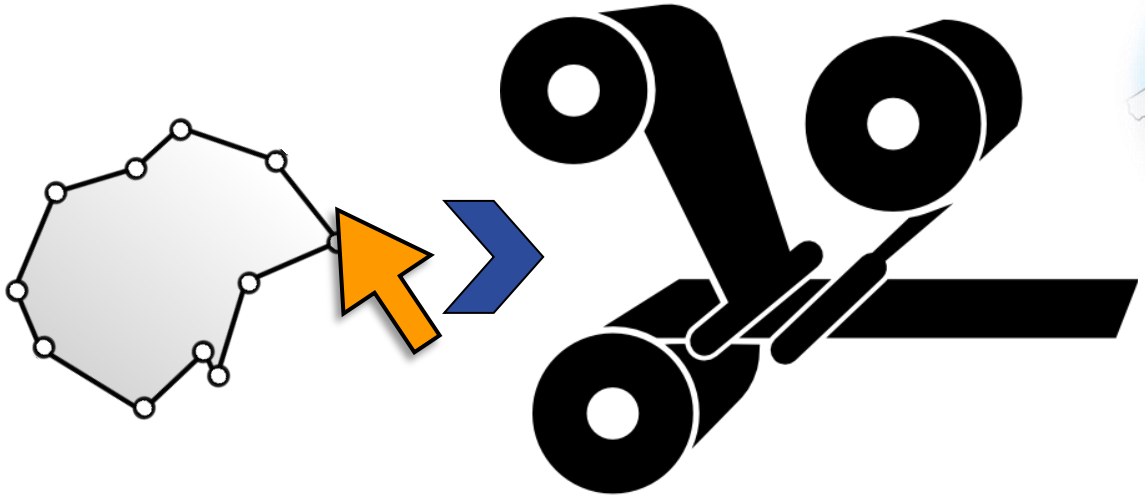
Open Data

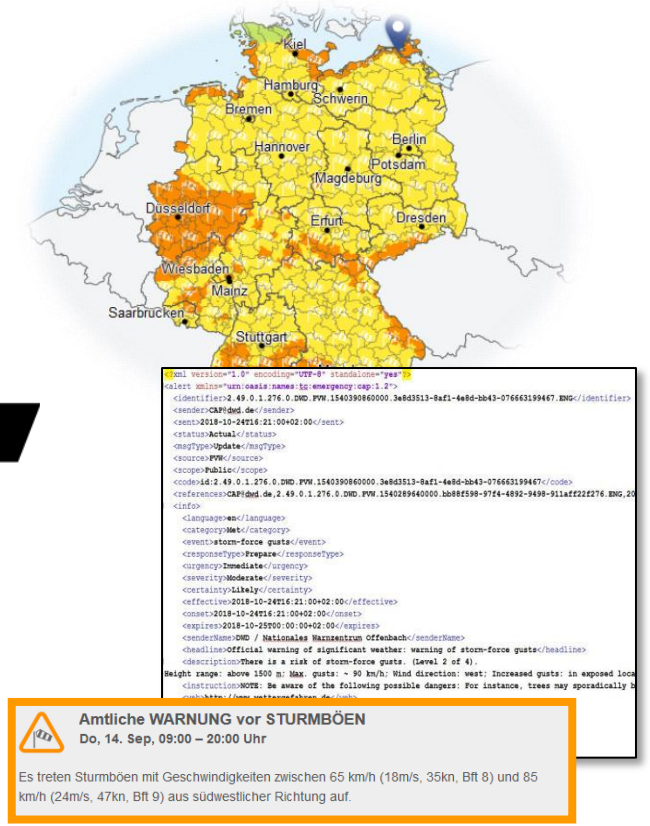


Distribution Channels for DWD Warnings

- DWD warnings are available through multiple distribution channels:
  - **CAP-feeds**: ATOM and RSS CAP feeds available via HTTPS at
    https://www.dwd.de/DWD/warnungen/cap-feed/de/atom.xml
    https://www.dwd.de/DWD/warnungen/cap-feed/de/rss.xml
    https://www.dwd.de/DWD/warnungen/cap-feed/en/atom.xml
    https://www.dwd.de/DWD/warnungen/cap-feed/en/rss.xml
  - **GeoServer**: OGC Compliant GeoWebServices, such as the Web Map Service (WMS) and Web Feature Service (WFS) available at https://maps.dwd.de
  - **Open Data Server**: CAP, SMS, text warnings available at https://opendata.dwd.de/weather/alerts/
  - **DAVID:** automatic distribution via SMS, FAX and eMail, recipients are fire departments, government (provincial, federal, state), civil protection, media,
  - **Automatic File Distributer (AFD):** FTP-Push Distribution for all products, BBK, Katwarn, International Customers, DWD GeoWebServices

Warning Product Generation in DWD



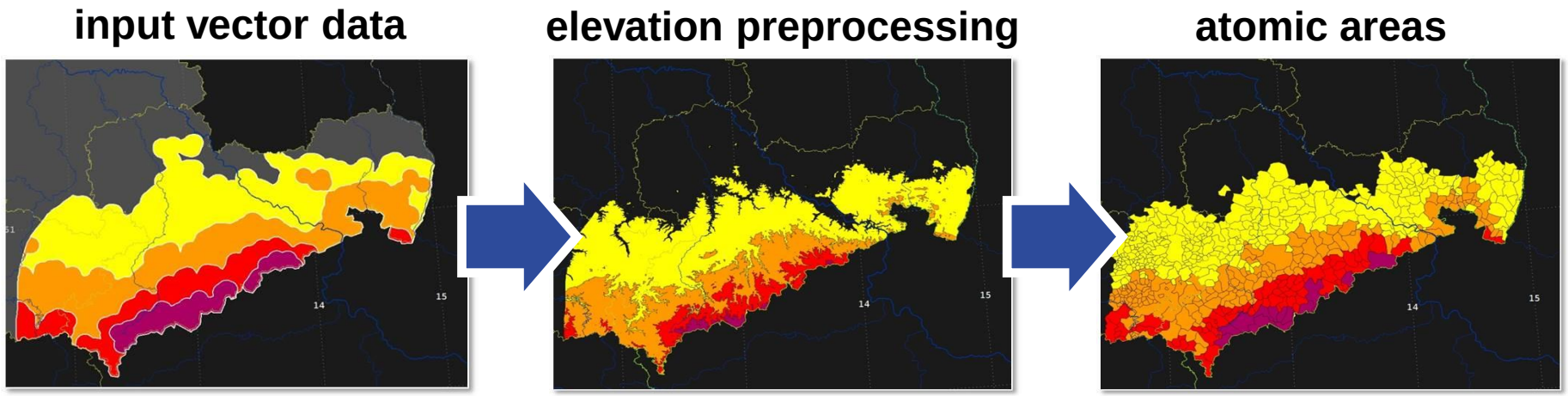


Warning Product Generation - Overview

- DWD uses an automatic **W**arning**P**roduct**G**enerator (**WPG**) to create public warnings
- distinguishes between a warning status (“abstract data”) and a warning product
  - the forecaster creates a polygon **only once**, but the WPG creates and manages a **wide range of warning products**
- the input for product generation can come from a variety of **different sources** (manual, semi-automatic, automatic) and is **processed in a unified manner** to create standardized warnings.
- in routine production three sources are used for public warnings
  - warning status (attributed meteorological events, text modules for special cases)
  - sea/coastal events (RSZ Hamburg, CAP)
  - health events Heat/UV (ZMMF Freiburg, CAP)

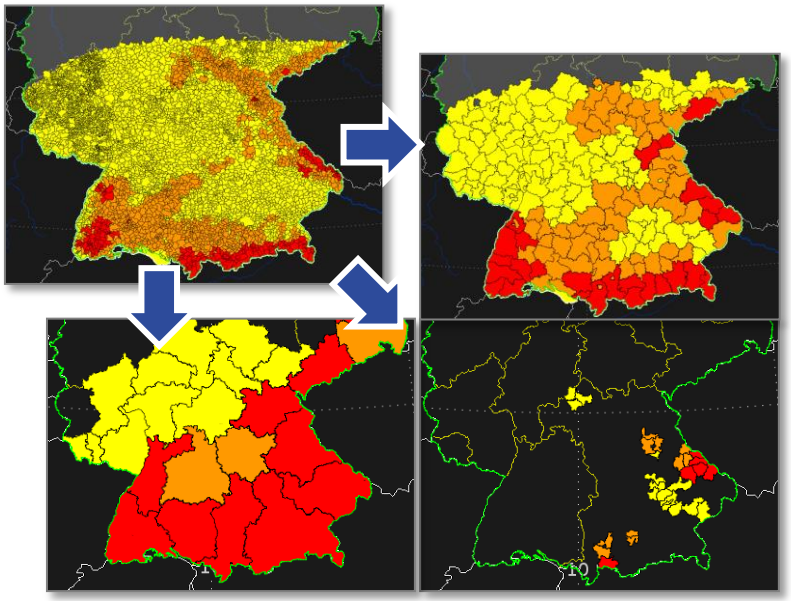
Warning Product Generation

- WPG **maps** the polygons and area IDs of all imported events to low level („atomic“) geographic areas (currently: municipalities and urban quarters) using fine grained elevation data
- WPG creates **consistent information** for each atomic cell by resolving consistency issues (such as overlapping events or simultaneous events) with a rule-based approach
- for status-based systems that do not provide information about updated events, **updates and references** are derived



Warning Product Generation

- WPG derives further data with different content, spatial resolution, informational granularity and different update behavior from the atomic level
- WPG creates products from the derived data with different languages and export formats



Text Products (FAX, email, SMS, …)

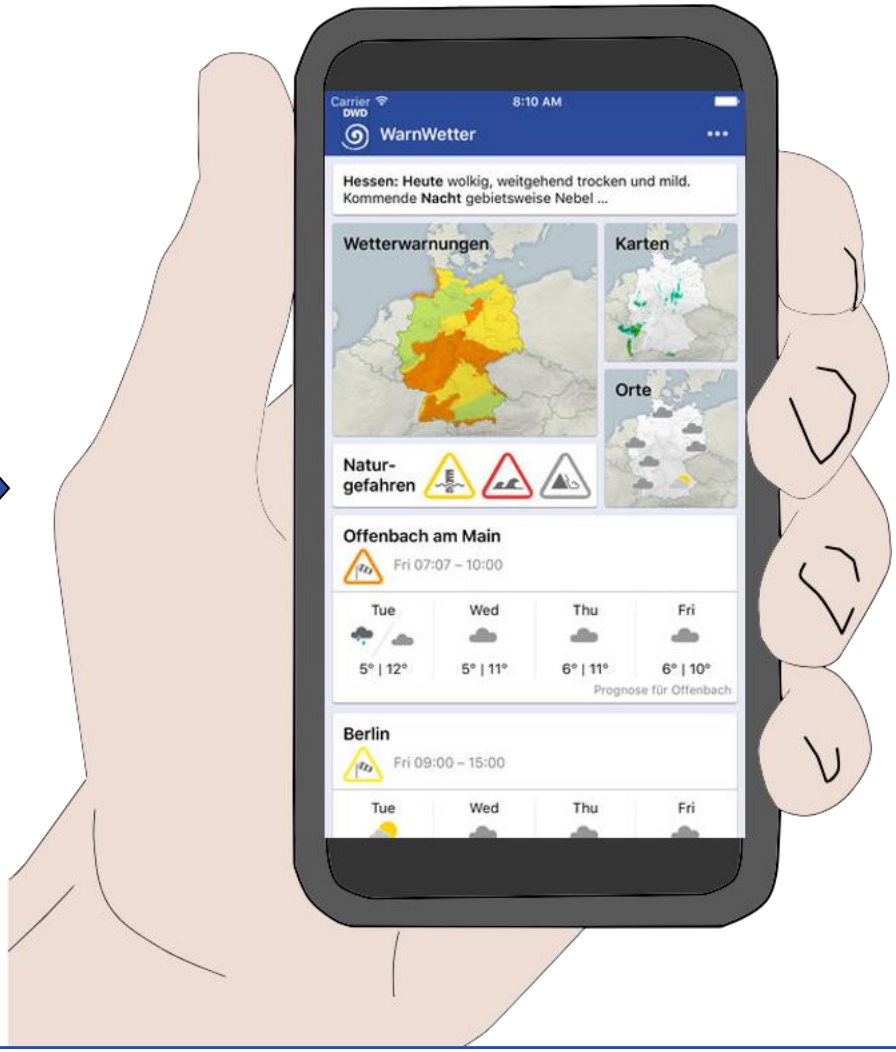
DWD WETTERWARNUNG: STURMBÖEN in Ostalbkreis über 600m

CAP v1.2

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<alert xmlns="urn:oasis:names:tc:emergency:cap:1.2"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="urn:oasis:names:tc:emergency:cap:1.2
https://werdis.dwd.de/conf/CAP-DWD-Profil-v2.1.xsd">
…
<headline>Official warning of significant weather: warning of storm-
force gusts</headline>
…
```

CAP-based Push Notifications

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<alert xmlns="urn:oasis:names:tc:emergency:cap:1.2">
  <identifier>2.49.0.1.276.0.DWD.PVW.1540390860000.3e8d3513-8af1-4e8d-bb43-076663199467.ENG</identifier>
  <sender>CAP@dwd.de</sender>
  <sent>2018-10-24T16:21:00+02:00</sent>
  <status>Actual</status>
  <msgType>Update</msgType>
  <source>PVW</source>
  <scope>Public</scope>
  <code>id:2.49.0.1.276.0.DWD.PVW.1540390860000.3e8d3513-8af1-4e8d-bb43-076663199467</code>
  <references>CAP@dwd.de,2.49.0.1.276.0.DWD.PVW.1540289640000.bb88f598-97f4-4892-9498-911aff22f276.ENG,20
  <info>
    <language>en</language>
    <category>Met</category>
    <event>storm-force gusts</event>
    <responseType>Prepare</responseType>
    <urgency>Immediate</urgency>
    <severity>Moderate</severity>
    <certainty>Likely</certainty>
    <effective>2018-10-24T16:21:00+02:00</effective>
    <onset>2018-10-24T16:21:00+02:00</onset>
    <expires>2018-10-25T00:00:00+02:00</expires>
    <senderName>DWD / Nationales Warnzentrum Offenbach</senderName>
    <headline>Official warning of significant weather: warning of storm-force gusts</headline>
    <description>There is a risk of storm-force gusts. (Level 2 of 4).
Height range: above 1500 m; Max. gusts: ~ 90 km/h; Wind direction: west; Increased gusts: in exposed loca
    <instruction>NOTE: Be aware of the following possible dangers: For instance, trees may sporadically b
    <web>http://www.wettergefahren.de</web>
    <contact>Deutscher Wetterdienst</contact>
    <parameter>
      <valueName>gusts</valueName>
      <value>~90 [km/h]</value>
```



CAP-based Push Notifications

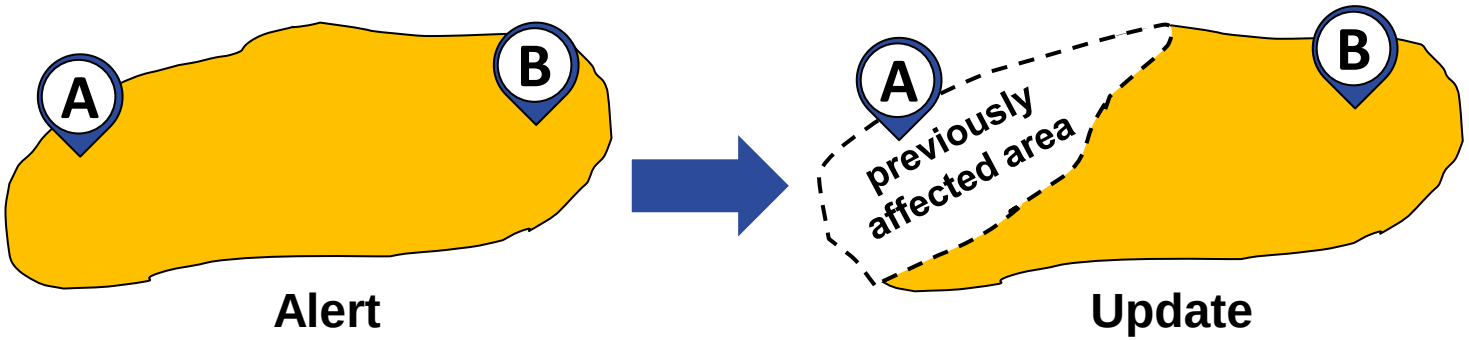
- **Task:**
  - push warnings to a user/device at a specific location
- **Solution:**
  - push every time you receive a CAP message affecting the user's location

What about updates?

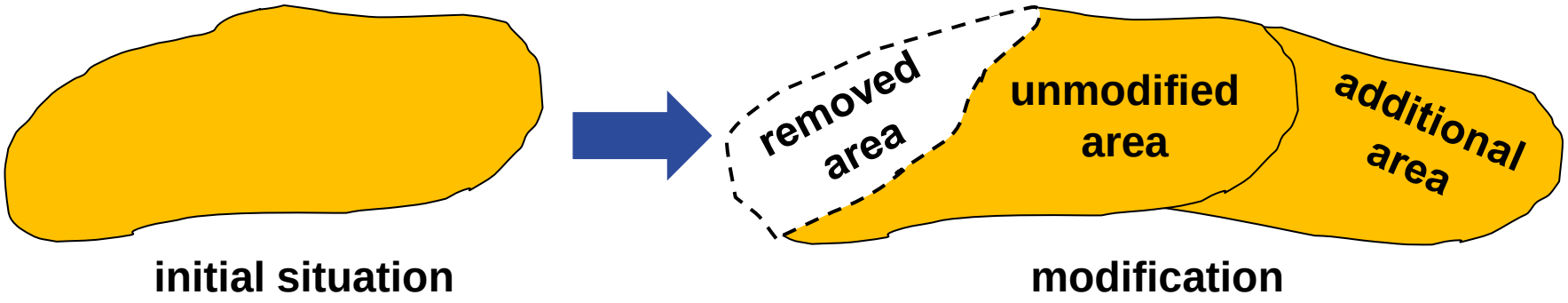
CAP-based Push Notifications

- **Task:**
  - push warnings to a user/device at a specific location
- **Solution:**
  - push every time you receive a CAP message affecting the user's location

- for someone who is processing a CAP **update** there is no simple way to determine if this information needs to be pushed to the recipient



CAP Update Strategies in DWD

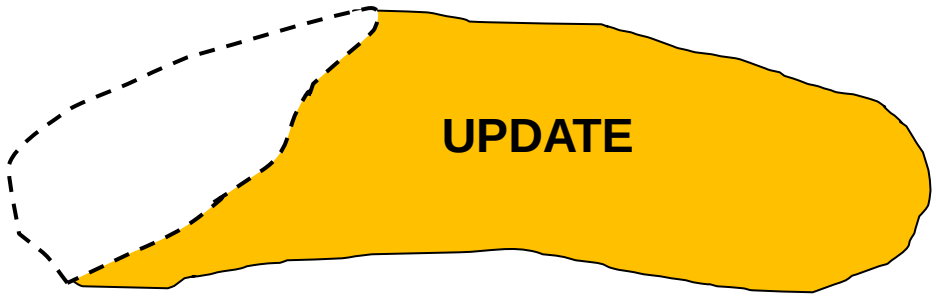


event-based update

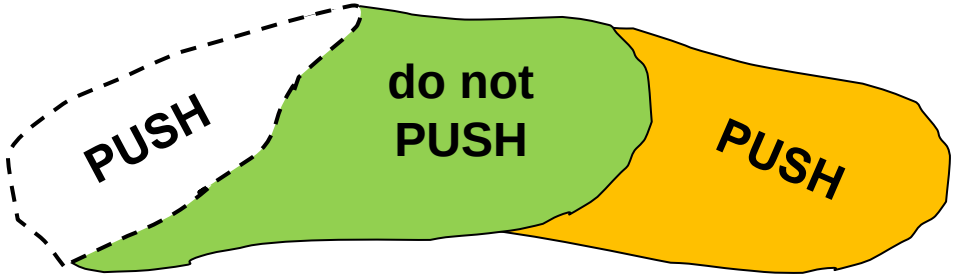
location-based updates

CAP Update Strategies in DWD

- **location-based strategy is <u>optimized for push notifications</u>**
  - subdivide updates, such that every affected area/point receives a minimal number of updates
  - CAP Updates <code>PARTIAL_CLEAR contain a list of cleared areas/polygon
  - CAP Updates <code>SILENT_UPDATE should not be pushed again to recipients of messages identified in <references>
- **event-based strategy is <u>optimized for visualization applications</u>**
  - combine changes in events to create a minimal number of CAP messages / polygons, prevent unnecessary fragmentation



event-based updates



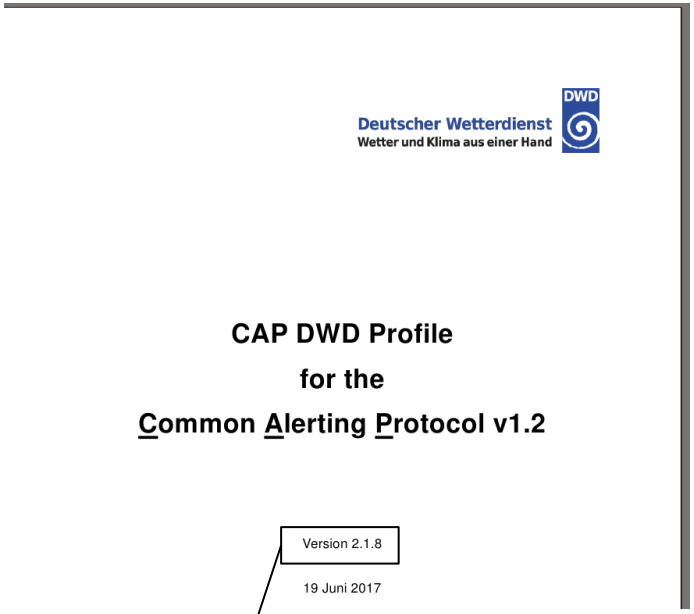
location-based updates

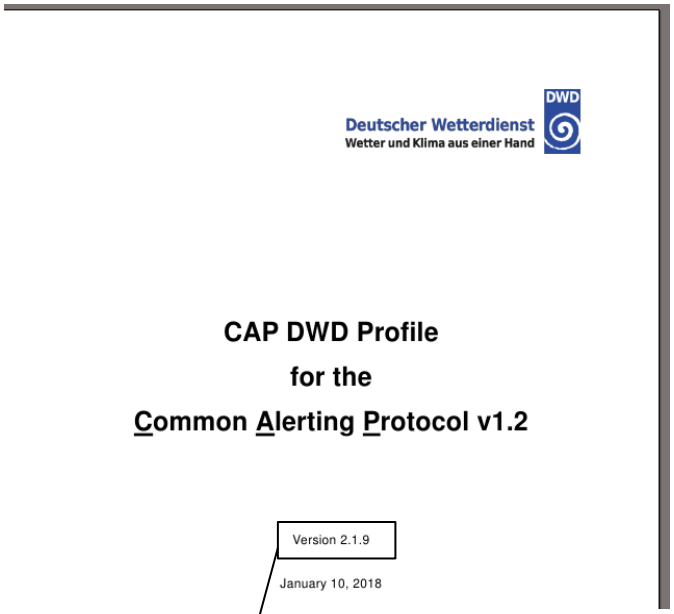
CAP-based Push Notifications

- a customer has to implement **some push strategy** when processing CAP to make push notifications available to recipients
- simple push logics may produce **unnecessary notifications**
- unnecessary push notifications can **lower user alertness** and in worst case might lead to users **disregarding important warnings** or disabling push notifications for public warnings

- with optimized CAP update strategies and additional flags for special message handling the DWD can provide a solution/**guidance for CAP based push notifications**
- currently 3 update strategies are provided:
  - event-based
  - location-based with neutral update logic
  - location-based with DWD update logic (contains some restrictions like Updates can not downgrade severity)

DWD CAP - Changes since 2017





DWD – CAP Documentation: https://www.dwd.de/opendatahelp

DWD CAP – Language sensitive Identifier

CAP-DWD-Profile 2.1.9 – section 2.2.1.1

<identifier>	Globally unique identifier of a CAP message
Format	2.49.0.1.276.<A>.<B>.<C>.<D>.**<E>**
<A>	Agency issuing the warning: DWD
<B>	Generating system: PVW
<C>	Time stamp in milliseconds since midnight, January 1, 1970 (in UTC)
<D>	Universally Unique Identifier version 4 [UUID]
<E>	**Product suffix, e.g. ISO 639-2 language code (“Alpha-3”)**
Example (German)	2.49.0.1.276.0.DWD.PVW.1493279880000.df9a4c74-4956-414b-916e-9ffa0875e320.**DEU**
Example (English)	2.49.0.1.276.0.DWD.PVW.1493279880000.df9a4c74-4956-414b-916e-9ffa0875e320.**ENG**

DWD CAP – Language sensitive Identifier

Problem: DWD CAP-feeds in English and German used the same message identifier

- recap warning production:
  - abstracted data is transformed into products with different languages and export formats
  - In our system it is one data object - internally there is only one identifier
- identical identifiers seemed beneficial as customers can find a corresponding message in another language using the identifier
- but any system aggregating and distributing CAP messages will deem this messages duplicates

Current solution:

- extended the `identifier` by a language specific code
- added an optional `<code>id:` containing the origin identifier

DWD CAP – Further Changes since 2017

- removed DWD-XSD schema of DWD-CAP files
  - it only further constrained some CAP fields
  - these constrains were even cumbersome for ourselves
- changed CAP time values (sent, effective, onset, expires) from UTC to usage of local time (CET/CEST)
  - the public does not measure time in UTC
  - CAP aggregators do not need to know the local time zone

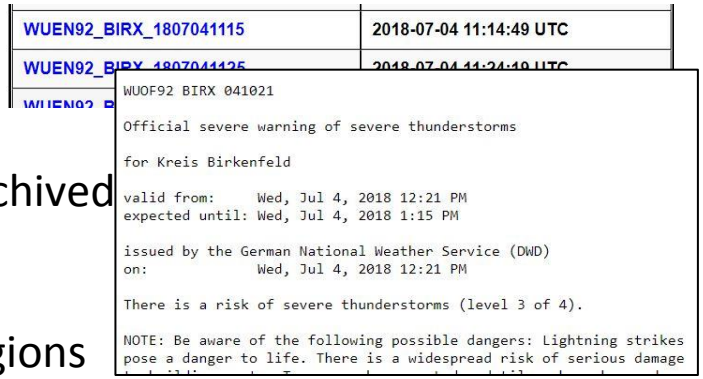
onset	Time at which the warning was issued
Format	<A> + <B>
<A>	Date and time (in CET/CEST) <yyyy>-<MM>-<dd>T<HH>:<mm>:<ss>
<B>	Time offset to UTC (UTC: +00:00; CET: +01:00; CEST: +02:00)
Example	2010-01-18T12:24:18+01:00 (= 2010-01-18T11:24:18+00:00) (issued on: Tuesday, 18.01.2010 12:24 local time (standard time))

CAP “Hidden” Advantages

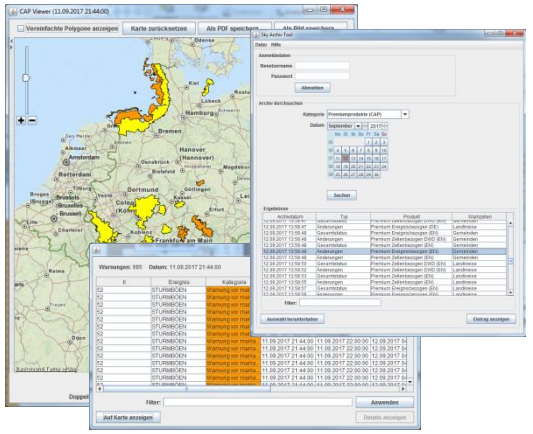
Cap “Hidden” Advantages

archiving and retrieval of warning products:

- before CAP single products based on text were archived
  - minimal meta information in headers
  - no vector data, only identifier for political regions
- now products are also archived in form of CAP
  - storage of complete states (in DWD) for a point in time (also possible using CAP-feed)
  - rich set of analyzable Meta-Information
  - storage of vector data in addition to region identifier (independent from political areas)
  - visualization in GIS -System



text based archive

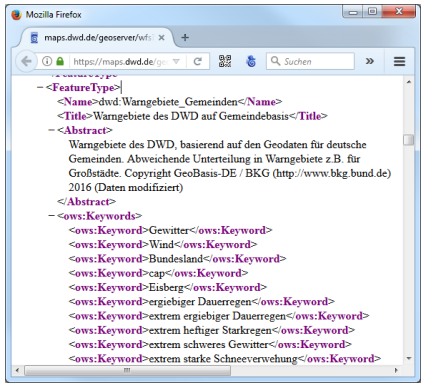


CAP based archive

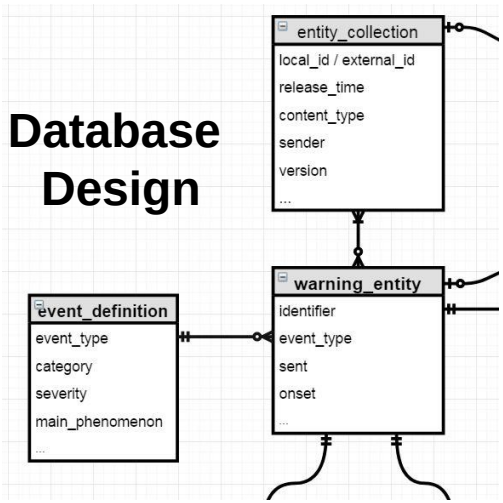
Cap "Hidden" Advantages

CAP as requirement specification

- CAP defines the necessary attributes of a warning message on a understandable fundamental level
- not every System can or will natively support CAP
  - E.g. GeoServer (WFS, WMS), DBMS
- but any system design which aims for processing/storing/managing/visualizing hazard related data can use CAP as reference
- in DWD we often came to a point in our design phase when we looked at CAP as a reference for possible data fields



Web Feature Service



Eduard Rosert

Björn Reetz

Bernd Erbshäußer

Martin Klink

Thank you!

Discussion ideas

- multiple languages (in one CAP-File: duplicates polygons because <area> is sub-element of <info>)
- multiple language CAP-Feeds: how to reference if multiple files and multiple languages (our solution: separate feed per language)
- the "right" format for CAP identifiers
- official guidelines/implementation note on how to designate "holes in polygons" in CAP would be nice (we want to get rid of <geocode>EXCLUDE_POLYGON ;)
- How to handle domain/category specific parameters in CAP
  - Extension for “Met” e.g. probability, returning period of event, risk/impact