

## 2017 CAP Implementation Workshop

20-21 September, Rome, Italy

# CAP at the Deutscher Wetterdienst

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## Overview

- Early Warning System of the DWD
- Warning Product Generation
- Distribution Channels for DWD Warnings
- CAP usage at the DWD
- CAP-based Push Notifications and CAP Update Strategies
- Outlook

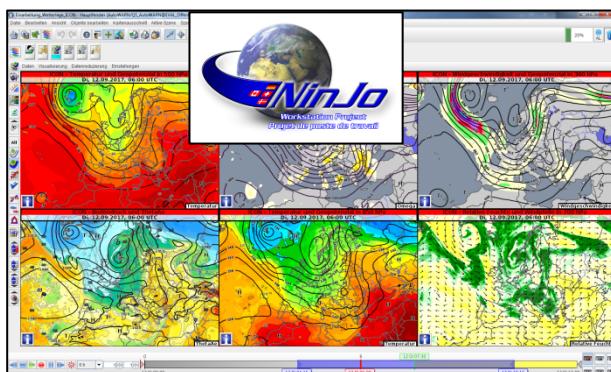
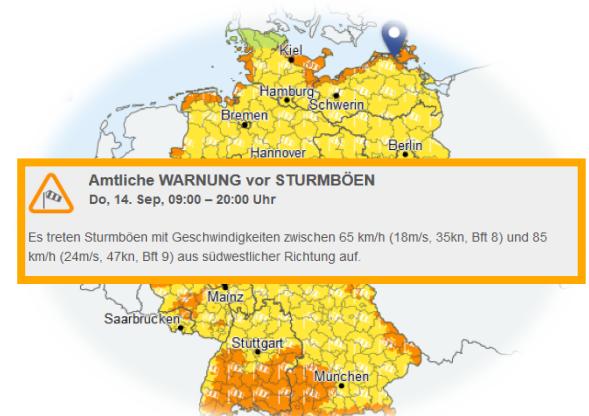
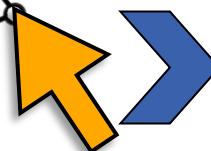
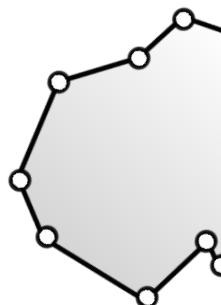


## Overview

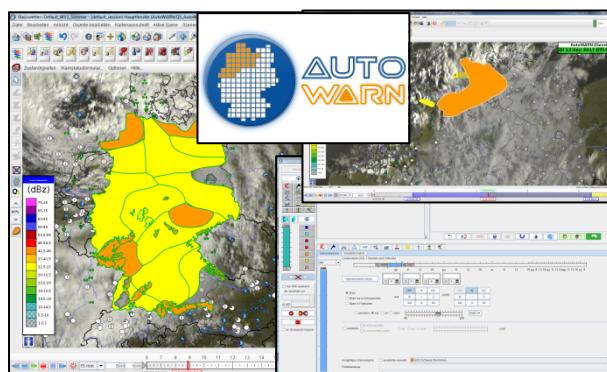
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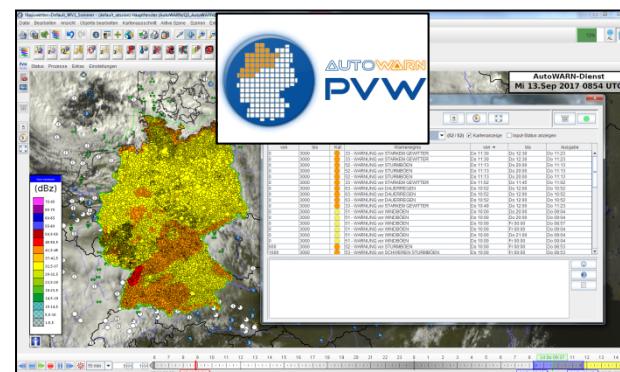
# Early Warning System of the DWD



NinJo  
forecaster workstation



AutoWARN ASG/ASE



AutoWARN PVW



# Early Warning System of the DWD

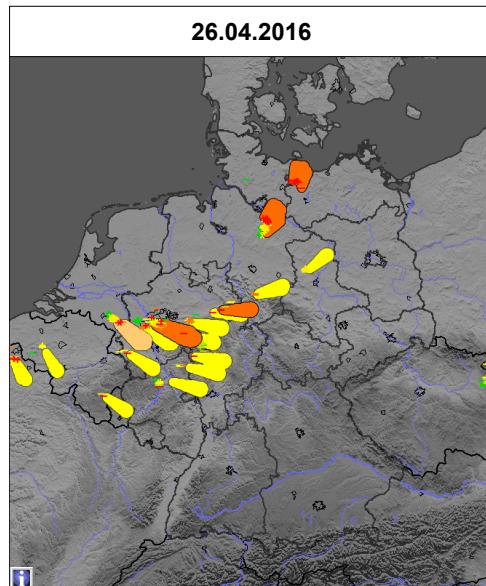
- **NinJo Forecaster Workstation**
  - visualization of satellite data, radar measurements, Nowcasting Products (e.g. NowCastMix), Numerical Weather Prediction (ICON, ECMWF-IFS, COSMO-DE, GFS) ...
  - allows the forecasters to monitor all relevant data in one application
- **AutoWARN System**
  - **Status Generator** (ASG): creates automatic proposals for future warning status
  - **Status Editor** (ASE): import of ASG proposals, manual assisted creation of the warning status („collection of polygons with attributes“)
  - **Product Generator** (PVW): aggregation of warnings from different sources, automatic generation of warning products (CAP, text, XML)
- **AFD/DAVID Product Distribution**: 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>) and many other applications



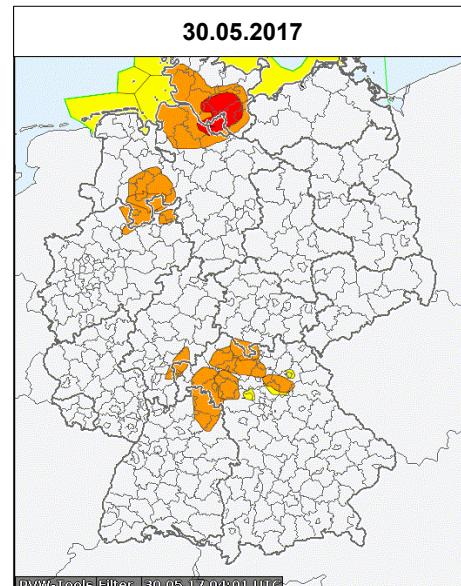
# Early Warning System of the DWD

- **Warning Status:** structured information/data about potential hazards
- **Warning Product:** the representation of a warning for a specific audience/purpose (e.g. an image on a website, CAP Alert)

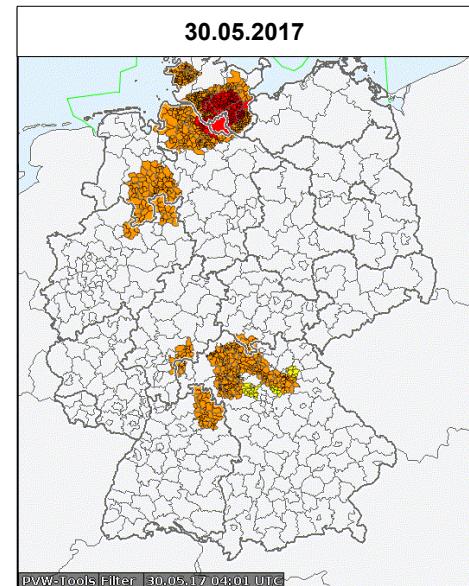
DWD forecasters create and update the Warning Status



automatic  
proposals



semi-automatic  
warning status



automatic  
warning products



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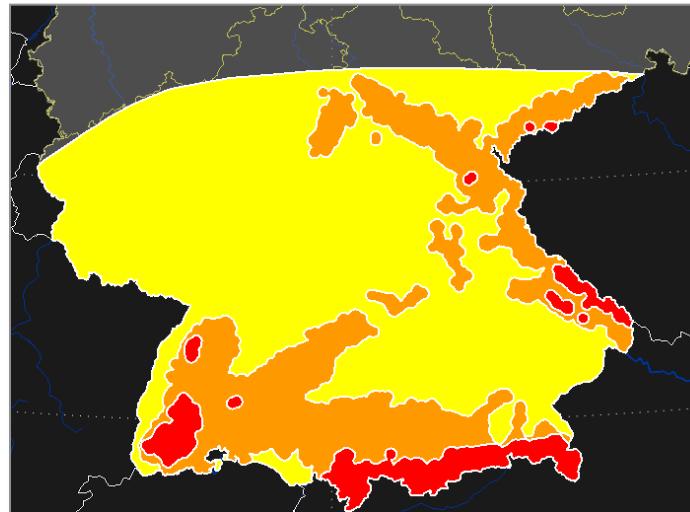


## Warning Product Generation

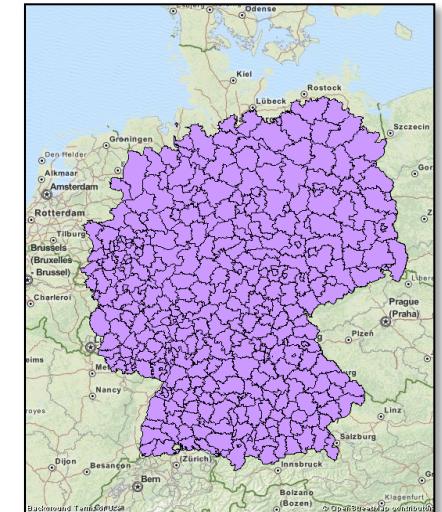
- The AutoWARN Product Generator (PVW) imports and aggregates events from different systems and supports different formats
- PVW currently aggregates events from three different sources:



RSZ Hamburg  
**sea / coastal  
events**  
(CAP)



AutoWARN Status Editor  
**meteorological  
events**  
(XML)

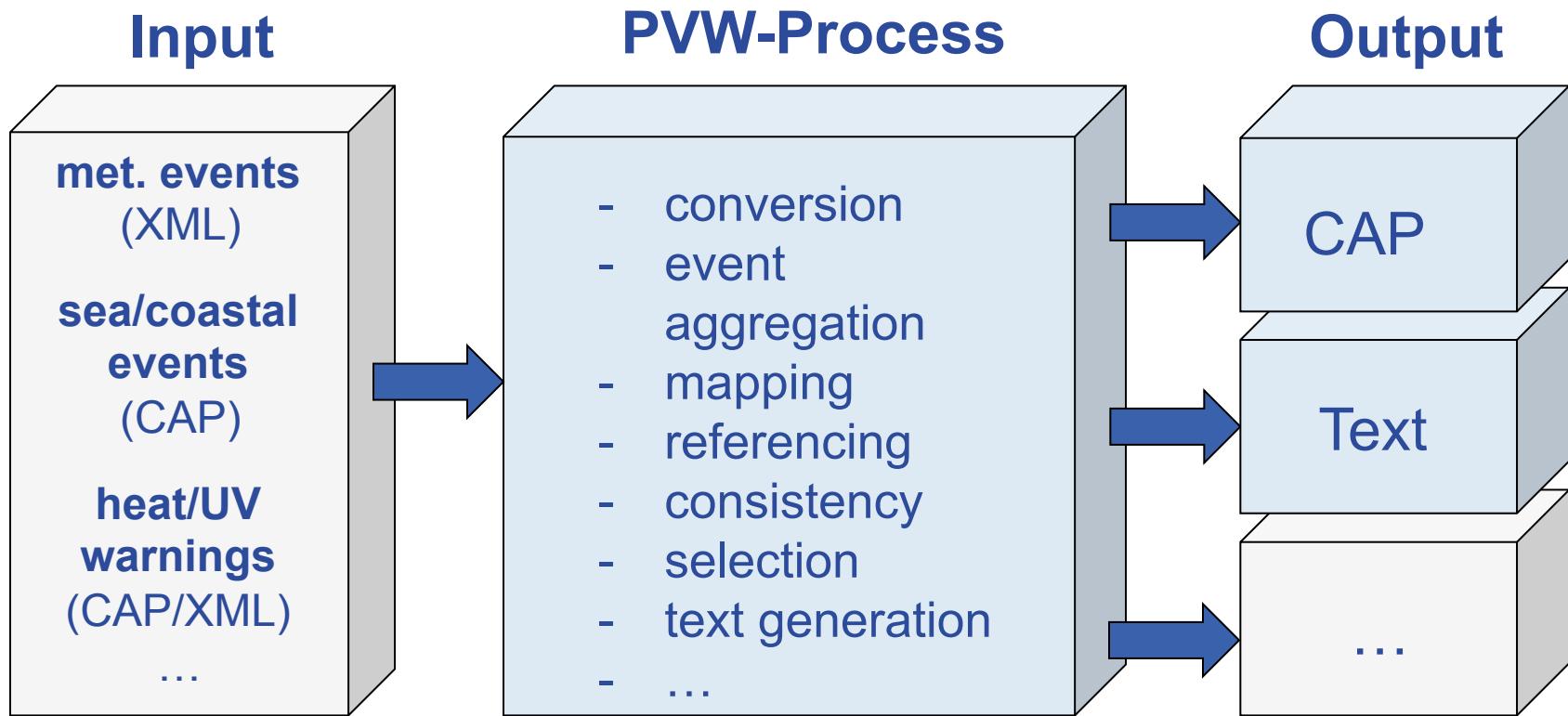


ZMMF Freiburg  
**health related  
events**  
(XML)



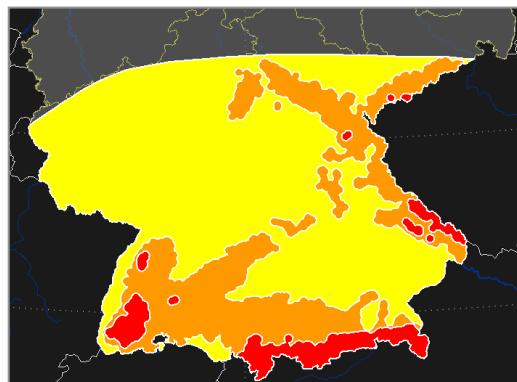
## Warning Product Generation

- Input data from different sources is processed in PVW in a unified manner to create standardized warnings.

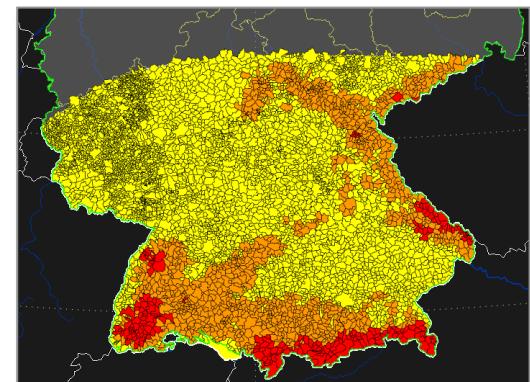
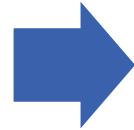


## Warning Product Generation

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



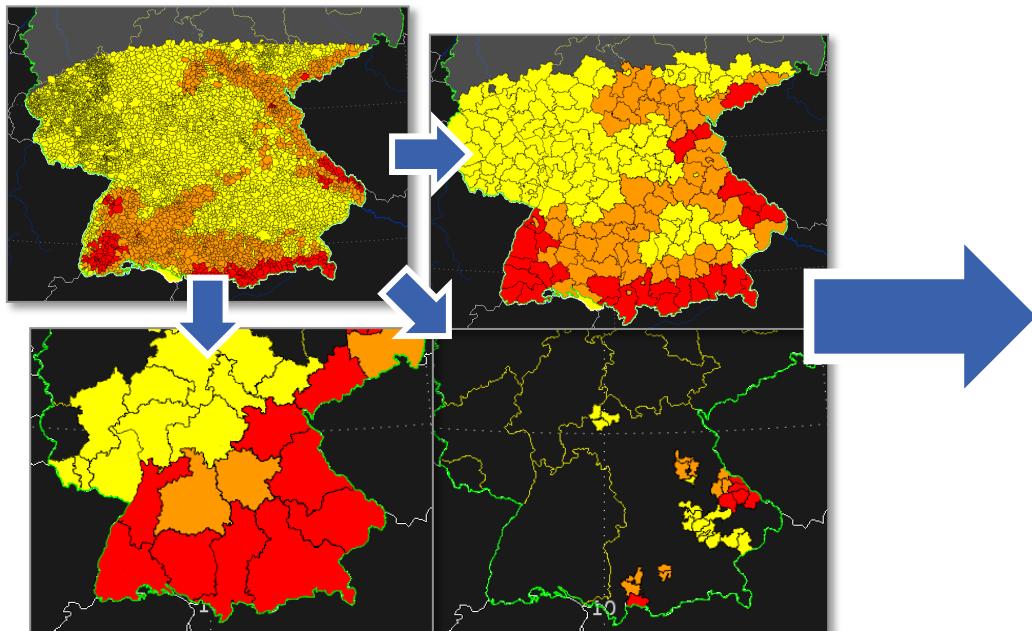
imported events



atomic cells

## Warning Product Generation

- Create products with different content, spatial resolution, informational granularity, language, export formats, update behaviour ...



**derivation of different spatial contexts**  
(mappings, collections, selections)

### Text Products (FAX, email, SMS, ...)

DWD WETTERWARNUNG: STURMBÖEN in Ostalbkreis über 600m vom 20.04.17 10:00 - 20.04.17 16:00 Uhr, Stufe 2 von 4 -> [www.dwd.de](http://www.dwd.de)

WWMS52 809172111D 200547  
Amtliche WARNUNG vor STURMBÖEN  
für Gemeinde Ainring, Lagen über 600 Meter

### 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">
...
<status>Actual</status>
<msgType>Alert</msgType>
...
<language>en-US</language>
<category>Met</category>
<event>storm-force gusts</event>
<responseType>Prepare</responseType>
<urgency>Immediate</urgency>
<severity>Moderate</severity>
...
<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: > 600 m; Max. gusts: < 100 km/h; Wind direction:  
south-west </description> ...
```

**generation of different representations**  
(CAP, xml, text)



# Warning Product Generation

- **Legacy Warning System**
  - create a warning for each (political/geographical) area (e.g. 294 German districts)
  - Manually issue and manage every warning for every area
- **Automated Warning Products**
  - Warnings are created/issued manually using standardized text templates
  - graphical user interface simplifies creation and management of warnings
- **DWD Automatic Warning Product Generation**
  - distinguishes between a warning status (“abstract data”) and a warning product
  - the forecaster creates a polygon **only once**, but the Product Generator creates and manages a **wide range of warning products** with different spatial contexts, level of detail, different texts and languages and update behavior
  - Can aggregate data from a variety of **different sources** (manual, semi-automatic, automatic)



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## Distribution Channels for DWD Warnings

- DWD Warnings are available through multiple distribution channels:
  - **CAP-Feeds:** RSS and ATOM 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 (including CAP), recipients are the BBK (German civil protection), Katwarn, International Customers, DWD GeoWebServices



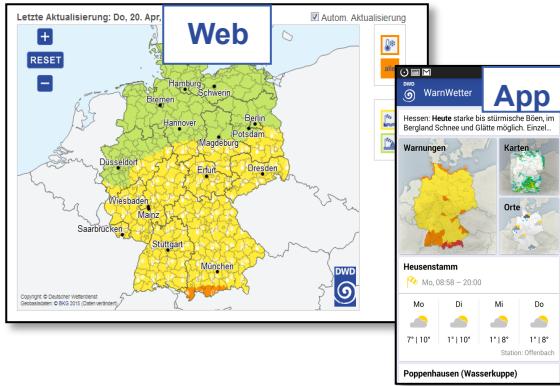
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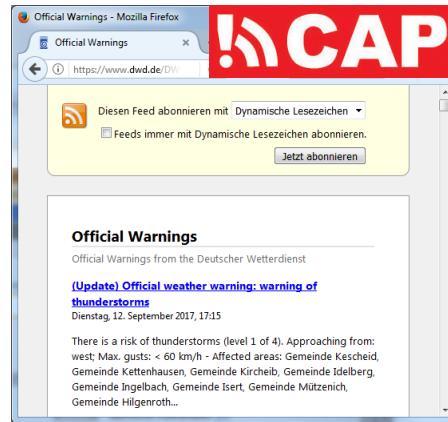


# CAP usage at the DWD

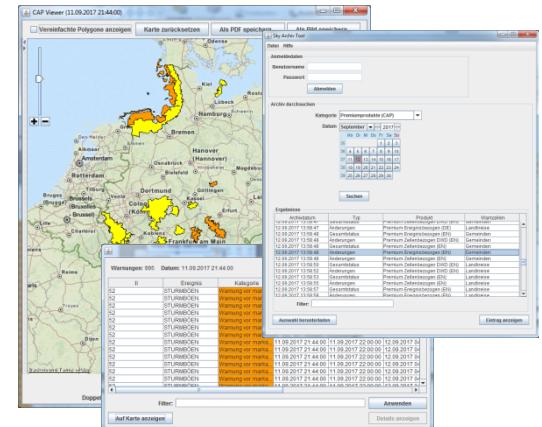
## visualization / notification



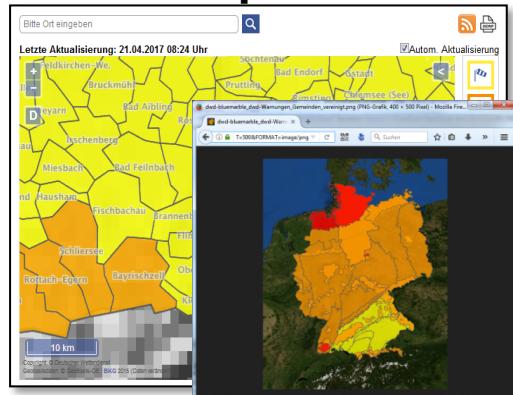
## CAP feeds



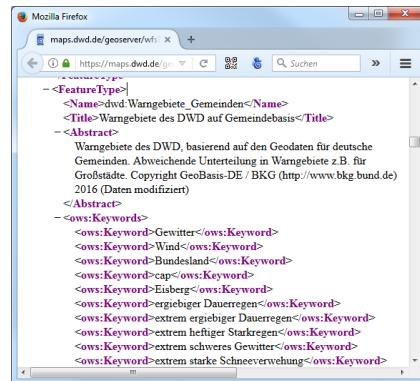
## archival / verification



## Web Map Service



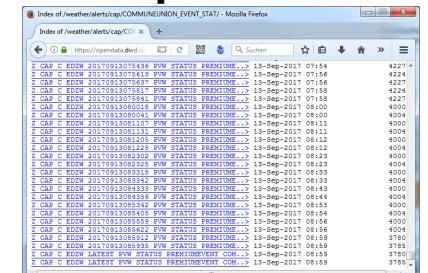
## Web Feature Service



## FeWIS / SWIS



## Open Data




## CAP usage at the DWD

- The Common Alerting Protocol (v1.2) has become **the primary exchange format** for Warnings at the DWD
- Most DWD applications that process or display warnings use CAP, e.g.
  - **DWD App „WarnWetter“** for displaying warnings on a map and push messages
  - **Expert Web Portals**, e.g. for Fire Departments (FeWIS) or Road Maintenance Services (SWIS)
  - OGC Compliant **GeoWebServices** (WMS/WFS)
- CAP messages are also used for
  - **Archival** of Warnings (e.g. to meet legal requirements)
  - **Verification** of the DWD Warning System (quality assessment/management and continuous improvement)

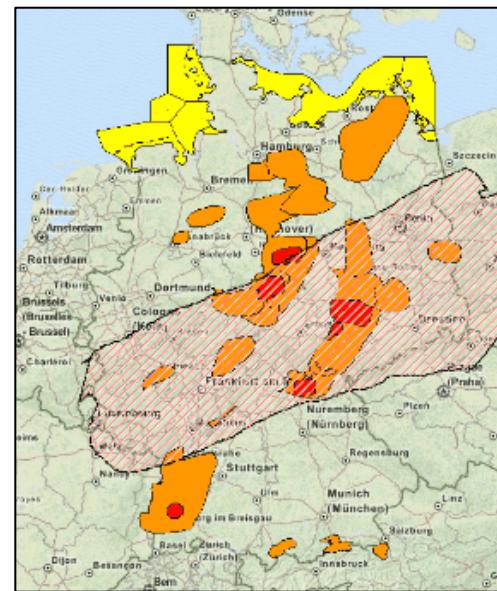
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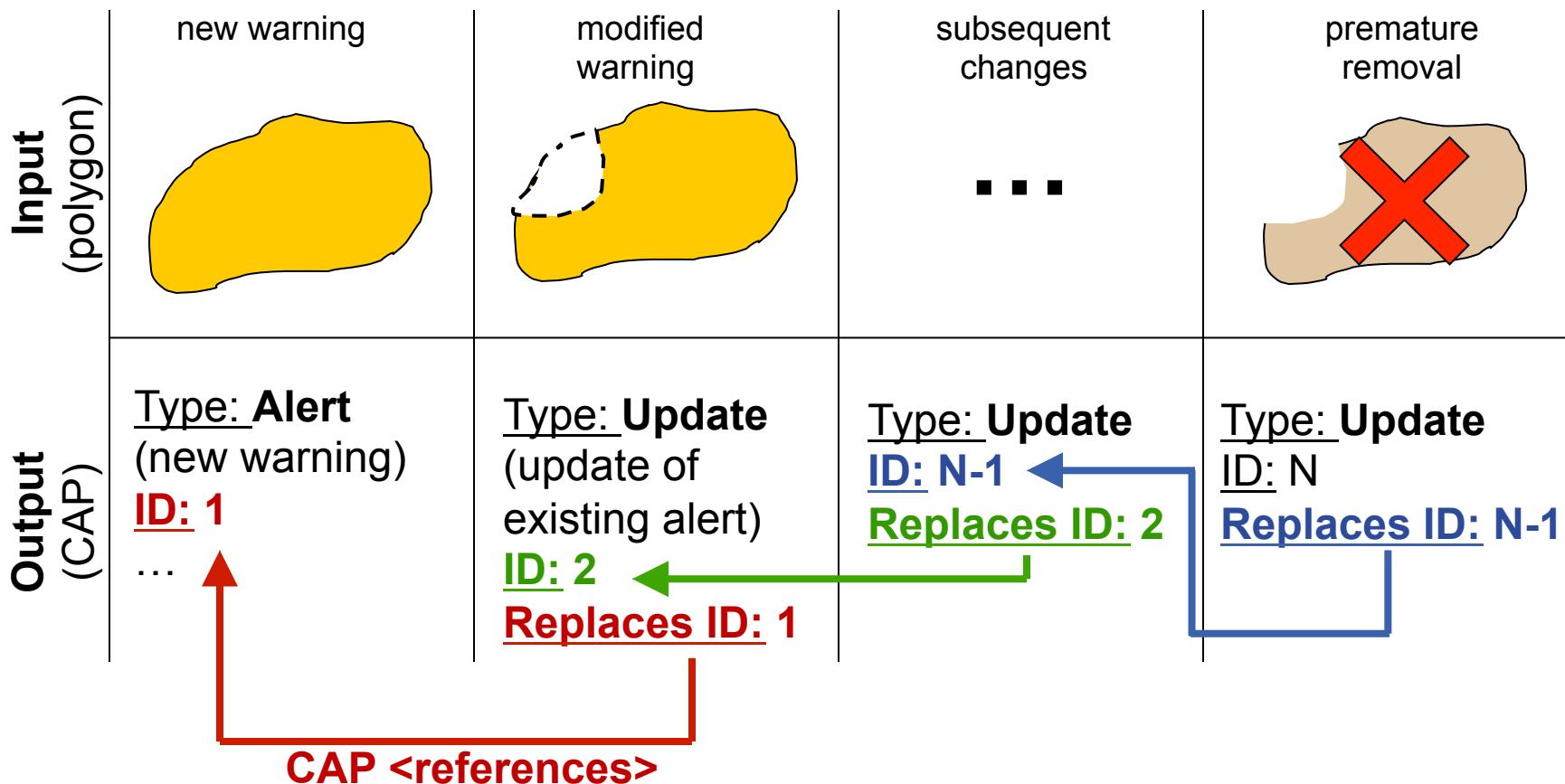


## CAP for Push Notifications

- The warning status **changes over time** when new information becomes available
- Typical changes for weather-related warnings usually include:
  - the **affected area**
  - the **expected beginning** and the **duration** of the event
  - the **expected intensity** and other concomitant event attributes
- **Push Notifications** (on mobile devices) offer a way to keep the public alert and up to date on potentially hazardous events
  
- CAP offers an **update mechanism** to convey these changes to recipients



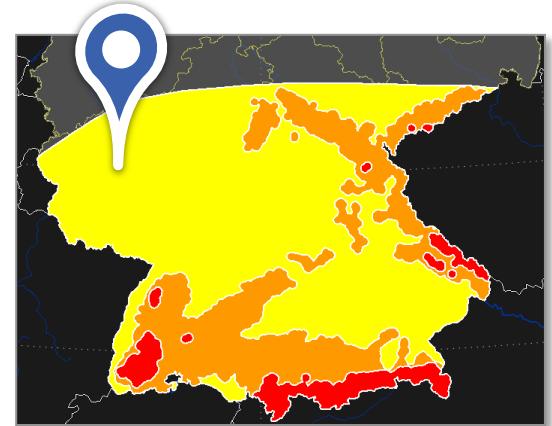
## CAP Update Chain



## CAP-based Push Notifications

How to push warnings to a user/device at a specific location using CAP?

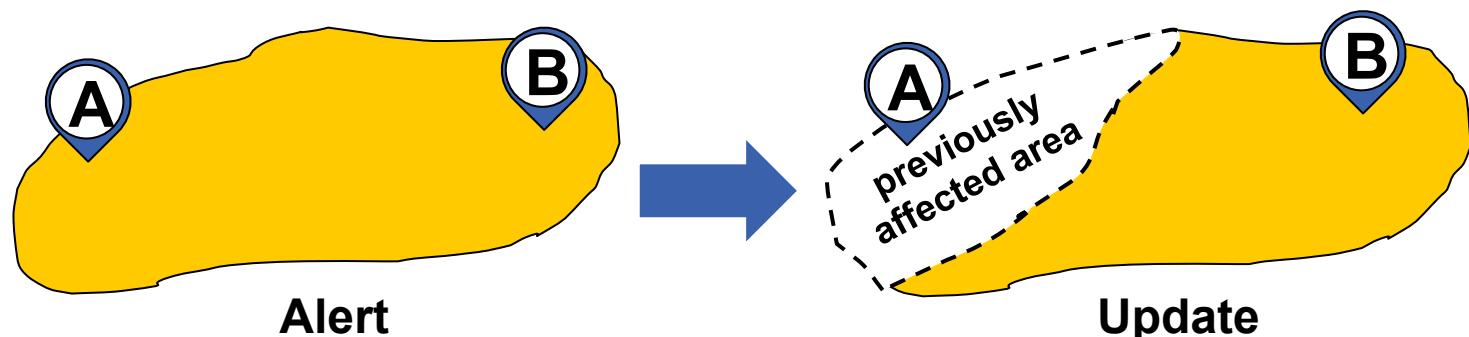
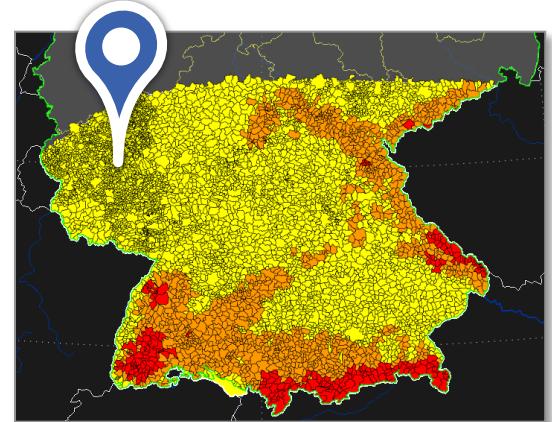
- **Simple push logic:**
  - user provides his location (e.g. GPS coordinates)
  - push every time you have a CAP message affecting the user's location
- **Advantages:**
  - Simple to implement
  - Works well with CAP Updates if a separate CAP message is produced for every affected area (e.g. a district)
  - no need to store previous alerts



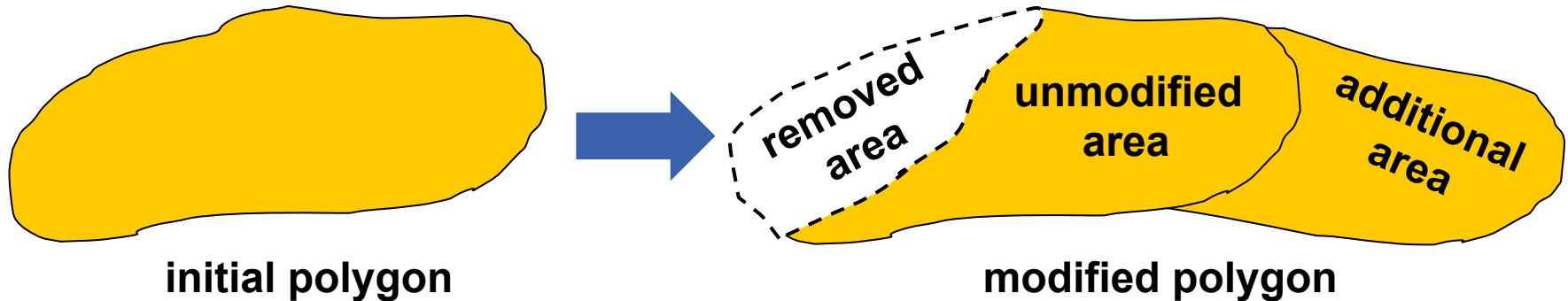
## CAP-based Push Notifications

### ➤ Drawbacks:

- not efficient for fine-grained warnings (an event affecting all of Germany's ~11000 municipalities would require 11000 separate cap alerts)
- can not be applied to warnings with „affected area polygons“ without producing **unnecessary push notifications when updating** an alert
- 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



event-based



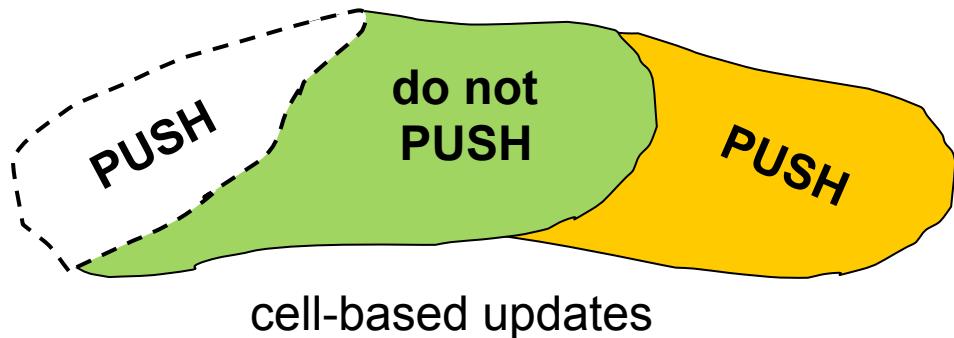
cell-based



## CAP Update Strategies

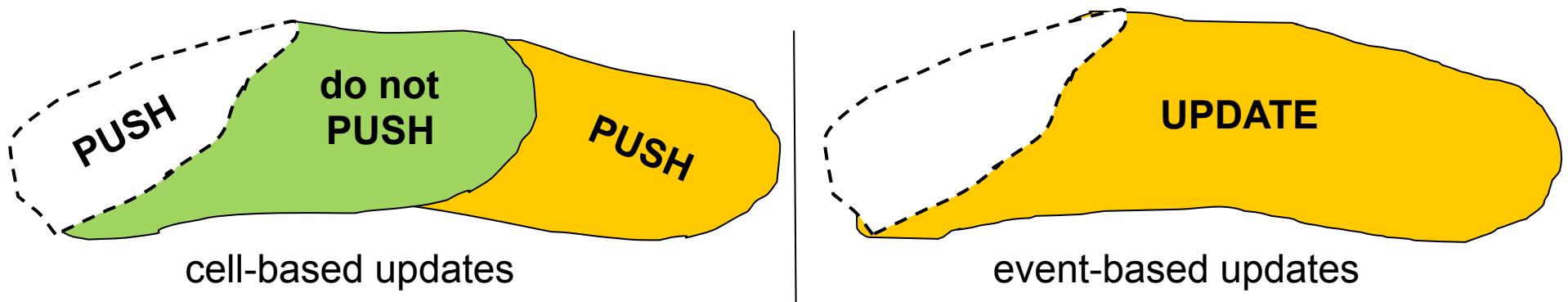
### ➤ Cell-based Update Strategy

- Create multiple update messages, such that every affected cell/point receives a minimal number of updates (**optimized for push notifications**)
- Create a CAP Update Message with <code>PARTIAL\_CLEAR, which contains a list of cleared areas/the removed part of the polygon
- Create a CAP Update Message with <code>SILENT\_UPDATE, to flag messages that should not be pushed again to recipients
- Create a CAP Alert Message for newly affected areas



## CAP Update Strategies

- **Event-based strategy**
  - combine changes in events to create a minimal number of CAP messages / polygons, prevent fragmentation (**optimized for visualization applications**)
- **Both update strategies are equivalent (but not equal!):**
  - the individual CAP messages are different (e.g. different IDs)
  - but the resulting warning situation is the same



## CAP Update Strategies

- Until now each customer had to implement **some push strategy** when processing CAP to make push notifications available to recipients
- a simple push logic can 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 altogether
- With different CAP update strategies and additional flags in CAP for special message handling we can provide optimized product lines (guidance) for CAP based **push notifications as well as for visualization purposes**
- although messages from different update strategies cannot be “mixed”, an application may use one product line to generate push notifications and another to display warnings on a map
- **the application determines which update strategy should be used**

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# Outlook

- News
  - Revised and updated **CAP DWD Profile** and Documentation (<http://www.dwd.de/DE/leistungen/opendata/hilfe.html>)
  - Operational DWD **CAP feeds** in German and English (since July 2017)
  - Start of the DWD **Open Data** initiative (<http://www.dwd.de/DE/leistungen/opendata/hilfe.html>)
- Future Work
  - further development of the CAP DWD Profile
  - adaption of applications to support CAP interfaces
  - expanded use of OGC compliant web services
  - development of APIs for simplified access to DWD Alerts





*Martin Klink*



*Bernd Erbshäuser*



*Eduard Rosert*

*Thank you!*