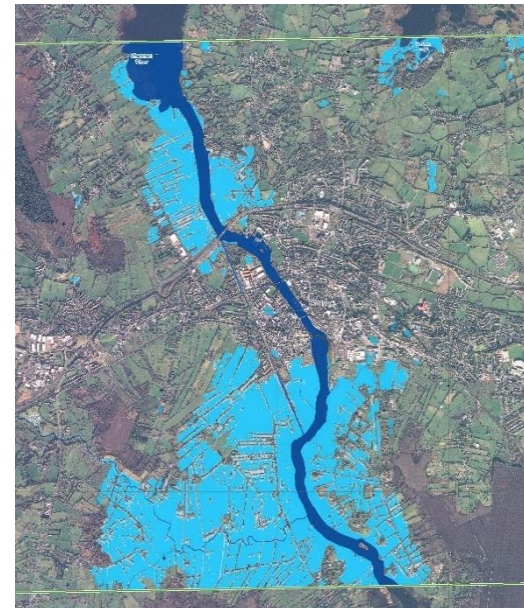


Monitoring Extreme Flood Events using Copernicus: An Irish Perspective





Presentation Outline

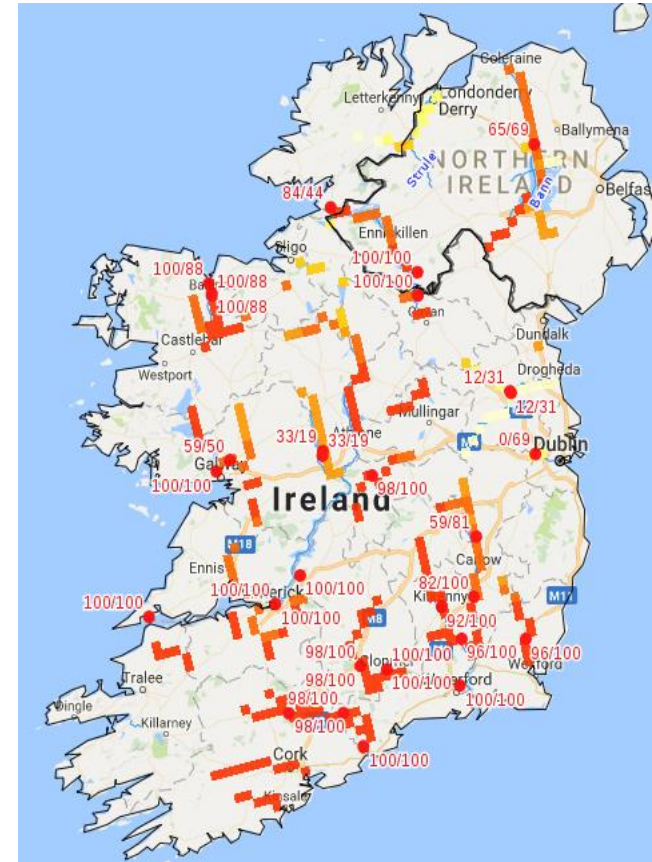
- Background
- European Flood Awareness System (EFAS)
- 2015/2016 Winter Flooding
- Copernicus EMS – Rapid Mapping
- Sentinel 1 Mapping
- Copernicus EMS vs Sentinel 1 Mapping
- Key Lessons Learned
- Acknowledgements and References

Background

- OPW is the lead state body in Ireland for coordination and implementation of Government policy on flood risk management
- In 2010, OPW became the European Flood Awareness System (EFAS) Partner for Ireland
- During the winter of 2015/2016, Ireland experienced exceptional and widespread flooding
- Extensive use was made at this time of the Copernicus EMS including the following modules:
 - The European Flood Awareness System (EFAS)
 - Copernicus EMS – Rapid Mapping

European Flood Awareness System (EFAS)

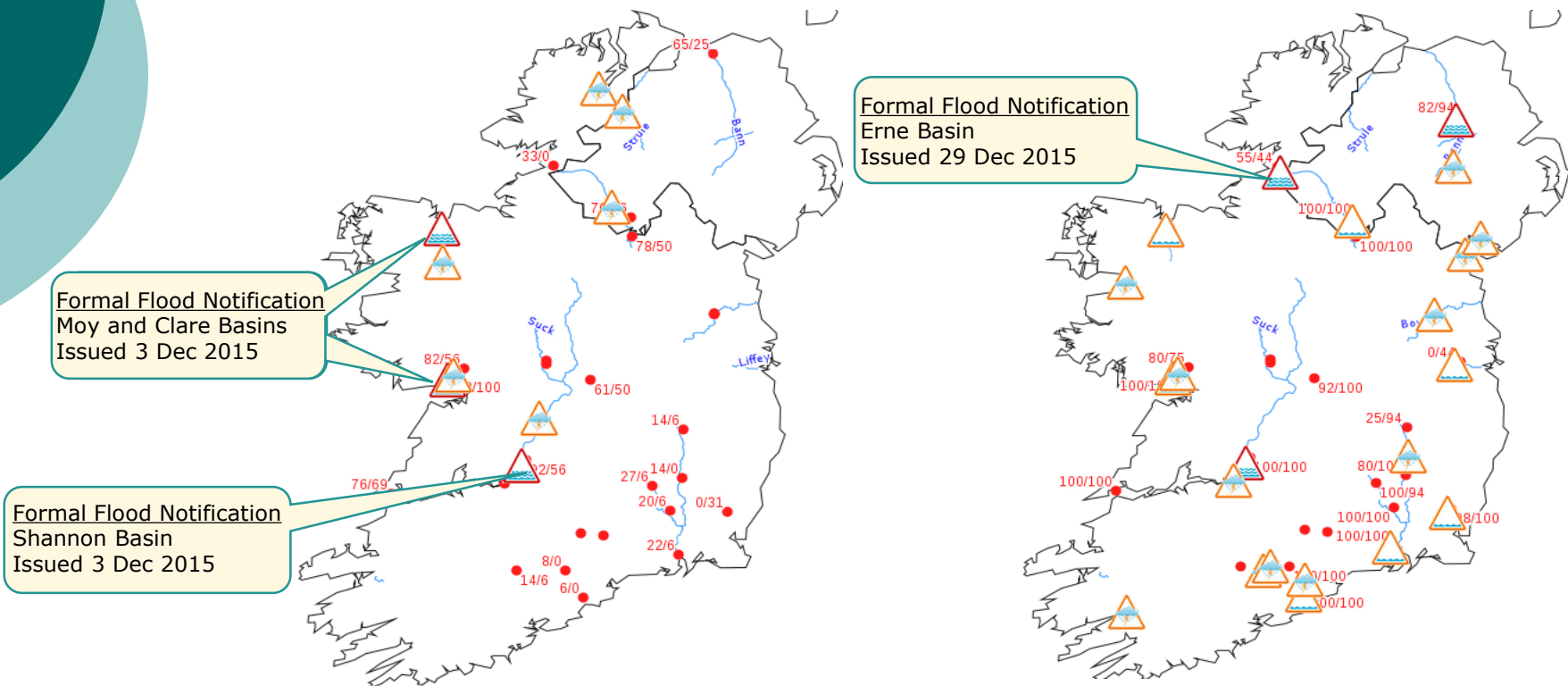
- Ireland does not have a dedicated National Flood Forecasting Service
- OPW has been disseminating EFAS Flood Notifications for Ireland, to Local Authorities and other relevant stakeholders, since 2010 (*EFAS Partner for Ireland*)
- OPW provides realtime flow data and post-event feedback to the EFAS team
- During the 2015/2016 winter flood emergency, OPW provided almost daily briefings on EFAS forecasts to the National Emergency Coordination Group (NECG)
- A total of 19 EFAS Flood Notifications were issued between 3rd December and 6th January (3 Formal, 7 Informal, and 9 Flash Flood)
- EFAS (Formal and Informal) Flood Notifications performed well overall, and gave at least one day advance notice of the 5 year threshold being exceeded
- Copernicus EMS – Mapping service was activated for flooding for the first time during this flood emergency



**EFAS Forecast as of 28/12/2015 at
12:00 UTC**

European Flood Awareness System (EFAS)

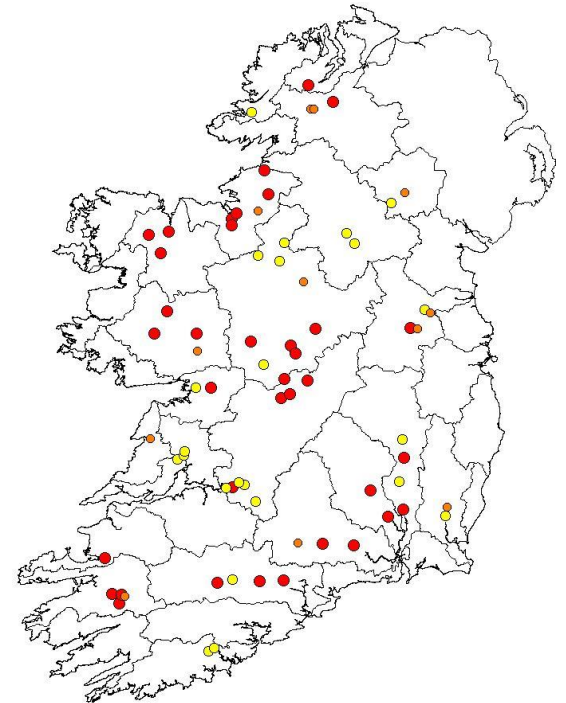
Formal Flood Notifications



EFAS Forecasts on 3rd Dec 2015 at 00 UTC (left) and 29th Dec 2015 at 12 UTC (right)

2015/2016 Winter Flooding

- Ireland experienced exceptional and widespread flooding during the winter of 2015/2016, especially in December and January
- Three storms occurred during December (Desmond 4th/5th, Eva 23rd and Frank 29th/30th)
- Flooding was reported in over 30 towns and villages (*Source: OPW, March 2016*)
- Over 600 households were evacuated and over 600 businesses flooded (*Source: NDFEM, November 2016*)
- Peak flood levels were examined at 75 OPW reference hydrometric gauging stations (river)
 - 37 (49%) stations recorded their highest level
 - 23 (31%) recorded their 2nd highest level
 - 12 (16%) recorded their 3rd highest level
- Copernicus EMS – Rapid Mapping was activated by the National Directorate for Fire and Emergency Management (NDFEM) through the European Civil Protection Mechanism, with assistance from the OPW



Legend:

- Highest flood on record
- Second highest
- Third highest

Spatial distribution of gauges that recorded very high river levels in winter 2015/2016

2015/2016 Winter Flooding

Examples of flood impacts



Sourced from Irish Daily Mirror

Graigueenamanagh, Co. Kilkenny - 30 Dec 2015



Sourced from the Irish Times

Enniscorthy, Co. Wexford - 31 Dec 2015



Sourced from the Irish Independent

Athlone Town, Counties Westmeath & Roscommon 05 Jan 2016

Copernicus EMS – Rapid Mapping

- **Copernicus EMS – Rapid Mapping** component was activated for Ireland by the NDFEM on 8th December 2015 (*EMSR149: Flood in Ireland*)
- Thirteen (13) locations mapped:
 - Carrick-on-Shannon (10 Dec – 10 Jan) – 14 captures
 - Athlone (11 Dec – 06 Jan) – 11 captures
 - Limerick (10 Dec – 10 Jan) – 19 captures
 - Castleconnell (14 Dec – 15 Jan) – 16 captures
 - Ennis (17 Dec – 09 Jan) – 11 captures
 - Corofin (17 Dec – 09 Jan) – 11 captures
 - Enniscorthy (02 Jan – 15 Jan) – 8 captures
 - Gort (10 Jan – 12 Jan) – 3 captures
 - Roscommon (10 Jan – 11 Jan) – 3 captures
 - Belturbet (10 Jan – 12 Jan) – 3 captures
 - Claremorris (11 Jan – 12 Jan) – 2 captures
 - Ballinasloe (10 Jan – 12 Jan) – 3 captures
 - Portumna (10 Jan – 12 Jan) – 3 captures
- Total of 107 flood delineation/extent maps were produced under this activation

EMS - MAPPING

- Service Overview
- Who can use the service
- How to use the service
- Products: Rapid Mapping
- Products: Risk and Recovery
- Quality control / Feedback
- User Guide

RAPID MAPPING

- List of Activations
- Map of Activations
- GeoRSS Feed

RISK AND RECOVERY

- List of Activations
- Map of Activations
- GeoRSS Feed

OTHER

- Map of Activations of Other Organizations
- Map Coverage Planner
- Meetings, Workshops
- Citation Guidelines
- Citations
- Calls for Tender

EMSR149: Flood in Ireland

Event Time (UTC): 2015-12-04 18:00
Event Time (LOC): 2015-12-04 18:00
Event Type: Flood
Activation Time (UTC): 2015-12-08 22:12
Reference maps produced: 0
Delineation maps produced: 107
Grading maps produced: 0
Activation Status: Closed


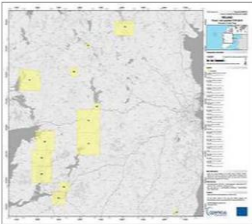
Affected Countries/Territories:
 Ireland

Area Descriptor: Cities of Limerick, Athlone and Carrick on Shannon

Authorized User:
 Ireland/National Directorate for Fire and Emergency Management

Activation Reason:
 Floods at Shannon River due to heavy rain.

Requested Product: Delineation

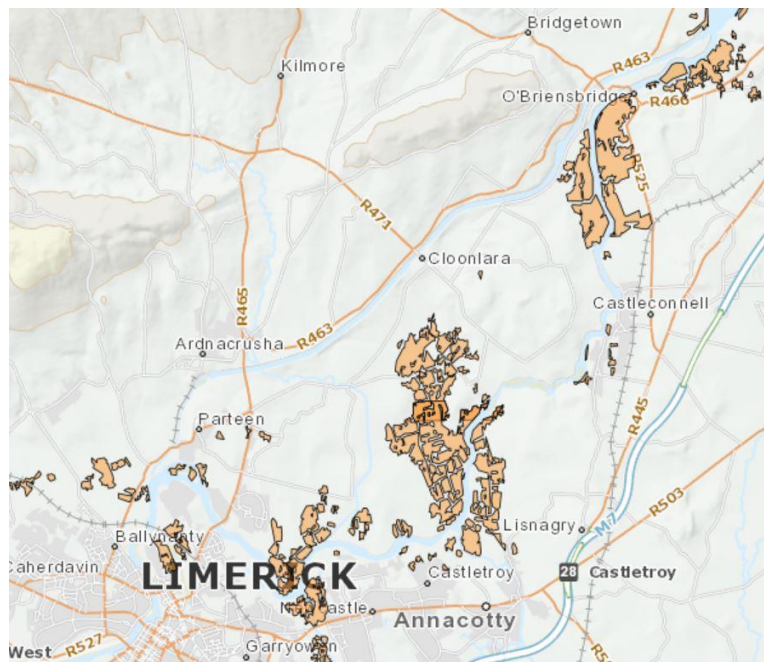



EMSR149 - Activation Extent Map
 Release: r29 - Version: v1 - Delivered: 2016-01-12 16:58
 View as: EMSR149-AEM-3PG - EMSR149-AEM-4MG - EMSR149-AEM

Filter by map type: ALL DELINEATION

Filter by product:
ALL
Athlone [02]
Ballinasloe [12]
Belturbet [10]
Carrick on Shannon [01]
Castleconnell [04]
Claremorris [11]
Corofin [06]
Ennis [05]
Enniscorthy [07]
Gort [08]
Limerick [03]
Portumna [13]
Roscommon [09]

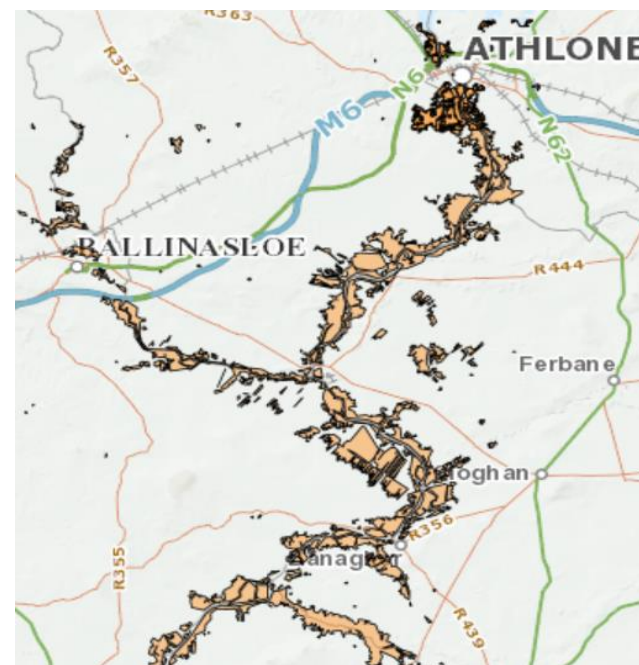
Copernicus EMS – Rapid Mapping



Source: Copernicus EMS

**Lower Shannon Catchment –
6th January 2016**

Montpelier, Springfield, Clonlara, Castletroy

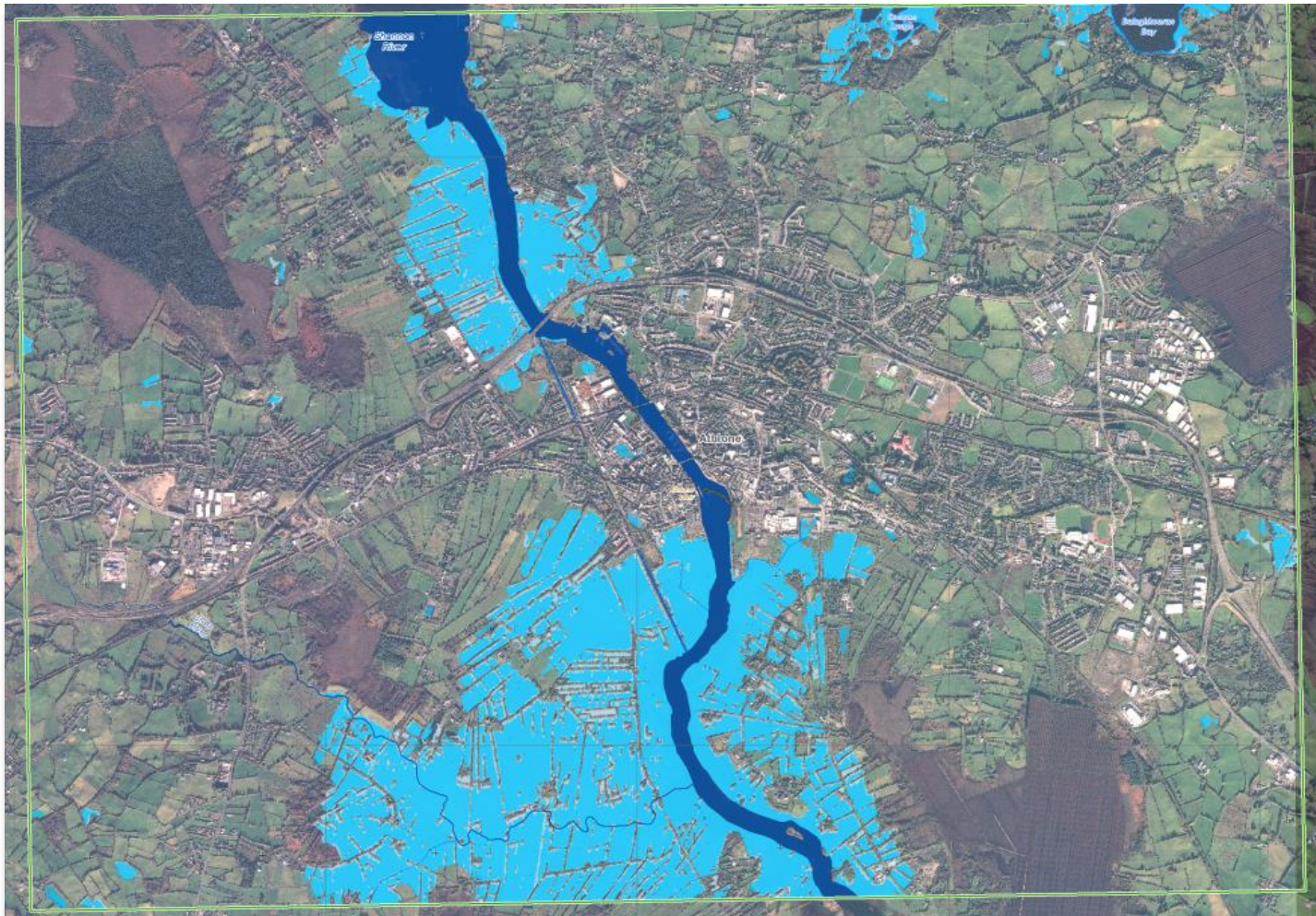


Source: Copernicus EMS

**Middle Shannon Catchment –
6th January 2016**

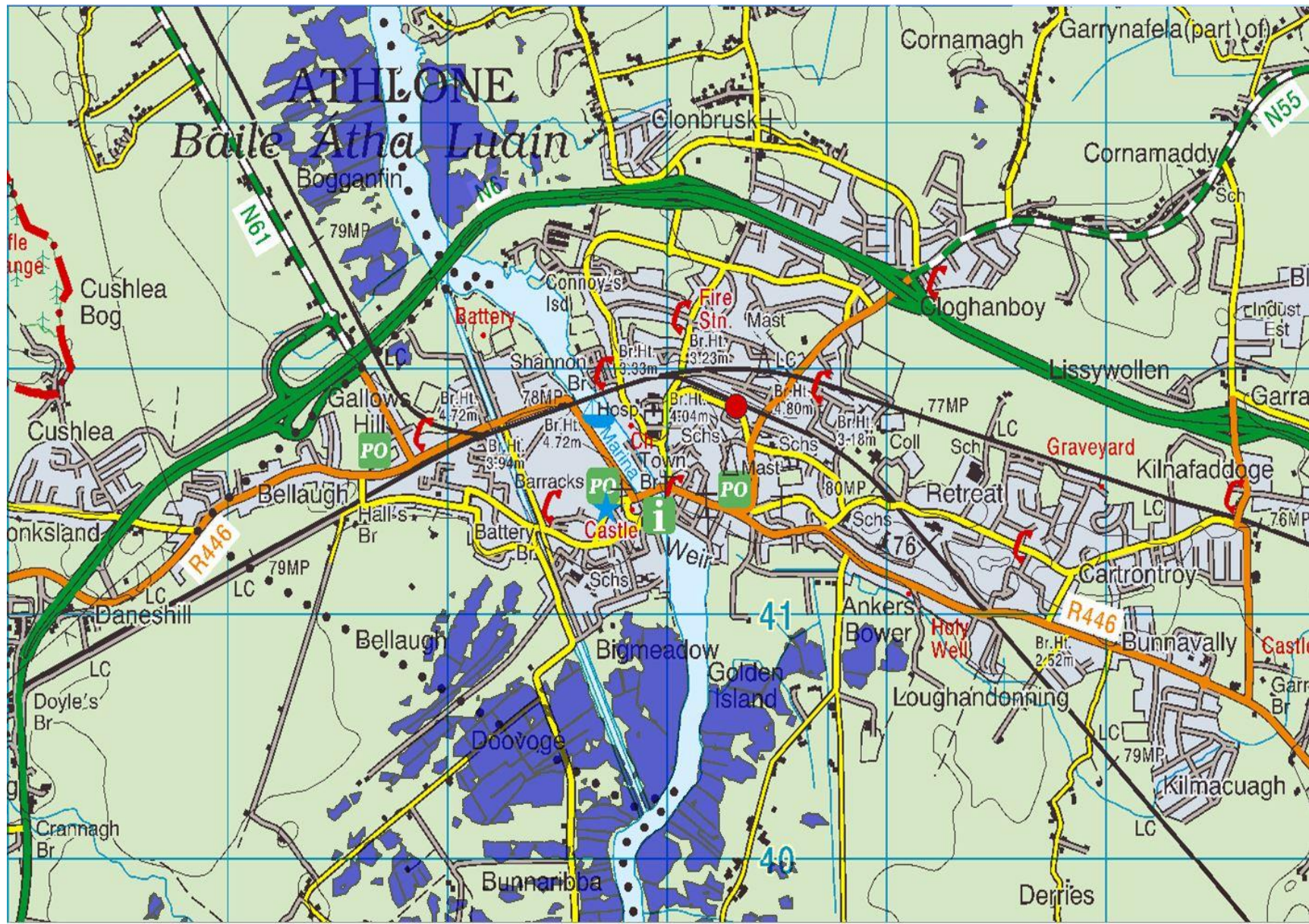
Athlone, Banagher and Ballinasloe

Copernicus EMS – Rapid Mapping

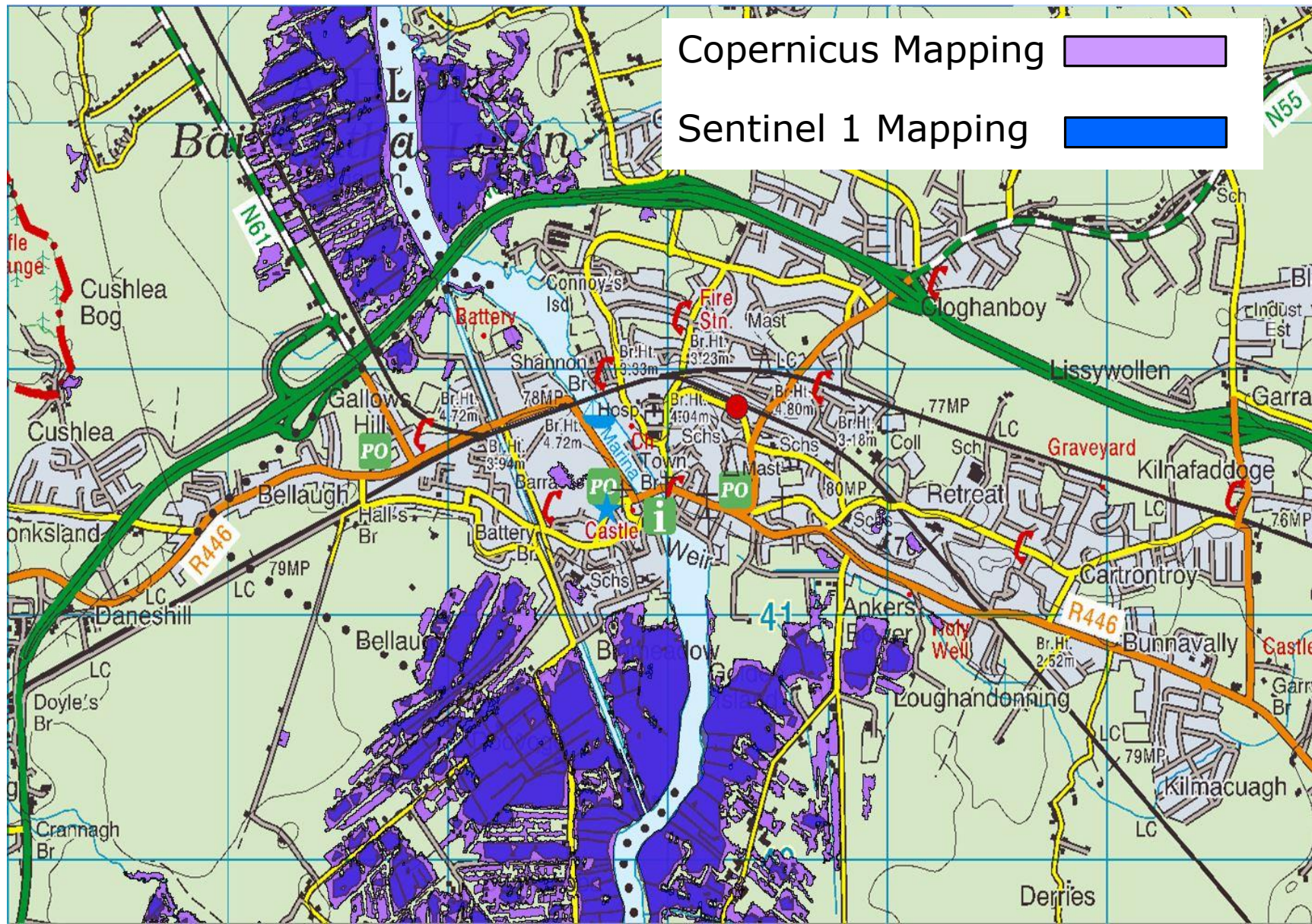


Athlone Flood Delineation Map - Situation on 6th January 2016

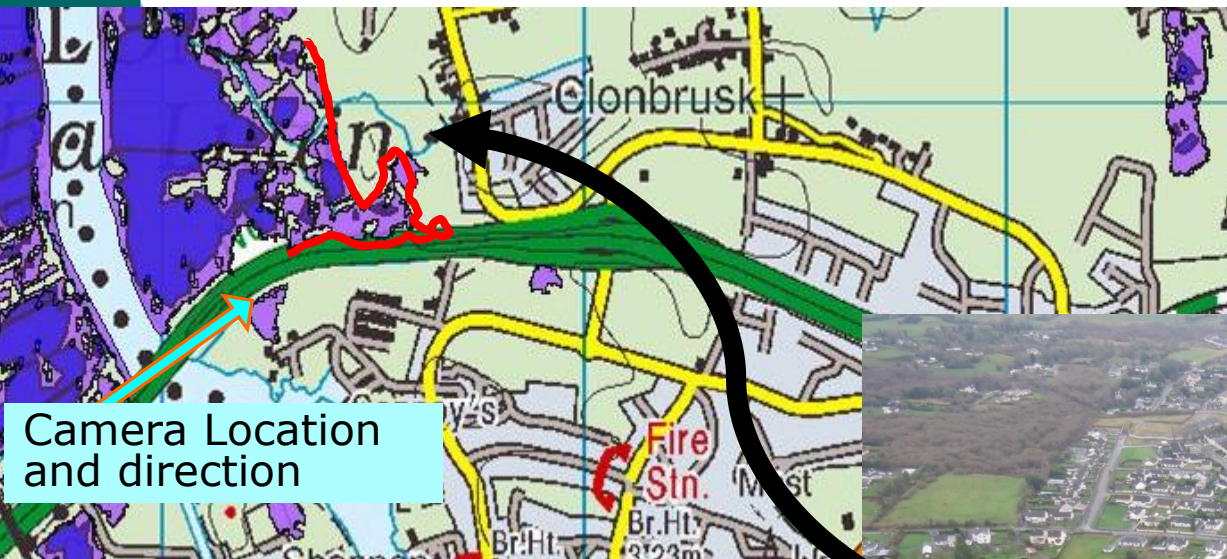
Sentinel 1 Mapping



Copernicus EMS vs Sentinel 1 Mapping



Copernicus EMS vs Sentinel 1 Mapping



- Copernicus feedback and validation using aerial photography provided by OPW

Key Lessons Learned (1)

- The winter 2015/2016 floods were the worst on record in terms of severity, duration and widespread geographical coverage
- Online flood forecasting tools such as EFAS, are very useful for tracking a flood event, but are also useful for decision makers and emergency responders to enable them visualise and better understand a developing flood situation
- A national flood forecasting service is required. Whilst EFAS proved very useful as a medium range and overview flood forecasting system, more accurate short range and detailed forecasts are required
- Improved awareness and preparedness amongst the local authorities, principal responders, and the public helped mitigate the impacts of the flooding
- Winter 2015/2016 was the first national scale activation of the Copernicus EMS. The maps provided were very useful for assessing the extent of flood damage, monitoring the ongoing flood situation, validating CFRAM flood maps and for other flood research
- The NECG acted as a single point of contact for dissemination of information and liaison with media. This worked well and reduced potential for erroneous information being issued to principal responders and the public

Key Lessons Learned (2)

(from Validation of EMSR149)

- Oblique aerial images are very useful for detecting flood extents in urban areas, provided image acquisition is carefully planned and controlled
- Copernicus EMS flood delineation maps were generally found to be more accurate than Sentinel 1 maps
- There are limitations with radar derived flood delineation maps in both urban areas and areas covered by trees that need to be highlighted
- The use of VV polarisation radar data to detect flooded areas should be avoided
- A nation-wide monitoring product from Copernicus EMS would be useful for Ireland
- The use of pre-existing vector data, such as OSi PRIME 2, could improve the accuracy of the Copernicus EMS products



Copernicus EMS
Mapping Validation Service
Framework Service Contract n° 199502

PRODUCT VALIDATION REPORT (Deliverable VR)

EMSV024 - Validation of EMSR149: Flood in Ireland



Acknowledgements and References

- **Acknowledgements:**

- OPW: Hydrology and Coastal Section, FRAM Section, Hydrometric Section, FRM Data Management Section and Regional Offices
- Met Éireann
- The Air Corps
- Joint Research Centre (JRC) and EFAS Operational Centres
- Compass Informatics
- National Directorate for Fire and Emergency Management (NDFEM)

- **References:**

- Report on the 2015/2016 winter flooding in Ireland (OPW, Aug. 2016)
- Report on Flooding – Dec 4, 2015 – January 13, 2016 (NDFEM, Nov. 2016)
- EMSV024 – Validation of EMSR149 – Flood in Ireland (Copernicus, Jan. 2017)
- European Space Agency Website – <http://www.esa.int/ESA>
- Copernicus EMS Website: <http://emergency.copernicus.eu/>
- Flood Extent Mapping (Compass Informatics, Mar. 2016)