

The Importance of Early Communication

A timeline of forecasting a flood event

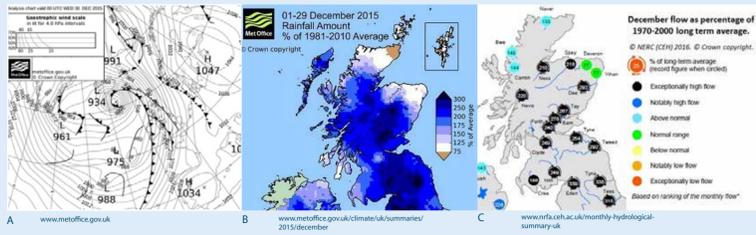
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Introduction

The Scottish Environment Protection Agency (SEPA) was identified under the Flood Risk Management (Scotland) Act 2009 as the flood warning authority with a duty for national flood forecasting, flood warning and strategic flood risk management. **The Scottish Flood Forecasting Service (SFFS), a strategic partnership formed of SEPA and the Met Office**, is responsible for communicating the flood risk to other Category 1 and 2 responders. Numerous tools and products are used to carry this out in the preceding days to a flood event, which all contribute to the decision making of partners.

During the winter of 2015/16 Scotland experienced numerous flood events, many of these causing significant impacts across the country. Here, a timeline follows the evolution of the flood risk status in Dumfries and Galloway prior to and during Storm Frank in December 2015. This demonstrates the decision making process of the SFFS (communications issued by SEPA column) and Dumfries and Galloway Local Authority and Local Resilience Partnership (actions taken by Dumfries and Galloway Council column) to provide an insight into the communications that are commonly required in the preparation and response to a flood event.

Context of Storm Frank



The UK was in a warm and moist tropical air mass for most of December 2015. This resulted in mild temperatures, but wet and windy conditions due to frequent deep depressions and frontal systems. The Met Office named three storms in December which caused widespread impacts across the UK. Storm Frank was responsible for some of the most severe impacts in Scotland. As evident from the synoptic chart (A) the deep depression brought strong winds and the long fetch across the Atlantic Ocean meant that there was a large supply of moisture to the system.

December 2015 was the wettest December on record in Scotland with rainfall 215% of the annual average (B). The majority of the rainfall associated with Storm Frank occurred between 1800 hrs on 29 December and 0900hrs on 30 December (+3 hours for the

North East). The maximum recorded rainfall for the event was 130.6mm which fell in 15.5 hours at Lower Black Laggan rain gauge in Dumfries and Galloway.

Similar rainfall totals were observed across the country on already saturated river catchments. This led to exceptionally high flows being recorded on the majority of main rivers in Scotland (C). At least 50 of SEPA's 400 river gauging stations recorded new peak flows, some of these being vastly greater than previous records. For example, on 30 December, the Park station on the River Dee was 1.34m higher than the previous maximum level.

Dumfries and Galloway



Dumfries and Galloway is situated in the South West of Scotland and subsequently is often affected first from storms tracking from the Atlantic Ocean, the cause of many coastal, fluvial and pluvial flooding events. The Southern Uplands stretch across the north of the region, which are the source for many of the waterways draining to the Solway Firth in the south. These include the River Annan, the River Cree, the River Esk and the River Nith.

The only fluvial flood warning area in the region is for Whitesands in Dumfries on the River Nith. It is the 14th most frequently issued Flood Warning in Scotland out of 269. During Storm Frank a Severe Flood Warning was issued for the first time.

The local authority, and the wider multi-agency Local Resilience Partnership (LRP), uses the Flood Guidance Statement (FGS) and Flood Warnings to take action to prepare for and respond to the impact of flooding. This includes the deployment of resources e.g. Flood Pod, sandbags, staff, alerting the Community Resilience Groups and issuing media briefings. A Graduated Response Plan (GRIP) facilitates scaling up and down as the weather event gets nearer. Therefore, early warning provides time to prepare effectively and make key tactical decisions on the prioritisation of resources.

"It's not just about the Forecasts/Alerts, it's about the added value that the experts can offer when you want more detail regarding potentially vulnerable areas. It's fair to say that the SFFS outputs are the most important forecasts we receive on a daily basis, given the vulnerabilities we have! The key piece of information was actually from SEPA, in that they were predicting record breaking levels on the Whitesands, that could exceed those experienced in 2009, 2013 and potentially as far back as 1982."

Mark Thomson, Principal Resilience Adviser, Dumfries and Galloway Council

Flood Guidance Statement

The Flood Guidance Statement (FGS) is the main product of the SFFS. This is produced 365 days of the year to communicate to emergency responders and central government the risk of flooding across Scotland for the next five days.

The FGS categorises the flood risk through the Flood Risk Matrix. This combines the potential impacts that could arise from fluvial, coastal or pluvial flooding and the likelihood of these impacts occurring. Consequently, a YELLOW (Low Overall Flood Risk) FGS could mean a high likelihood of minor flooding impacts that may cause some disruption or a very low likelihood of Severe flooding impacts such as risk to life. The associated text in the FGS is vital to interpret the situation and inform decision making.

Flood Risk Matrix Definitions

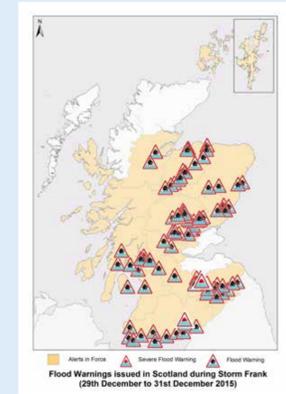
		Potential Impacts			
		Minimal	Minor	Significant	Severe
Likelihood	Expected (High)	Very High	High	Medium	Low
	Likely (Medium)	High	Medium	Low	Very Low
	Possible (Low)	Medium	Low	Very Low	Minimal
	Very Low	Low	Very Low	Minimal	None

OVERALL FLOOD RISK			
VERY LOW	LOW	MEDIUM	HIGH
Very Low	Low	Medium	High

POTENTIAL IMPACTS

- MINIMAL**
Isolated and minor flooding of land and roads
Isolated wave and spray
- MINOR**
Localised flooding of land and roads
Flooding affecting individual properties
Disruption to travel and key sites in floodplains
- SIGNIFICANT**
Flooding affecting parts of communities
Danger to life and damage to buildings
Disruption to travel and infrastructure
- SEVERE**
Widespread flooding affecting communities
Danger to life and severe travel disruption
Large scale evacuations
Collapse of buildings and loss of infrastructure

Impacts observed during Storm Frank



- Dumfries and Galloway**
- 11 Flood Warnings issued around the Solway Firth
 - Severe Flood Warning at Whitesands, Dumfries
 - Widespread flooding across the region
 - Significant impacts in a number of communities:
 - Newton Stewart
 - Carsphairn
 - Moniaive
 - Dumfries
 - Castle Douglas
 - Around 400 properties significantly affected
 - Major transport disruption, with some communities cut off
 - Major communications outage in Newton Stewart due to flooding of BT Exchange
- Nationwide**
- 101 Flood Warnings issued across the country
 - Two Severe Flood Warnings (Peebles and Whitesands)
 - Widespread flooding was observed
 - Many road and rail closures
 - Numerous evacuations
 - Over 1,000 properties flooded

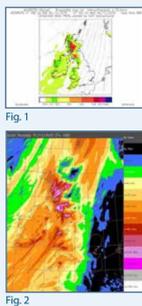
Summary

Due to the amber alert being raised on Day 4, Dumfries and Galloway was able to hold additional planning meetings and prioritise resources. Early communication is key in order to facilitate the extensive actions required by partners to respond. To assist with this the SFFS assessed multiple models to improve confidence and lead times in flood forecasts. This will continue to be improved as technology and science develops to ensure that the service is as efficient and valuable as it can be.

Similarly, the communication of flood risk to the public through new channels, such as social media, enabled the information to be distributed to a wider audience that may not be signed up to Flood Warnings. For Storm Frank, this allowed early action to be taken and property was protected, despite it being a significant flood event.

Supporting tools for SEPA

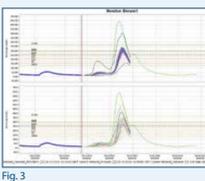
The Met Office forecast Storm Frank from a long way out. The MOGREPS (Global) (Fig. 1) and Euro4 model (Fig. 2) were both highlighting extremely large precipitation totals for Wednesday into Thursday.



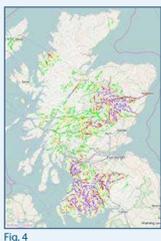
All forecasts continued to indicate an extreme event, with already saturated catchments from previous storms suggesting that flooding impacts were highly likely, with the potential to be severe and widespread throughout the country, particularly in Dumfries and Galloway.

This enabled the SFFS to issue an AMBER (Medium Flood Risk) status on Day 4 of the FGS Daily Risk Assessment. **One of the earliest since the service began.**

Nearer to the time of the predicted event, SEPA Flood Forecasting Hydrologists were able to see the impact of the precipitation on the river flows. Hydrographs, such as the MOGREPS probabilistic for Newton Stewart in Dumfries and Galloway (Fig. 3), highlighted huge flows in many rivers in multiple ensemble forecasts.

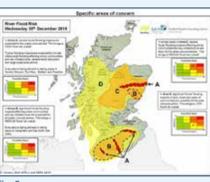


The Grid-to-Grid deterministic forecast also suggested significantly high flows that would equate to high return period flood events, especially in the South West and North East of the country as the rain band moved through (Fig. 4).



From the continued consistency of the forecasts and comparison with historical floods, the SFFS concluded that there was the potential for risk to life from flooding of the River Nith in Dumfries. A Severe Flood Warning message was issued.

The River Cree and River Annan were also expected to have Severe flooding impacts, however, no Flood Warnings are currently in existence in these catchments. To communicate this message to communities, SEPA tweeted the Areas of Concern map (Fig. 5). This was one of the most shared tweets by SEPA in 2015.



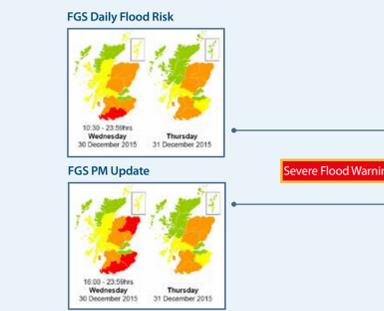
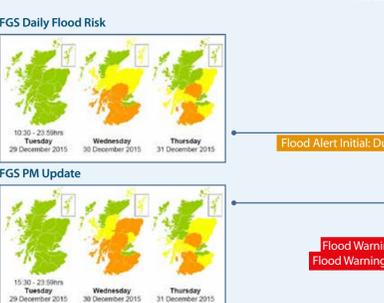
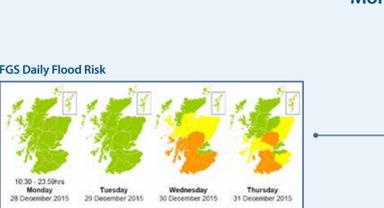
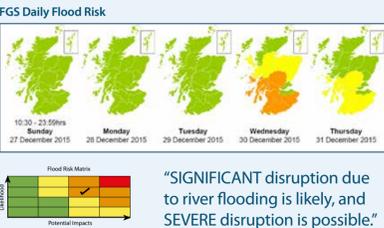
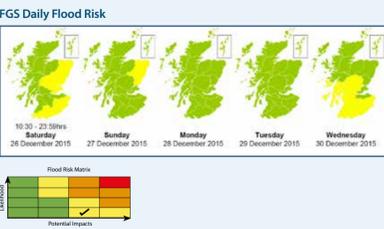
The Severe Flood Warning for Whitesands was downgraded to a Flood Warning after the worst of the weather had passed, to reflect the continued risk.

Winter 2015/16 was the first storm season to see the new Report-A-Flood tool used (Fig. 6). This allowed the public to report flooding in their area. It was incredibly useful to SEPA to understand the full extent of the situation on the ground and communicate any flooding in areas without Flood Warnings to the public and partners.



www.floodlinescotland.org.uk/report-a-flood/

Communications issued by SEPA



Sat 26 December 2015

Actions taken by Dumfries and Galloway Council

Sun 27 December 2015

10.30 → Enhanced monitoring
Early discussion with SEPA

Mon 28 December 2015

09.00 → Internal discussions between Flood Risk Management and Resilience Teams

12.00 → Briefing to Senior Officers in Dumfries & Galloway. Highlight weather forecast and schedule Multi-Agency meeting

14.00 → SgoRR Officials meeting

16.00 → 1st Multi Agency Incident Planning Meeting
Consider implications and commence preparations

Tue 29 December 2015

09.00 → Preparation begins
Clearing trash screens, alerting stakeholders, alerting communities, social media, etc.

12.00 → SgoRR Officials meeting → 2nd Multi Agency Incident Planning Meeting

12.30 → Agree specific actions for the evening and overnight in terms of resource deployment and communication

18.00 → 3rd Multi Agency Incident Planning Meeting
Finalise preparations

Wed 30 December 2015

05.45 → Major incident declared in Dumfries & Galloway → Emergency Centre Activated

06.00 →

10.30
13.41
15.30

Thurs 31 December 2015

08.18
10.30

18.00 → Dumfries & Galloway move to Recovery Phase