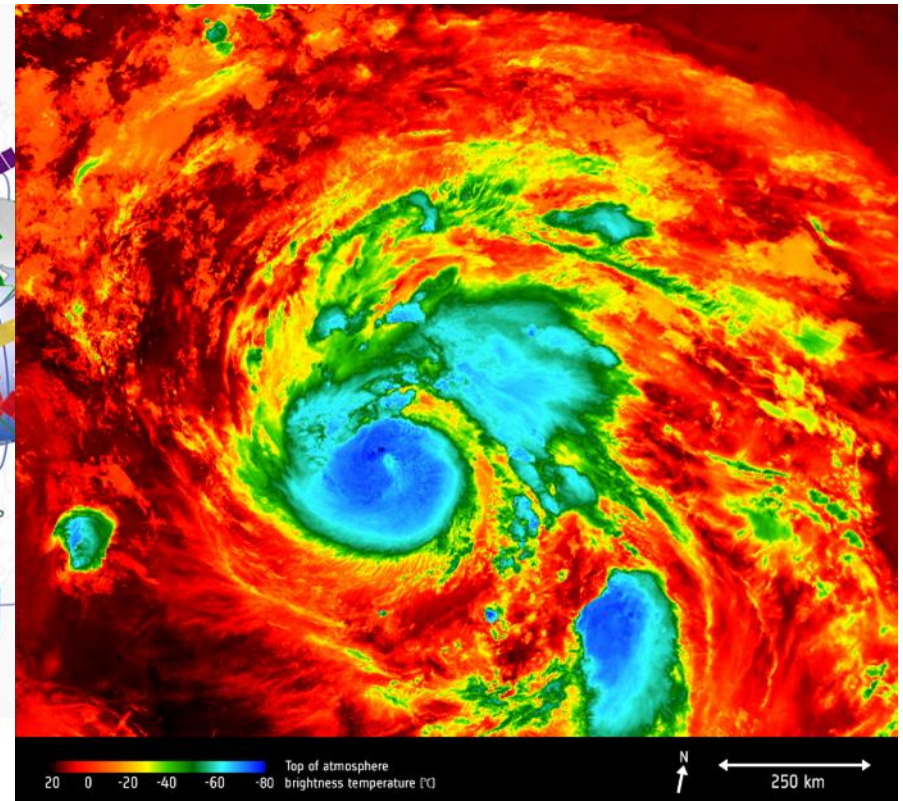
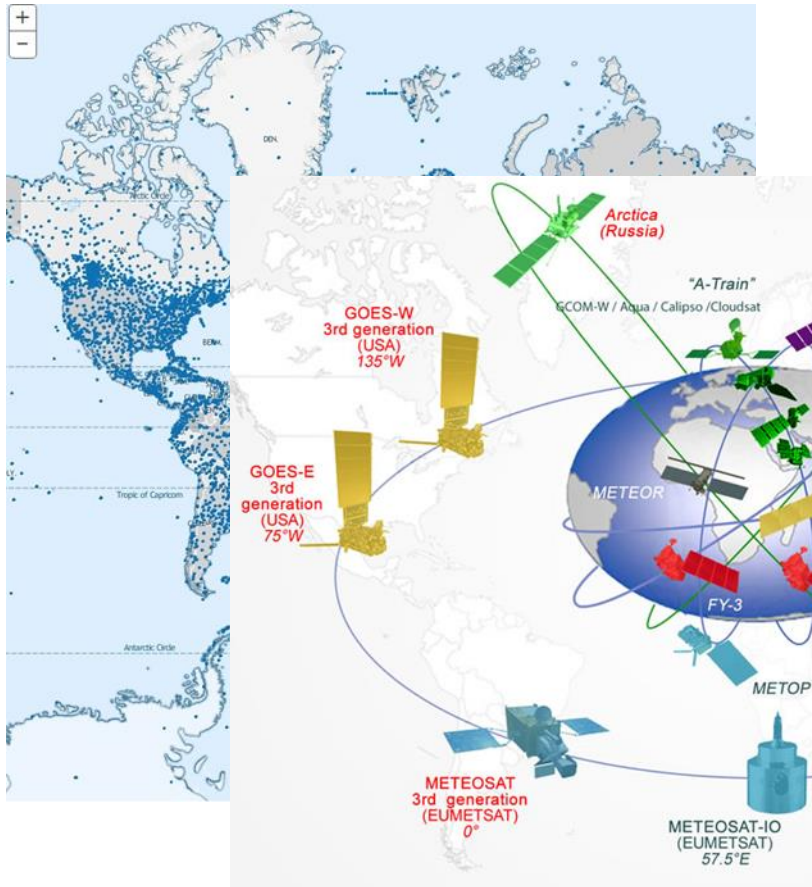


UK Approach to Space Weather Resilience

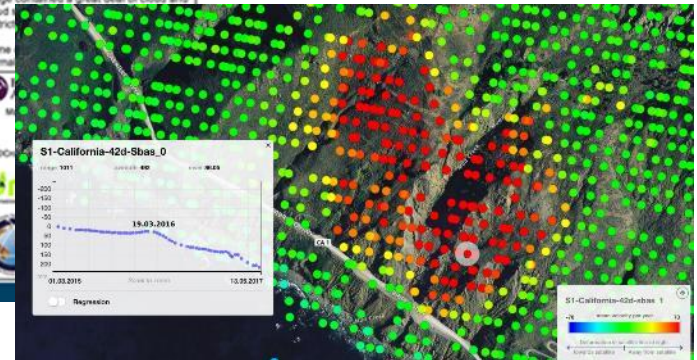
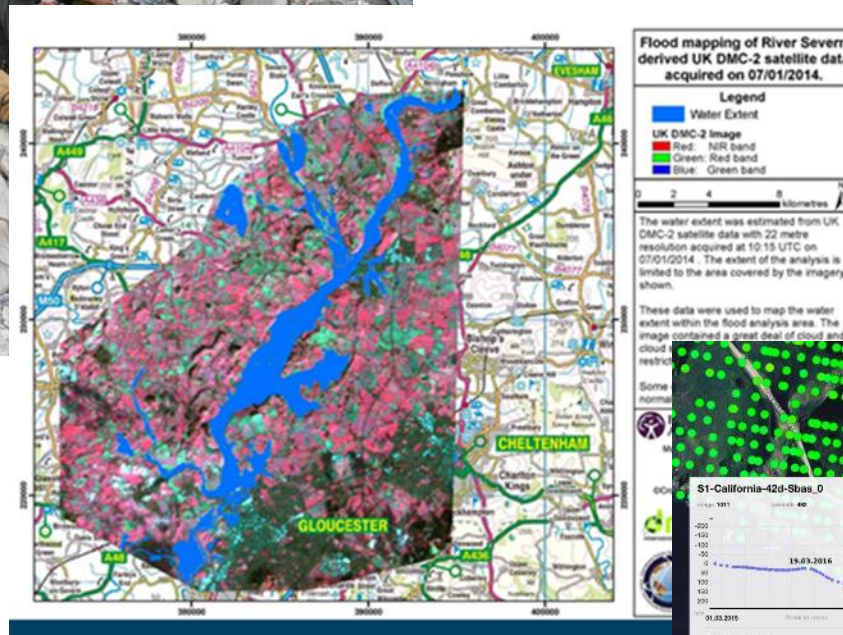
Dr Alice Bunn
International Director

The growing importance of Space



Hurricane Harvey August 2017
(ESA Sentinel 3 Temperature data)

The growing importance of Space



California Landslide
(Copernicus data, Norut)

The growing importance of Space

LONDON COUNTRY
Associated with the National Bus Company

Buses **347·347A**
and **HEMEL H**
via Denham, Harefield, Gars

*Bus 347 runs via Sandy Lane and H

Mondays

Uxbridge LT Station	06:01	06:08	06:34
Denham Chase Lane	06:02	06:09	06:35
Denham Station	06:03	06:10	06:36
Harefield Kings Arms	06:04	06:11	06:37
Mount Vernon Hospital	06:05	06:12	06:38
Northwood Station	06:06	06:13	06:39
South Oxhey Heyham Drive	06:07	06:14	06:40
South Oxhey Hayling Road	06:08	06:15	06:41
Oxhey Hillcroft Crescent	06:09	06:16	06:42
Bushey Arches	06:10	06:17	06:43
Watford Exchange Road	06:11	06:18	06:44
Watford Junction	06:12	06:19	06:45
Garston Bus Garage	06:13	06:20	06:46
Abbots Langley Lane Lane	06:14	06:21	06:47
Bedmond The Bell	06:15	06:22	06:48
Loversock Green Leather Bottle	06:16	06:23	06:49
Adeyfield High St. Green	06:17	06:24	06:50
Hemel Hempstead The Parade	06:18	06:25	06:51
Hemel Hempstead Bus Station	06:19	06:26	06:52



UK Government response



HM Government



HM Government

We will work with international partners to improve space weather forecasts and develop our capacity to respond to events....

A Secure and Prosperous
United Kingdom

National Security

Defence operations and our international security policy interests are heavily underpinned by access to space systems, and we will continue to use space capabilities to enhance the United Kingdom's national security.

The growing economic and military significance of space means a growing vulnerability to the associated risks, either from non-malicious hazards e.g. space debris and **space weather**, or threats from malicious counter-space technologies. Government is committed to assuring this critical strategic capability.



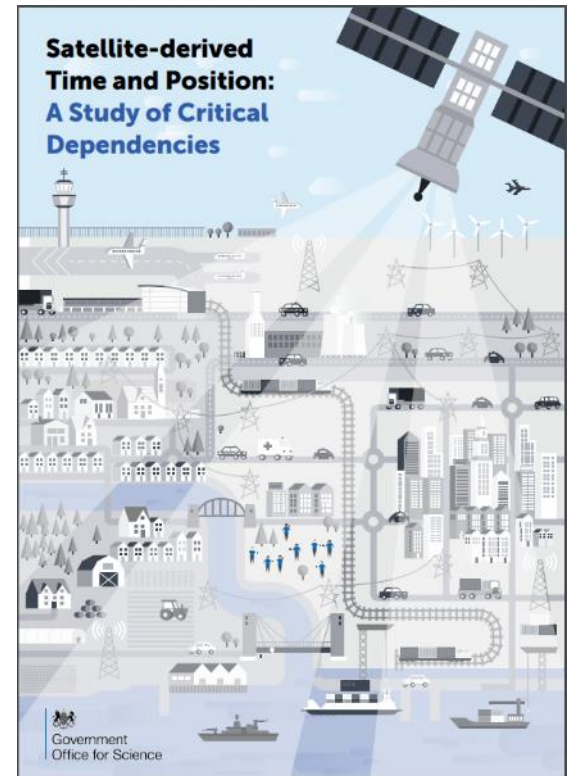
UK Government response

The UK considers space as critical national infrastructure, with the UK Space Agency the leading government department.

We must understand:

- What critical infrastructure relies on space
- What would be the consequences of disruption to or loss of space services
- How we can minimise the impact

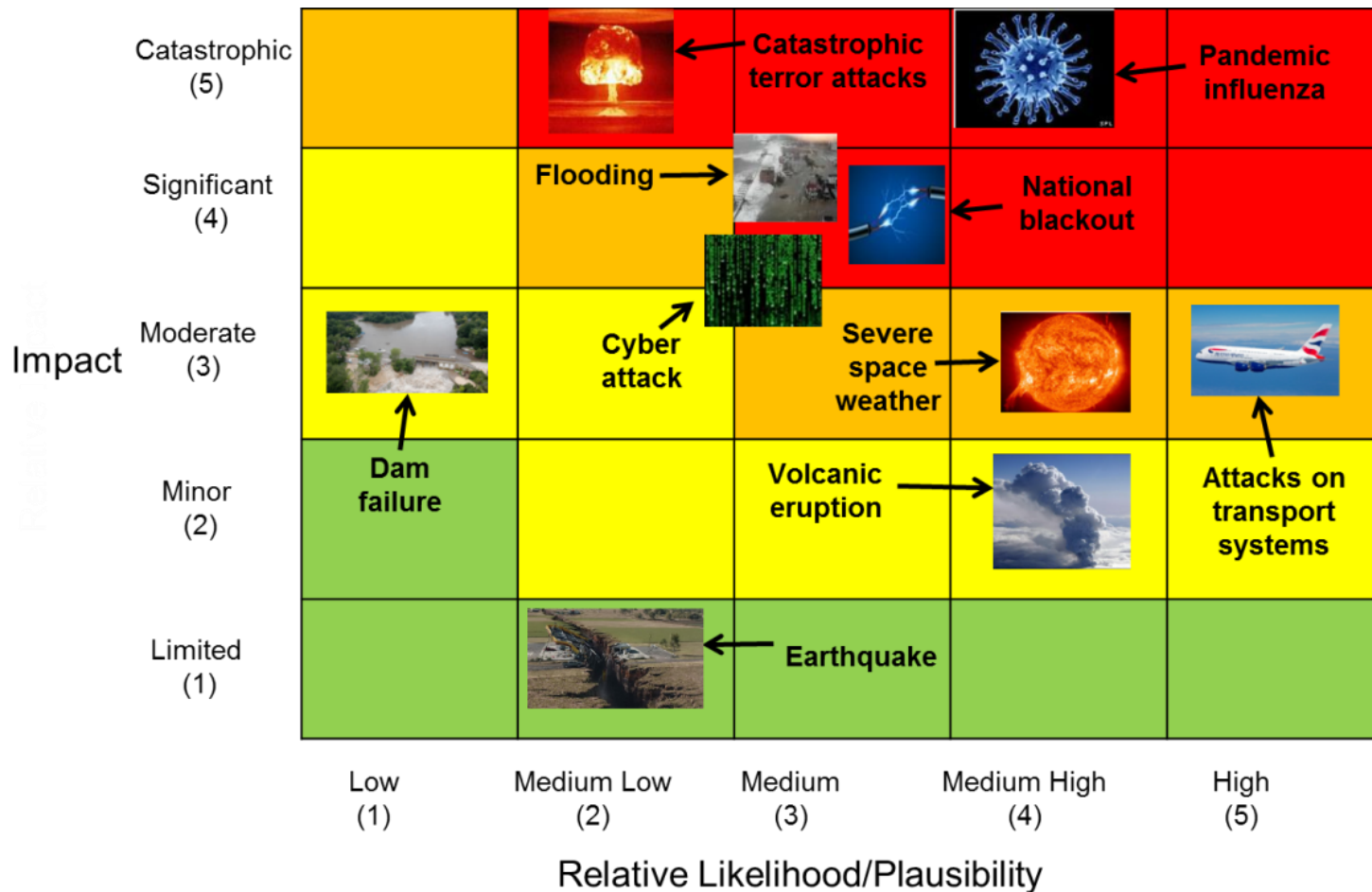
We must improve our resilience and prepare our response and recovery



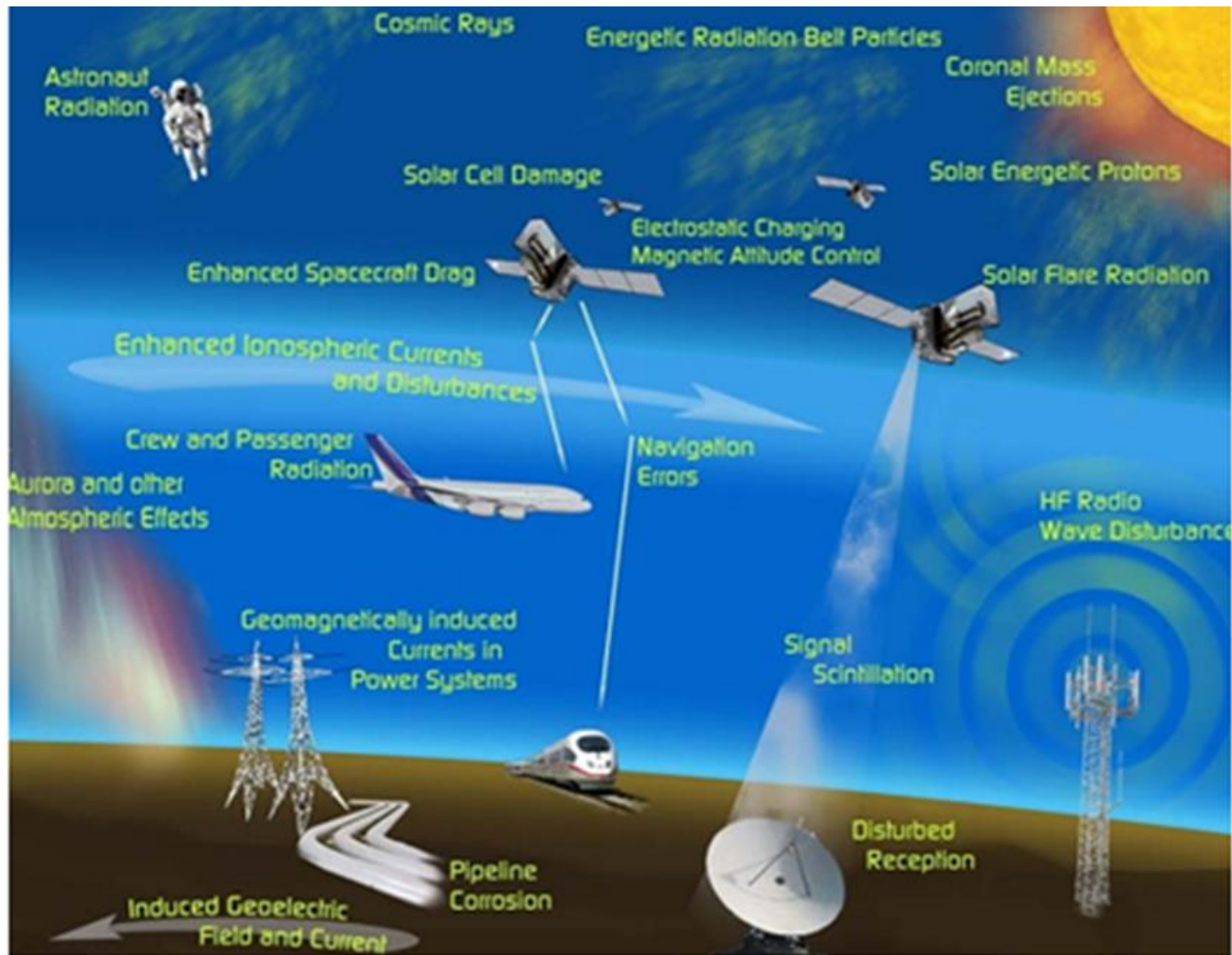
Case Study - 2018
Blackett Review into
GNSS Dependency

Space Weather poses a risk to space services

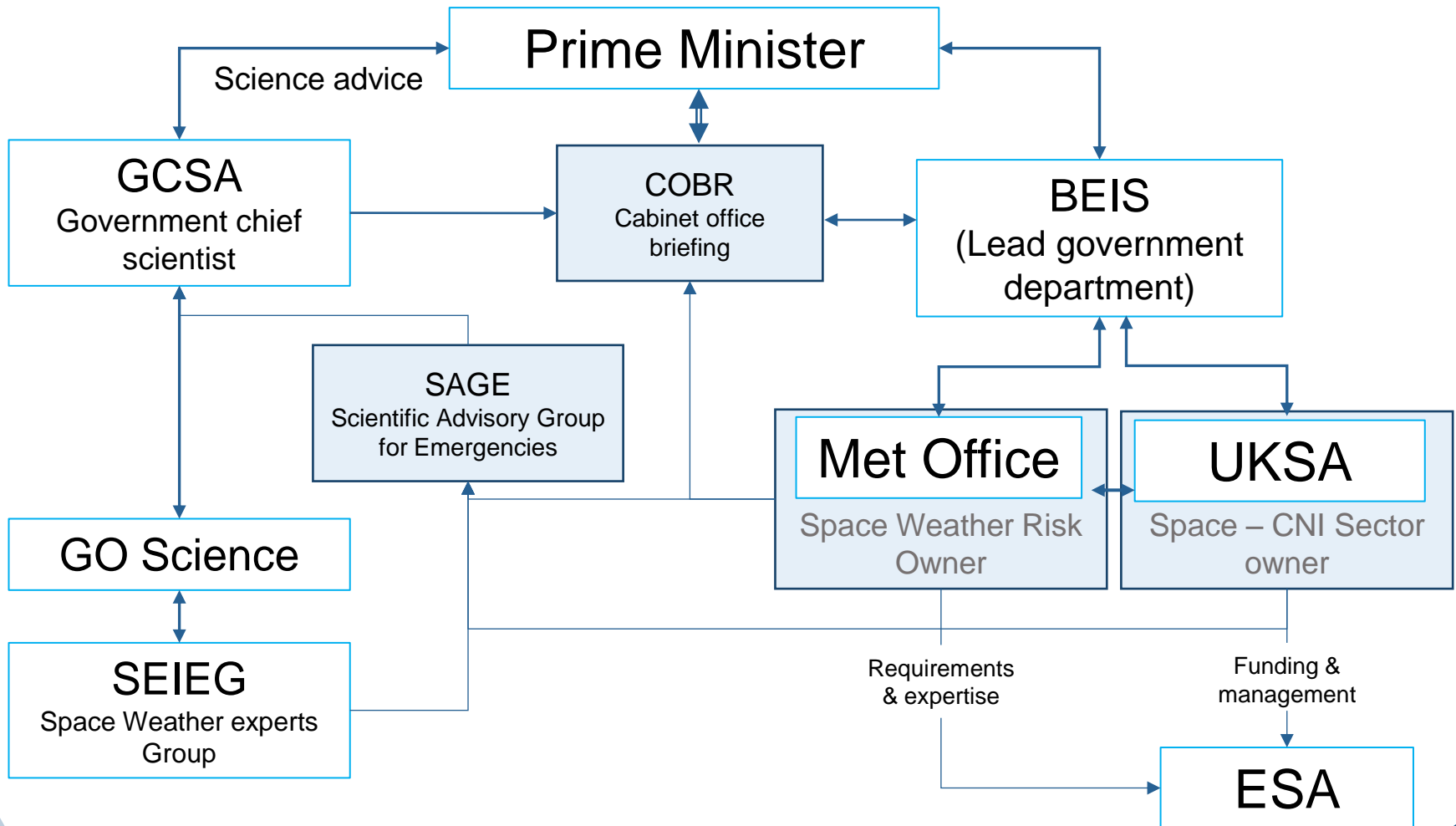
National Risk Assessment



Space Weather embedded in our overall CNI response



Government response in practice



Getting the advice right

The UK Met Office has developed a 24/7 space weather forecast service, operating now for 4 years

- Works closely with NOAA's Space Weather Prediction Centre, increasingly with USAF 557th and European partners

Timely and accurate forecasting is essential to mitigate extreme events.



International Cooperation

- Space weather is a global issue
- Reliable, fit for purpose, space weather observations are needed
 - Many of these can only be made from space
- We know space missions are expensive to launch and maintain
 - How can we share the burden?
 - We are already working together on forecasting
 - There is a synergy between our efforts in Europe and those of the US



International Cooperation

- UK have invested strongly in the European Space Agency programme
 - About €18M on Space Weather and €4M on SST
 - UK are the largest contributor to this programme
- Focus is on a L5 mission to deliver reliable observations of the solar corona and the inner heliosphere
 - Together L1 and L5 will greatly improve our capability to predict CMEs
 - We are also supporting improved models and observational capability in near Earth
- We can only achieve this through international cooperation



Space weather: In it for the long haul



Space Industry Act
2018

- The UK has come along way in recognising the importance of space weather
- The importance only grows:
 - Space already contributes over £13Bn to the economy directly
 - We are targeting a fourfold growth in the UK space sector
 - We have just passed new legislation to enable launches from UK soil
 - New innovations, high bandwidth telecommunications, satellite constellations and in-orbit servicing present new opportunities