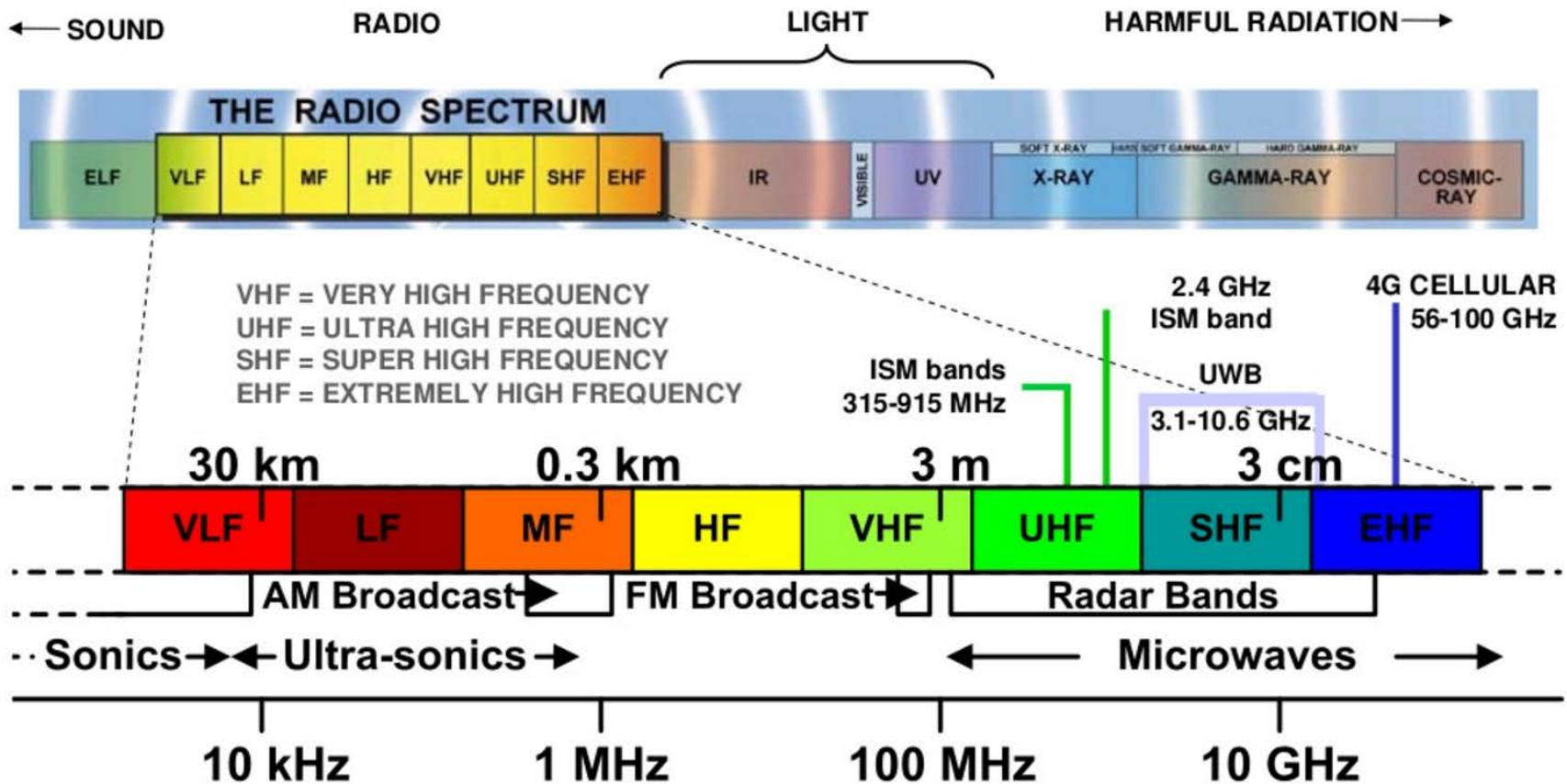


NCEO's frequency spectrum activities

Protecting the frequency spectrum
for existing and future EO missions

Richard Bantges
Imperial College London & NCEO

Electromagnetic Spectrum



ISM = Industrial, Scientific and Medical
UWB = Ultra Wide Band

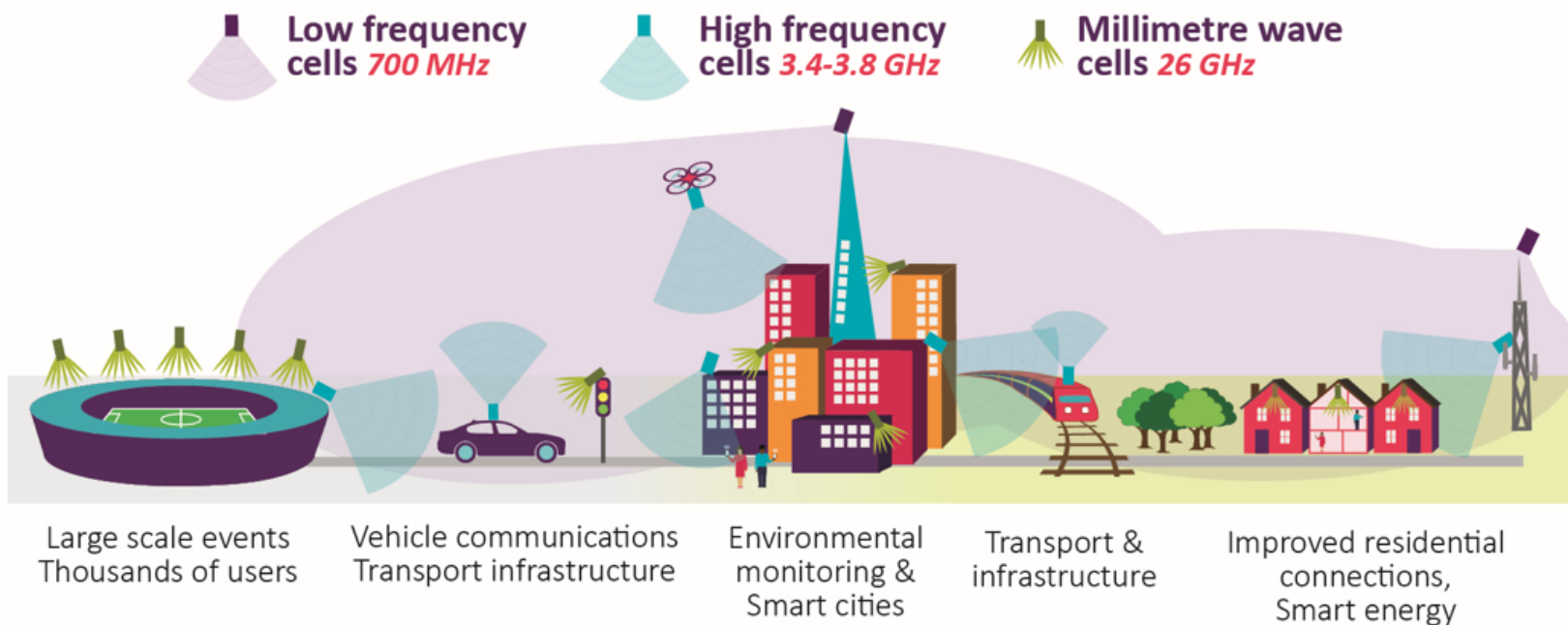
Source: JSC.MIL

Why is NCEO talking with Ofcom?

5G and Wi-Fi



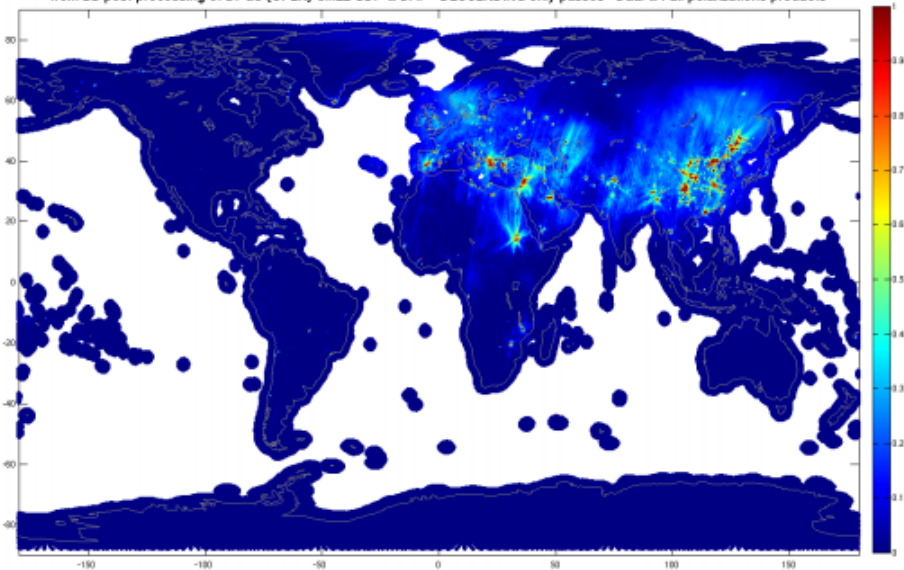
The RSPG has identified several bands for 5G in Europe, including three 'pioneer bands': **700 MHz, 3.4-3.8 GHz and 26 GHz**



Why is NCEO talking with Ofcom?

'Blinded' Satellite Gains Ground in Radio Interference Battle

Probability of sustained hard RFI occurrences (no outliers detection) for 20100216T003822_20100317T001334 Period (720 orbits) from BB post-processing of DPGS (OPER) SML2 UDP & DAP - DESCENDING only passes - Dual & Full polarizations products

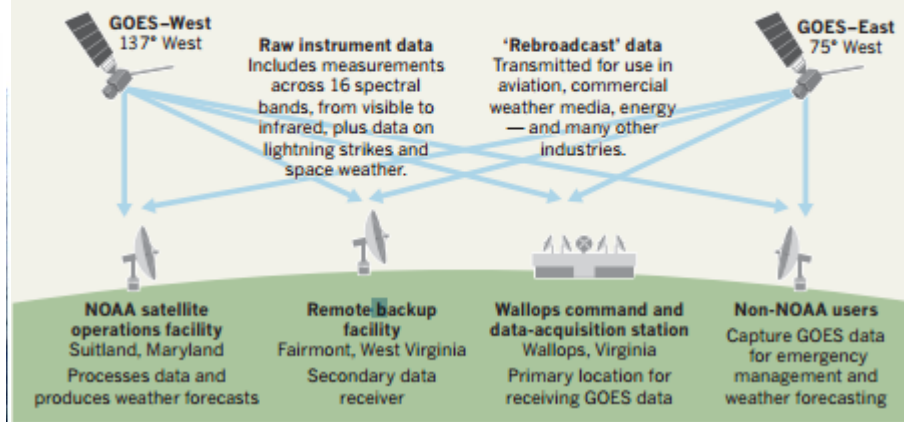


Oliva et al., IEEE, 2012

"At times, this interference was effectively blinding the instrument, rendering the data over certain areas unusable.. TV transmitters, radio links and networks such as security systems. Terrestrial radars appear to also cause some problems" ESA officials said.

WEATHER WATCHERS

The US government's Geostationary Operational Environmental Satellite (GOES) system monitors atmospheric and surface conditions in the continental United States — collecting data that power the country's weather forecasts.



Severe-weather forecasts deteriorate when wireless broadband interferes with satellite transmissions.

METEOROLOGY

Interference puts satellite data at risk

US plan to expand mobile-phone bandwidth raises alarm.

A. Witze, Nature 2016

"You couldn't even see the hurricane.. That's how devastated the imagery was." says Al Wissman, NOAA. "The culprit was radio interference from mobile-phone companies."

Impacts other science sectors

Spectrum wars: The battle for the airwaves

TV, mobiles, broadband, ID tags, tyre pressure sensors in your car: the radio spectrum may be our playground, but spectral noise is a nightmare for stargazers



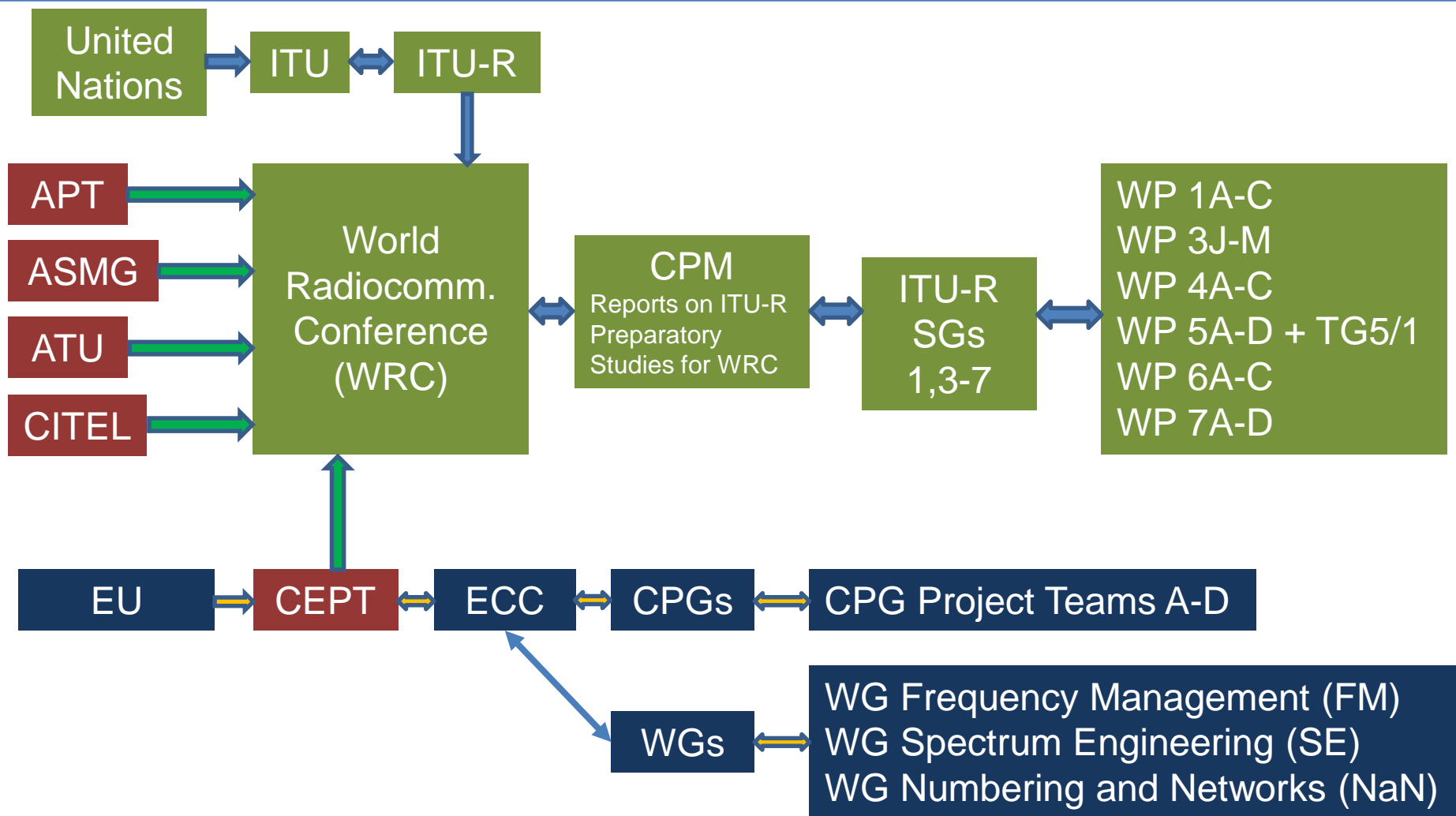
The right to remain silent...
Enrico Sacchetti/Millennium Images, UK

By Stephen Battersby

How is spectrum allocated?

- ITU – (United Nations) International Telecommunication Union
- ITU-R WRC (SGs -> WPs). Agenda - 10 “chapters”.
 - WRC-19 AI 1.5 – new bands for ESIM (17.7-19.7, 27.5-28.5GHz)
 - WRC-19 AI 1.13 – new bands for IMT 2020 (26, 32 & 40GHz)
 - WRC-19 AI 1.16 – RLAN increased spectrum (5150-5350, 5725-5850MHz)
- EU: CEPT (CPG, WGs), RSPG (advise EC)
- UK: Spectrum Strategy Committee (UK Government)
 - **SCC, SSAC**, IFPG
 - **Ofcom (consultations), Workshops (SPF), UKSA SM (stakeholders’ mtg)**
- UK contributions from
 - UKSA, Met Office, MoD, DCMS, **NCEO**, **CEOI**, ESA, satellite / communications /media industries

How is spectrum allocated?





Ofcom Consultations



Strategic review of satellite and space science use of spectrum

This Call for Input asks for stakeholders' input to Ofcom's **strategic review of spectrum used by the satellite and space science sectors**. We are keen to understand potential demand and supply trends, as well as trends in technology that might mitigate additional demand. The information provided by stakeholders will help us refine our understanding of the future spectrum challenges facing these two sectors. This understanding will inform the prioritisation of our work in these sectors and our future spectrum policy decisions.

Call for Input

Publication date: 4 June 2015

Closing Date for Responses: 13 August 2015



Space spectrum strategy Consultation

This document sets out our proposed Space Spectrum Strategy which covers the use of spectrum by the satellite and space science (including earth observation) sectors. These sectors already deliver important benefits to UK citizens and consumers, such as broadcast TV, global positioning, communications to ships and aircraft, satellite imagery and information about our climate. There is potential for greater benefits in the future and **we want to make sure we are focusing our efforts on the issues that we expect to unlock the biggest benefits**. We are inviting stakeholders' views on our analysis and our proposed priorities. Once confirmed, the strategy will shape the prioritisation of our work in these sectors over the coming years.

Consultation

Publication date: 1 March 2016

Closing Date for Responses: 10 May 2016

Ofcom Consultations

EXAMPLE UTILISATION OF THE ELECTROMAGNETIC SPECTRUM BY EARTH OBSERVATION SENSORS (1)

P-Band	L-Band	S-Band	C-Band	X-Band
P-Band SAR (Biomass)	PALSAR (ALOS)	S-SAR (NovasAR)	C-Band SAR (Sentinel-1A,B,C)	X-Band SAR (TerraSAR-X, TanDEM-X)
DORIS-NG (CryoSat-2, Jason-2)	PALSAR-2 (ALOS-2)	DORIS-NG (CryoSat, SPOT)	SRAL (Sentinel-3A,B,C)	SAR-2000 (COSMO-SkyMed)
	SAR-L (SAODCOM-1A,1B, 2A, 2B)	IGOR/GOX (COSMIC-1/6)	Poseidon-3B (Jason-3)	AMSR-E (Aqua)
	L-band Radar & L-band Radiometer (SMAP)		Poseidon-4 SAR (Sentinel 6A,B)	
	MIRAS (SMOS)		AMSR-E (Aqua)	
			ASCAT (Metop-A,B,C)	

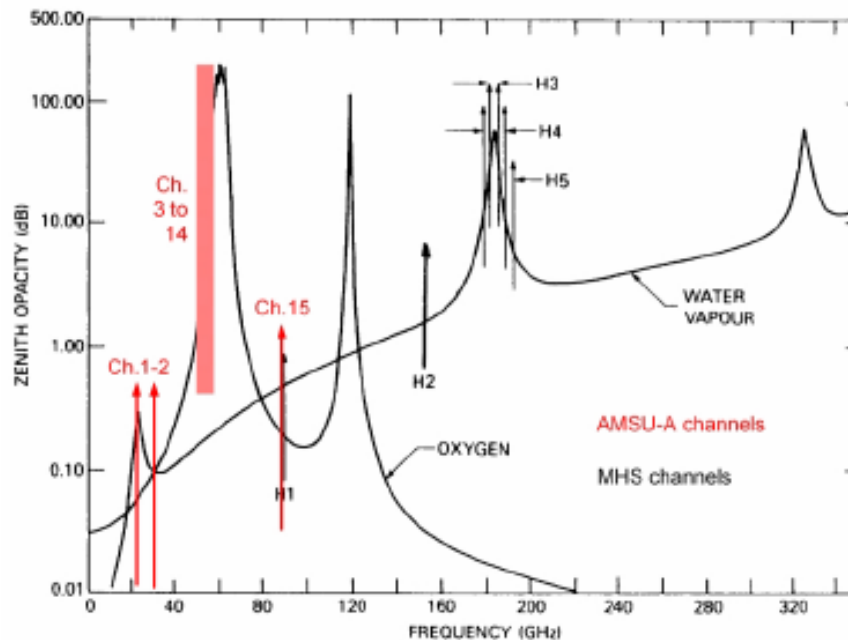
SENSOR TYPES (typical bandwidth)	Imager (6MHz)	Scatterometer (5-500kHz) Imager (20-85MHz)	Altimeter (200MHz) Imager (20-200MHz)	Scatterometer (5-500kHz) Altimeter (320MHz) Imager (20-320MHz)	Scatterometer (5-500kHz) Altimeter (100, 300MHz) Imager (20-100, 20-600MHz)
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NERC-NCEO Response to Ofcom strategic review of Space Science use of spectrum

August 2015

35 page

NERC, UKSA & The Met Office



NCEO Spectrum

- What can NCEO members do to help?
 - Provide expert advice / insight when requested
 - Uniqueness of observations
 - Need for continuity (climate vs NWP)
 - Think about impact of interference on your data / research aims (interference model?)
 - Think about future requirements:
 - observation types (active / passive, GSO/NGSO)
 - data rates (burst / continuous)
 - Think of the economic value / potential of the downstream data products

Summary

- NCEO is actively engaging with Ofcom to ensure the current and future value of specific frequency bands are recognised (impact at Government level, BEIS)
- Immense pressure on frequency bands where technology exists to exploit for future 5G services
- NCEO is coordinating with the UKSA (Mike Willis) and The Met Office (Neil Bewley / Mike Banks)
- NCEO frequency spectrum representatives cannot be experts in all areas – your help may be required
- Industry relates well to science value, but even more so to economic value