Imperial College London Projects

Environmental Research Group

Sussex Air Pollution Monitoring Network

Annual Report 2020

Independent analysis provided by:

Hima Chouhan, Senior Air Quality Analyst

Erica Winn, Senior Air Quality Analyst

School of Public Health

Environmental Research Group, Imperial College London

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EXECUTIVE SUMMARY

The Sussex Air Quality Monitoring Network provides a central source of information on air pollution issues of a defined and robust quality and can be used with confidence by members of the public, researchers and local authority officers.

Overall, the data capture was good across the network during 2020 with most of the analysers that were in operation for the whole year meeting the minimum requirement of 75% data capture. The reasons for lower capture rate at certain sites are described in Chapter 1.

As seen each year there were many days of 'Moderate' ozone (O_3) - recorded at all network sites monitoring for this pollutant. The first widespread incident resulting in 'moderate' O_3 occurred in April, and the last in September. 'High' levels were reached on six separate days in June and August.

'Moderate' PM_{10} levels were measured at five sites on seven days from February to April.

$PM_{2.5}$ was measured at four network sites during 2020. 'Moderate' pollution was recorded on five days from March to April.

There were no occurrences of 'Moderate' sulphur dioxide or 'Moderate' nitrogen dioxide recorded during the year.

All network sites, that achieved the necessary data capture, met the PM_{10} and $PM_{2.5}$, NO_2 and SO_2 Air Quality Strategy (AQS) objectives. Carbon monoxide (CO) is no longer measured at any network site.

All network sites monitoring O_3 exceeded the AQS objective.

The running annual mean concentrations for PM_{10}, PM_{25} and NO_2 showed a downward trend during 2020 while O_3 concentrations across the network showed a general increase during 2020.

The air quality sustainability indicator for roadside and background PM_{10} in Sussex has decreased in 2020 when compared to the previous year.

The air quality sustainability indicators for the Sussex urban and rural O_3 showed an increase in 2020.

INTRODUCTION

The Sussex Air Pollution Monitoring Network was formed in 1995 and has developed into a comprehensive regional monitoring network with twenty continuous monitoring sites in operation in January 2020.

Network sites are placed in a range of locations according to local monitoring requirements and resources. As a network, these individual sites allow an overall view of pollution levels in rural, industrial, urban and roadside parts of Sussex. As all sites are operated to defined network quality standards, each district or borough can augment their own monitoring results with comparable data from other network sites.

This report aims to make the data more accessible by describing the air pollution trends, episodes and standards across Sussex, and providing a freely available source of information for the public, local authorities and those in education.

The network's Internet site contains peak daily readings from each site, updated each day, as well as historical data from the continuous monitoring carried out across the region. There are many other features and data tools to aid interpretation as well as more detailed information about the network and the individual monitoring sites.

A general information section on the health effects of air pollution can also be found:

Network Home page:	http://www.sussex-air.net

CHAPTER 1: Results of Continuous Monitoring, 2020

This chapter describes the results of continuous monitoring which are presented in comparison to national and international standards and guidelines.

The extent and frequency of pollution episodes recorded during 2020 are also reported with some background information as to the cause of each.

Statistics from three London Air Quality Network sites are included at the base of each table for comparison purposes.

'Marylebone Road' is a kerbside site located on a busy six-lane road in central London. 'Kensington & Chelsea' is a background site in central London and 'Greenwich' is a background site in outer London.

Further information on these sites can be found at:

http://www.londonair.org.uk

Network performance

Table 1.1 shows data capture rates for each network analyser during 2020. Low capture rates may be caused by repeated or prolonged analyser or logging system breakdown, on-site communications problems or interruptions in power supply to the monitoring stations.

Most of the analysers that were in operation for the whole year met the minimum requirement of 75% data capture. However, the following sites failed to meet the stricter network target of 90% valid data capture:

Brighton and Hove - Preston Park, PM_{25}: a national monitoring network site ratified by a third party. The reasons for the low data capture are not known at this time.

Eastbourne – Holly Place, NO_2: a national monitoring network site ratified by a third party. The reasons for the low data capture were due to insufficient calibration information during a period of changing response.

Hastings – Bulverhythe, PM_{10}: the TEOM was removed for a workshop repair for a whole month during March to April. Due to overheating during June and July the analyser was switched off. Further issues occurred during August and October due to excessive noise on readings, often due to the imprecise seating of the main filter.

Wealden – Lullington Heath, SO_2: a national monitoring network site ratified by a third party. The reasons for the low data capture are not known at this time.

For the sites where analysers fell below the 75% threshold annual statistics are generally considered unrepresentative of the full year and results in the following tables are replaced with 'n.a.' where applicable.

Table 1.1 Analyser capture rates (%) for 2020					
Capture Rate (%)	**Nitrogen Dioxide**	**Ozone**	**PM_{10}**	**PM_{25}**	**Sulphur Dioxide**
Adur - Shoreham-by-Sea	96	-	100	-	-
Chichester - Lodsworth	-	97	-	-	-
Wealden - Isfield	-	94	-	-	-
Brighton and Hove - Preston Park [1]	99[1]	96[1]	-	70[1]	-
Crawley - Gatwick Airport[2]	90	-	94	80[2]	-
Chichester - A27 Chichester Bypass	100	-	99	-	-
Chichester – Orchard Street	99	-	-	-	-
Chichester – Westhampnett Road	100	-	-	-	-
Eastbourne - Devonshire Park	99	99	99	-	-
Eastbourne - Holly Place[1]	51[1]	-	98[1]	98[1]	-
Horsham - Park Way	100	-	100	-	-
Horsham - Storrington [1]	94[1]	-	-	-	-
Horsham - Cowfold	100	-	-	-	-
Hastings - Bulverhythe	91	-	77	-	-
Wealden - Lullington Heath[1]	11[1]	97[1]	-	-	86[1]
Lewes - West Street	100	-	-	-	-
Lewes – Newhaven[3]	63[3]	67[3]	70[3]	-	-
Rother – Rye Harbour	-	97	-	-	-
Rother - De La Warr Road	99	-	99	-	-
Worthing 2 - Grove Lodge[1]	99[1]	-	-	98[1]	-

[1] AURN
[2] Crawley Gatwick Airport PM_{25} joined network in March 2020
[3] Lewes Newhaven commissioned March 2020

A statistical overview of 2020

Annual mean concentrations are shown in Table 1.2. These statistics are calculated from hourly mean concentrations.

Chapter 2 describes trends in running annual mean concentrations in more detail.

Tables 1.3 and 1.4 show the number of days in which 'Moderate' and 'High' pollution were measured at each site. 'Very high' air pollution was not measured at any of the network sites during 2020.

The air quality banding system has been set by the Government to help describe pollution levels and their associated health effects.

More information on the Air Quality Banding System can be found at:

http://londonair.org.uk/london/asp/airpollutionindex.asp?IndexDate=2012

Air pollution banding	Value	Accompanying health messages for at-risk groups and the general population	
		At-risk individuals *	General population
Low	1-3	***Enjoy*** your usual outdoor activities.	***Enjoy*** your usual outdoor activities.
Moderate	4-6	Adults and children with lung problems, and adults with heart problems, ***who experience symptoms***, should ***consider*** **reducing** strenuous physical activity, particularly outdoors.	***Enjoy*** your usual outdoor activities.
High	7-9	Adults and children with lung problems, and adults with heart problems, should ***reduce*** strenuous physical exertion, particularly outdoors, and particularly if they experience symptoms. People with asthma may find they need to use their reliever inhaler more often. Older people should also ***reduce*** physical exertion.	Anyone experiencing discomfort such as sore eyes, cough or sore throat should ***consider reducing*** activity, particularly outdoors.
Very High	10	Adults and children with lung problems, adults with heart problems, and older people, should ***avoid*** strenuous physical activity. People with asthma may find they need to use their reliever inhaler more often.	***Reduce*** physical exertion, particularly outdoors, especially if you experience symptoms such as cough or sore throat.

* Adults and children with heart or lung problems are at greater risk of symptoms. Follow your doctor's usual advice about exercising and managing your condition.

Table 1.2 Annual means 2020					
Mean concentration	**Nitrogen Dioxide**	**Ozone**	**PM_{10}**	**PM_{25}**	**Sulphur Dioxide**
Adur - Shoreham-by-Sea	20	-	22	-	-
Chichester - Lodsworth	-	60	-	-	-
Wealden - Isfield	-	52	-	-	-
Brighton and Hove - Preston Park [1]	11[1]	56[1]	-	(9)[1]	-
Crawley - Gatwick Airport[2]	17	-	15	8[2]	-
Chichester - A27 Chichester Bypass	23	-	18	-	-
Chichester – Orchard Street	16	-	-	-	-
Chichester – Westhampnett Road[3]	19	-	-	-	-
Eastbourne - Devonshire Park	11	61	17	-	-
Eastbourne - Holly Place[1]	(10)[1]	-	14[1]	9[1]	-
Horsham - Park Way	19	-	16	-	-
Horsham - Storrington [1]	17[1]	-	-	-	-
Horsham - Cowfold	23	-	-	-	-
Hastings - Bulverhythe	11	-	21	-	-
Wealden - Lullington Heath[1]	6[1]	66[1]	-	-	2[1]
Lewes - West Street	16	-	-	-	-
Lewes – Newhaven[3]	(20)[3]	(54)[3]	(23)[3]	-	-
Rother – Rye Harbour	-	57	-	-	-
Rother - De La Warr Road	15	-	20	-	-
Worthing 2 - Grove Lodge[1]	26[1]	-	-	8[1]	-
Greenwich 4	13	44	14	10	(3)
Kens and Chelsea 1	21	57	-	8	2
Marylebone Road	44	31	-	-	42
Values shown in brackets have less than 75% data capture rate					

[1] AURN
[2] Crawley Gatwick Airport PM_{25} joined network in March 2020
[3] Lewes Newhaven commissioned March 2020

Table 1.3 Number of days 'moderate' air pollution during 2020 (Air Quality Index 4-6)					
	Nitrogen Dioxide	Ozone	PM_{10}	PM_{25}	Sulphur Dioxide
Adur - Shoreham-by-Sea	0	-	0	-	-
Chichester - Lodsworth	-	44	-	-	-
Wealden - Isfield	-	20	-	-	-
Brighton and Hove - Preston Park [1]	0[1]	29[1]	-	(3)[1]	-
Crawley - Gatwick Airport[2]	0	-	5	1[2]	-
Chichester - A27 Chichester Bypass	0	-	0	-	-
Chichester – Orchard Street	0	-	-	-	-
Chichester – Westhampnett Road	0	-	-	-	-
Eastbourne - Devonshire Park	0	21	1	-	-
Eastbourne - Holly Place[1]	(0)[1]	-	0[1]	2[1]	-
Horsham - Park Way	0	-	0	-	-
Horsham - Storrington [1]	0[1]	-	-	-	-
Horsham - Cowfold	0	-	-	-	-
Hastings - Bulverhythe	0	-	1	-	-
Wealden - Lullington Heath[1]	0[1]	34[1]	-	-	0[1]
Lewes - West Street	0	-	-	-	-
Lewes – Newhaven[3]	(0)[3]	(17)[3]	(1)[3]	-	-
Rother – Rye Harbour	-	17	-	-	-
Rother - De La Warr Road	0	-	1	-	-
Worthing 2 - Grove Lodge[1]	0[1]	-	-	0[1]	-
Greenwich 4	0	13	1	7	(0)
Kens and Chelsea 1	0	35	-	2	0
Marylebone Road	0	9	-	-	0
Values shown in brackets have less than 75% data capture rate					

[1] AURN
[2] Crawley Gatwick Airport PM_{25} joined network in March 2020
[3] Lewes Newhaven commissioned March 2020

Table 1.4 Number of days 'high' air pollution during 2020 (Air Quality Index 7-9)					
	Nitrogen Dioxide	Ozone	PM_{10}	PM_{25}	Sulphur Dioxide
Adur - Shoreham-by-Sea	0	-	0	-	-
Chichester - Lodsworth	-	0	-	-	-
Wealden - Isfield	-	1	-	-	-
Brighton and Hove - Preston Park [1]	0[1]	1[1]	-	(0)[1]	-
Crawley - Gatwick Airport[2]	0	-	0	0[2]	-
Chichester - A27 Chichester Bypass	0	-	0	-	-
Chichester – Orchard Street	0	-	-	-	-
Chichester – Westhampnett Road	0	-	-	-	-
Eastbourne - Devonshire Park	0	5	0	-	-
Eastbourne - Holly Place[1]	0[1]	-	0[1]	0[1]	-
Horsham - Park Way	0	-	0	-	-
Horsham - Storrington [1]	0[1]	-	-	-	-
Horsham - Cowfold	0	-	-	-	-
Hastings - Bulverhythe	0	-	0	-	-
Wealden - Lullington Heath[1]	0[1]	5[1]	-	-	0[1]
Lewes - West Street	0	-	-	-	-
Lewes – Newhaven[3]	(0)[3]	(0)[3]	(0)[3]	-	-
Rother – Rye Harbour	-	3	-	-	-
Rother - De La Warr Road	0	-	0	-	-
Worthing 2 - Grove Lodge[1]	0[1]	-	-	0[1]	-
Greenwich 4	0	0	0	0	(0)
Kens and Chelsea 1	0	4	0	0	0
Marylebone Road	0	0	-	-	0
Values shown in brackets have less than 75% data capture rate					

[1] AURN
[2] Crawley Gatwick Airport PM_{25} joined network in March 2020
[3] Lewes Newhaven commissioned March 2020

Nitrogen Dioxide (NO_2) and Sulphur Dioxide (SO_2)

There were no occurrences of 'Moderate' or above NO_2 or SO_2 pollution during 2020 at network sites.

Ozone (O_3)

Widespread 'Moderate' O_3 was recorded on a number of days at all the network sites monitoring for this pollutant. These episodes occur during the warmer sunnier months due to the photochemical reaction of nitrogen oxides with hydrocarbons.

It is also known that a proportion of the O_3 experienced in Sussex is transported from continental Europe under certain meteorological conditions.

The first widespread incident resulting in 'Moderate' O_3 occurred in April, and the last in September.

'High' levels were reached on six separate days – 24th and 25th June and then again on 8th, 9th, 11th and 12th of August.

PM_{10} Particulates

Defra's Air Pollution Index applies to PM_{10} measured by a reference equivalent method such as the Filter Dynamic Measurement System (FDMS). The TEOM PM_{10} data has been converted to reference equivalent PM_{10} using the Volatile Correction Model (VCM) method developed by the Environmental Research Group. All TEOM PM_{10} data reported on the Sussex-air website prior to the 1st January 2004 has been corrected using a gravimetric conversion factor of 1.3. All data reported after the 1st January 2004 has been corrected using the Volatile Correction Model (VCM).

Further details about the VCM can be found at:

http://www.volatile-correction-model.info/

'Moderate' PM_{10} levels were measured at five sites on seven days from February to April.

$PM_{2.5}$ Particulates

$PM_{2.5}$ was measured at four network sites during 2020. 'Moderate' pollution was recorded on five days from March to April.

Significant episodes during 2020

Particulate Episodes

'Moderate' PM_{10} and $PM_{2.5}$ episodes occurred from February to April 2020 at seven of the network sites that monitor these pollutants.

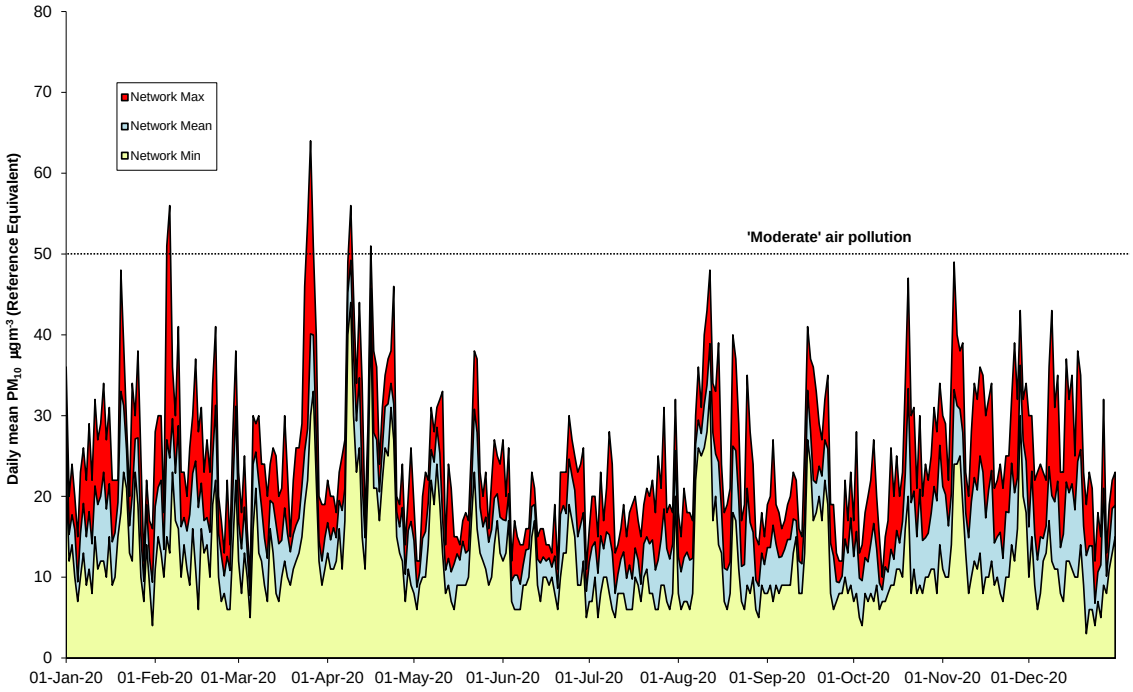
The first widespread incident occurring at five of the sites (Eastbourne – Devonshire Park, Eastbourne – Holly Place, Hastings – Bulverhythe, Rother – De La Warr Road, Brighton and Hove – Preston Park) was on the 9th April. Prior to this there were five days during February and March where 'moderate' levels were recorded at the Crawley - Gatwick Airport site only. There were a further three days in April where episodes occurred at Eastbourne – Holly Place and Brighton and Hove – Preston Park.

Particle pollution episodes are common during spring over western Europe as the wind direction becomes easterly and air pollution builds up across the continent and the UK. During March 2020 transport restrictions due to the Covid pandemic and the temporary closures of many businesses may have averted widespread moderate or high air pollution episodes.

The chemical signature of the particles that we did detect indicated that the dominant pollution sources were wood burning along with emissions from agriculture, transport and industry.

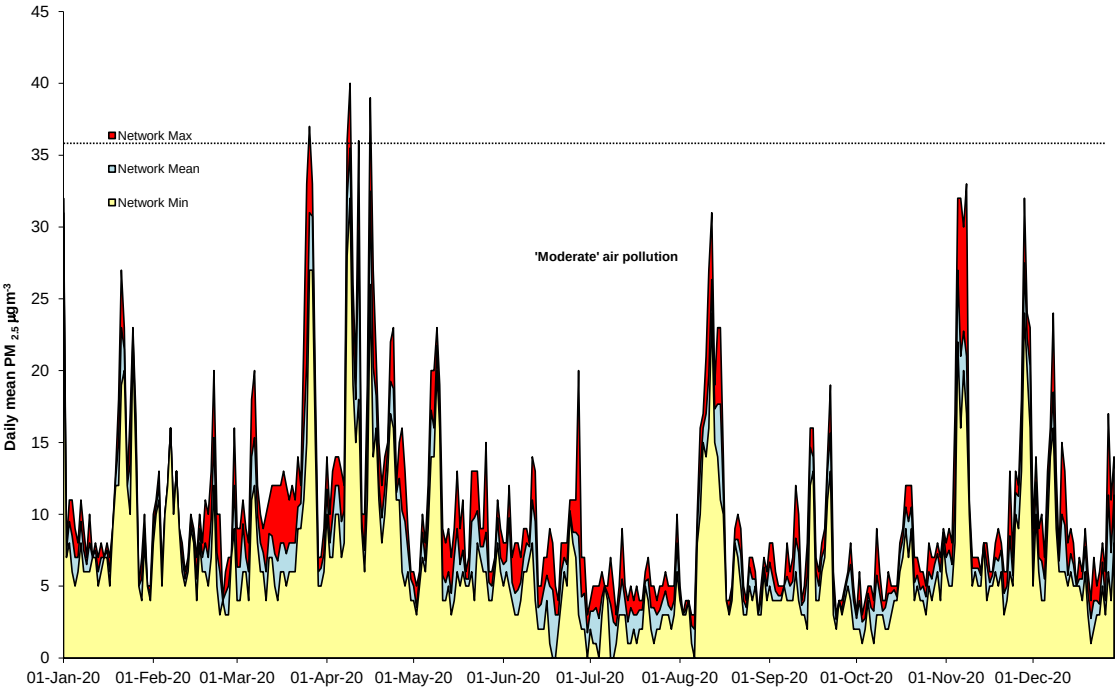
The daily mean PM_{10} levels for 2020 are illustrated in Figure 1.

Figure 1 Daily mean PM_{10} levels across the network during 2020



The daily mean $PM_{2.5}$ levels for 2020 are illustrated in Figure 2.

Figure 2 Daily mean $PM_{2.5}$ levels across the network during 2020



Spring & Summer Photochemical Episodes

Figure 3 illustrates the distribution of photochemical episodes of O_3 during 2020.

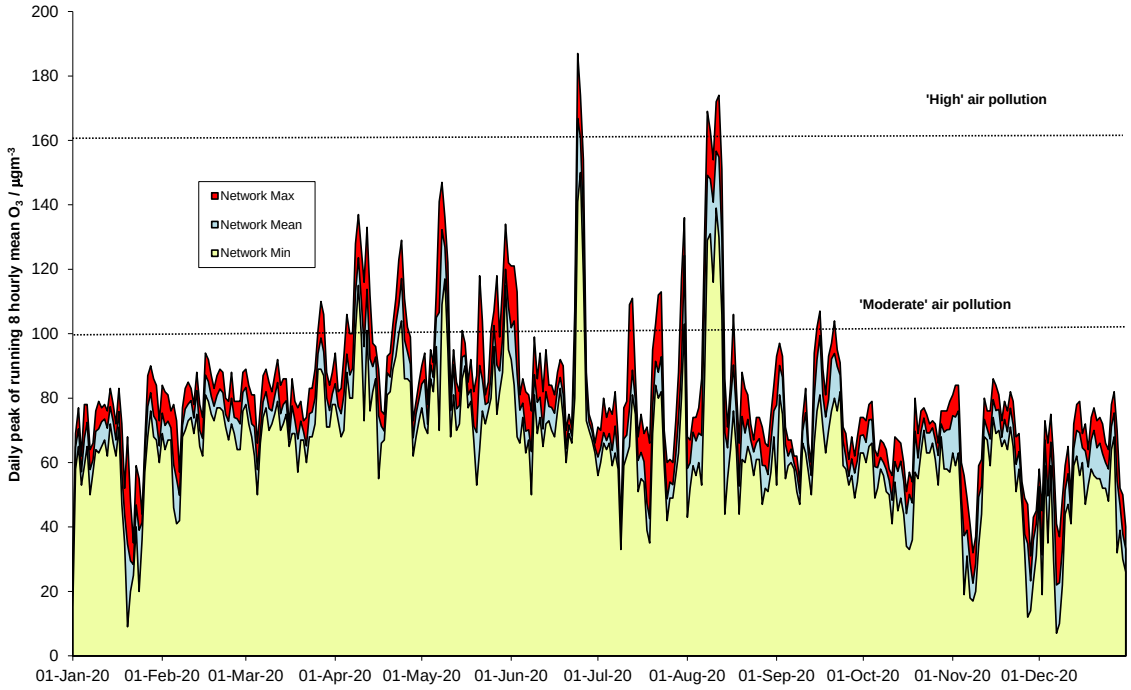
Photochemical episodes occur annually in Sussex. Ozone is a secondary pollutant produced by reactions of other pollutants in the atmosphere, and locally it is scavenged (reduced) by exhaust emissions.

A proportion of the O_3 experienced in Sussex is also transported from continental Europe.

An additional consequence of the Covid restrictions and reduced traffic emissions, is that ozone concentrations were higher and longer lived than we normally experience.

The first widespread O_3 episode of the year occurred in April and the last in September with 'High' levels recorded on six separate days in June and August at several sites.

Figure 3 Daily peak of running 8 hourly mean ozone levels across the network during 2020



2020 in Comparison with the Air Quality Strategy (AQS) Objectives

Tables 1.5a and 1.5b compare results of monitoring in 2020 to the Government's AQS objectives. There is often more than one objective per pollutant reflecting the differing health effects of short and long-term exposure. Each objective had an achievement date between 2004 and 2010 depending on the pollutant. The $PM_{2.5}$ objective had an achievement date of 2020.

Where a site did not achieve a minimum of 75% data capture for the year, the measurements cannot be accurately compared to the AQS objectives and are entered as 'not applicable'.

No network sites exceeded either PM_{10} or $PM_{2.5}$ objectives. The distribution of exceedances of the 50 μgm^{-3} daily mean value of PM_{10} (equating to the EU Health Threshold) across the network during 2020 is shown in Figure 1.

The distribution of exceedances of the 36 μgm^{-3} daily mean value of $PM_{2.5}$ during 2020 is shown in Figure 2.

All sites also met the NO_2 and SO_2 objectives (SO_2 measured at only one site).

All network sites monitoring O_3 exceeded the AQS objective.

The daily peak of running eight hourly mean O_3 levels across the network during 2020 are shown in Figure 3.

CO is no longer monitored at any of the Sussex stations.

Table 1.5a Comparison with Air Quality Strategy Objectives – Achieved ('yes') or Exceeded ('no')						
	PM_{10}		$PM_{2.5}$		SO_2	
	A	B	C	D	E	F
Adur - Shoreham-by-Sea	Yes (0)	Yes (22)	-	-	-	-
Chichester - Lodsworth	-	-	-	-	-	-
Wealden - Isfield	-	-	-	-	-	-
Brighton and Hove - Preston Park [1]	-	-	n.a	-	-	-
Crawley - Gatwick Airport[2]	Yes (5)	Yes (15)	n.a[2]	-	-	-
Chichester - A27 Chichester Bypass	Yes (0)	Yes (18)	-	-	-	-
Chichester – Orchard Street	-	-	-	-	-	-
Chichester – Westhampnett Road[3]	-	-	-	-	-	-
Eastbourne - Devonshire Park	Yes (1)	Yes (17)	-	-	-	-
Eastbourne - Holly Place[1]	Yes (0)[1]	Yes (14)[1]	Yes (9)[1]	-	-	-
Horsham - Park Way	Yes (0)	Yes (16)	-	-	-	-
Horsham - Storrington [1]	-	-	-	-	-	-
Horsham - Cowfold	-	-	-	-	-	-
Hastings - Bulverhythe	n.a	n.a	-	-	-	-
Wealden - Lullington Heath[1]	-	-	-	Yes (0)[1]	Yes (0)[1]	Yes (0)[1]
Lewes - West Street	-	-	-	-	-	-
Lewes – Newhaven[3]	n.a[3]	n.a[3]	-	-	-	
Rother – Rye Harbour	-	-	-	-	-	-
Rother - De La Warr Road	Yes (1)	Yes (20)	-	-	-	-
Worthing 2 - Grove Lodge[1]	-	-	Yes (8)[1]	-	-	-
Greenwich 4	Yes (1)	Yes (14)	Yes (10)	n.a	n.a	n.a
Kens and Chelsea 1	-	-	Yes (8)	Yes (0)	Yes (0)	Yes (0)
Marylebone Road	-	-	-	Yes (0)	Yes (0)	Yes (0)

[1] AURN
[2] Crawley Gatwick Airport PM_{25} joined network in March 2020
[3] Lewes Newhaven commissioned March 2020

A: 50 μg m^{-3} not to be exceeded more than 35 times a year measured as 24 hr mean.

B: 40 μg m^{-3} measured as annual mean. All data is reference equivalent

C: 25 μg m^{-3} measured as annual mean. All data is reference equivalent

D: 350 μg m^{-3} not to be exceeded more than 24 times a year measured as 1 hour mean.

E: 125 μg m^{-3} not to be exceeded more than 3 times a year measured as 24 hour mean.

F: 266 μg m^{-3} not to be exceeded more than 35 times a year measured as 15 min.

Table 1.5b Comparison with Air Quality Strategy Objectives – Achieved ('yes') or Exceeded ('no')			
	O_3	NO_2	
	A	B	C
Adur - Shoreham-by-Sea	-	Yes (0)	Yes (20)
Chichester - Lodsworth	No (44)	-	-
Wealden - Isfield	No (21)	-	-
Brighton and Hove - Preston Park [1]	No (30)[1]	Yes (0)[1]	Yes(11)[1]
Crawley - Gatwick Airport	-	Yes (0)	Yes (17)
Chichester - A27 Chichester Bypass	-	Yes (0)	Yes (23)
Chichester – Orchard Street	-	Yes (0)	Yes (16)
Chichester – Westhampnett Road[3]	-	Yes (0)	Yes (19)
Eastbourne - Devonshire Park	No (26)	Yes (0)	Yes (11)
Eastbourne - Holly Place[1]	-	n.a	n.a
Horsham - Park Way	-	Yes (0)	Yes (19)
Horsham - Storrington [1]	-	Yes (0)[1]	Yes (17)[1]
Horsham - Cowfold	-	Yes (0)	Yes (23)
Hastings - Bulverhythe	-	Yes (0)	Yes (11)
Wealden - Lullington Heath[1]	No (39)[1]	n.a[1]	n.a[1]
Lewes - West Street	-	Yes (0)	Yes (16)
Lewes – Newhaven[3]	n.a[3]	n.a[3]	n.a[3]
Rother – Rye Harbour	No (20)	-	-
Rother - De La Warr Road	-	Yes (0)	Yes (15)
Worthing 2 - Grove Lodge[1]	-	Yes (0)[1]	Yes (26)[1]
Greenwich 4	No (13)	Yes (0)	Yes (13)
Kens and Chelsea 1	No (39)	Yes (0)	Yes (21)
Marylebone Road	Yes (9)	Yes (0)	No (44)

[1]AURN
[2]Crawley Gatwick Airport PM_{25} joined network in March 2020
[3]Lewes Newhaven commissioned March 2020

A: 100 μg m^{-3} not to be exceeded more than 10 times a year measured as the daily max of running 8 hour mean.

B: 200 μg m^{-3} not to be exceeded more than 18 times a year measured as 1 hour mean.

C: 40 μg m^{-3} measured as an annual mean.

Indicators of Sustainable Development

The UK Government is required by European Union law to publish a number of indicators that can be used to assess whether its aims of sustainable development are being met. The UK Sustainable Development Strategy was released in 1999 and one of the Headline Indicators was air quality. The strategy was updated in 2005 and included new air quality indicators designed to better reflect the effects on health of long term exposure to lower levels of pollution.

The three indicators are:

i. Annual average urban PM_{10} concentrations (roadside and background),

ii. Annual average O_3 concentrations (rural and urban background) measured as the daily maximum 8-hour running mean,

iii. Total number of days in which one or more of the specified pollutants were recorded as 'Moderate' or worse air pollution (the old headline indicator) in urban and rural locations.

The third indicator is the most complex and has a number of site requirements to ensure that monitoring data are representative:

- Rural sites should be included if they at least monitor O_3 (ideally PM_{10} should also be monitored but this criterion would exclude almost all sites from the Indicator),

- Urban Background and Roadside sites should be included if they monitor at least PM_{10}

Due to the small number of exceedances, it was decided that the absence of monitoring for NO_2 and CO would not result in a significant under-reporting of episodes.

Analysers must record an annual data capture rate of at least 75% to be included in any of the indicator calculations.

Sites demonstrated to be far outliers as a result of local factors in a particular year should be excluded from the analysis.

Air Quality Sustainability Indicator for Sussex

The following sites meet the criteria for inclusion in the Indicator calculation for 2020:

- **Rural: AQ Indicator:** Chichester - Lodsworth, Wealden – Isfield, Wealden – Lullington Heath, Rother – Rye Harbour.

- **Urban AQ Indicator *(background):*** Brighton and Hove – Preston Park, Crawley – Gatwick Airport, Eastbourne – Devonshire Park, Eastbourne – Holly Place

- **Urban AQ Indicator *(roadside):*** Adur – Shoreham-By-Sea, Hastings – Bulverhythe, Horsham – Park Way, Chichester - A27 Chichester Bypass, Rother – De La Warr Road.

Figure 4 plots the first Sustainability Indicator for long-term monitoring sites in Sussex.

Figure 5 shows a similar plot for the second indicator. Table 1.6 shows the third indicator.

Figure 4 First Air Quality Indicator for Sussex 2001 to 2020 (annual mean PM_{10})

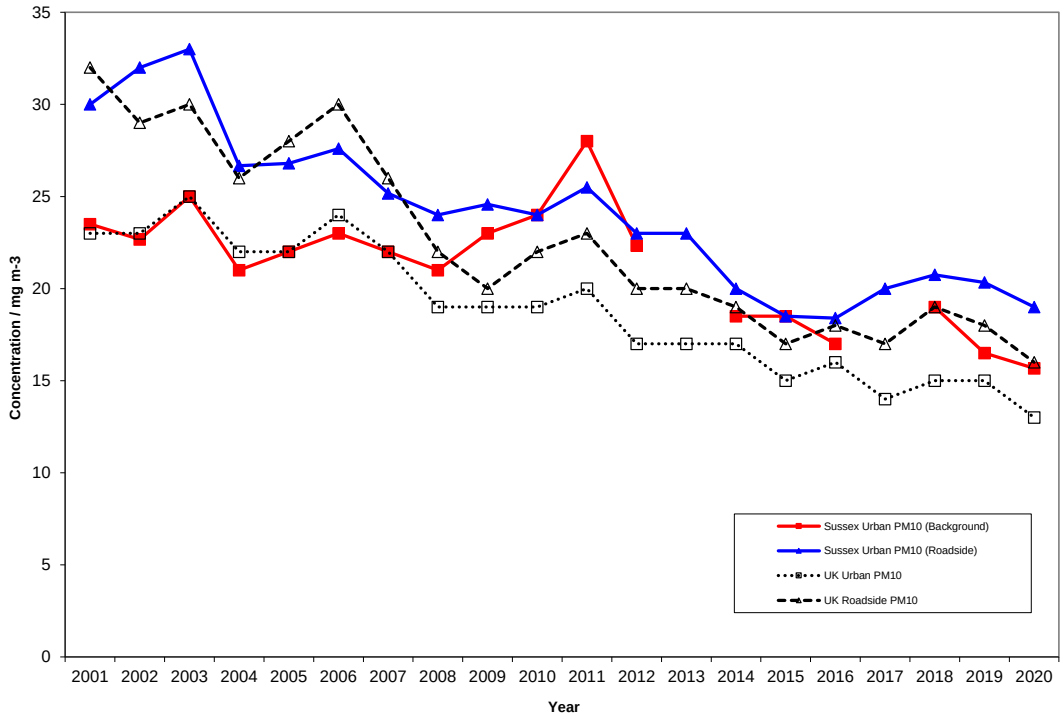


Figure 5 Second Air Quality Indicator for Sussex, 2001 to 2020 (mean daily max running 8hr ozone)

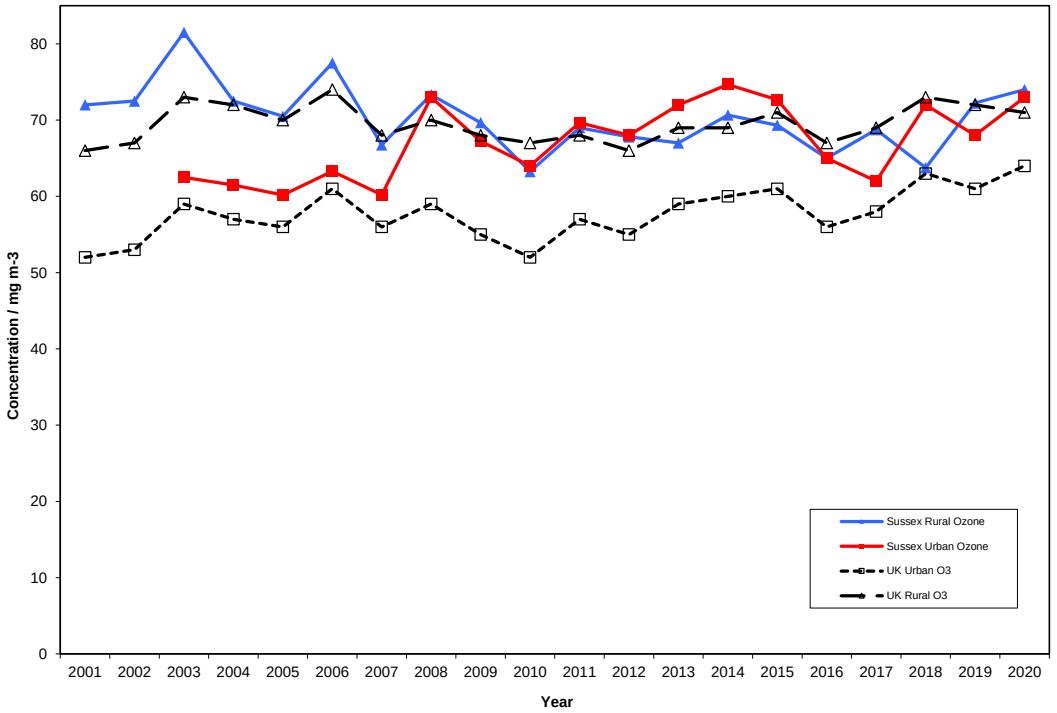


Table 1.6 Third (original) Air Quality Sustainability Indicator for Sussex																				
Indicator	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Adur Shoreham-By-Sea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	0
Chichester Lodsworth	-	-	-	-	-	71	43	76	39	39	43	13	24	18	7	16	15	36	10	44
Wealden Isfield	-	-	-	-	-	78	24	-	-	36	76	16	31	12	16	14	20	55	27	23
Brighton and Hove Preston Park	-	-	-	-	26	36	24	20	25	7	26	19	29	16	14	12	9	21	14	30
Brighton and Hove Stanmer Park	-	-	-	-	-	-	-	-	-	-	38	19	21	-	-	8	-	-	-	-
Crawley Gatwick Airport	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Chichester A27 Chichester Bypass	-	1	14	1	-	11	9	5	3	1	5	5	1	3	1	2	1	0	0	0
Eastbourne Devonshire Park	0	4	10	12	14	27	21	52	18	9	31	28	-	-	-	-	-	36	13	26
Eastbourne Holly Place	-	-	-	-	-	-	-	-	-	-	-	11	-	3	3	2	-	-	-	0
Horsham Park Way	-	-	-	-	10	4	12	6	3	0	10	3	2	4	-	4	2	0	5	0
Horsham Storrington	-	-	-	-	-	-	-	-	-	0	10	7	16	-	1	3	-	-	-	-
Hastings Bulverthythe	-	19	41	3	11	12	8	4	6	0	0	1	-	-	3	0	4	1	4	1
Hastings Fresh Fields	-	-	-	-	-	-	-	-	17	7	-	-	-	-	-	-	-	-	-	-
Wealden Lullington Heath	50	40	94	56	64	64	27	51	36	10	25	12	12	6	12	16	10	32	20	40
Telscombe Cliffs Roadside	6	10	8	-	12	23	28	56	12	-	-	-	-	-	-	-	-	-	-	-
Lewes Commercial Square	-	-	-	-	20	13	15	5	4	1	0	-	-	-	-	-	-	-	-	-
Lewes Denton Community Centre	-	-	-	-	-	-	-	-	-	-	-	-	-	30	14	17	-	-	-	-
Lewes West Street	-	-	-	-	-	-	-	-	-	-	-	2	0	1	-	0	1	-	1	-
Rother Rye Harbour	-	47	107	37	26	59	24	44	39	10	37	24	-	-	-	-	12	24	19	20
Rother De La Warr Road	-	-	-	-	-	-	7	-	2	0	8	-	1	-	-	-	2	4	5	1
Sussex-Rural	50	44	101	47	45	68	30	57	38	24	44	17	22	12	12	14	14	37	19	32
Sussex-Urban-(Background)	-	4	10	12	20	32	23	36	22	8	29	19	29	16	10	10	9	29	14	15
Sussex-Urban-(Roadside)	6	10	21	2	13	13	13	15	7	1	6	4	4	3	2	2	2	1	3	0
UK-Rural-Indicator	*34*	*32*	*64*	*45*	*40*	*55*	*30*	*45*	*32*	*22 (10)*	*30 (17)*	*14*	*17*	*9*	*11*	*12*	9	*25*	*18*	*20*
UK-Urban-Indicator	*23*	*19*	*48*	*22*	*21*	*38*	*23*	*26*	*10*	*8 (15)*	*15 (24)*	*18*	*14*	*12*	*10*	*8*	*7*	*8*	*11*	*10*

The 2020 figures in Table 1.6 are based on the revised index. The 2010 and 2011 figures in brackets are also based on the new threshold levels. As can be seen the changes to the thresholds has had a significant effect on the third indicator.

Sussex:

A general improvement has been seen for both roadside and background PM_{10} since 2001 and the air quality sustainability indicator for roadside and background PM_{10} in Sussex has decreased in 2020 when compared to the previous year.

The air quality sustainability indicators for the Sussex urban and rural O_3 showed an increase in 2020, although the general trend since 2001 remains fairly stable.

The UK:

While the urban O_3 indicators showed a decrease in 2020 the rural has slightly increased. Roadside and background PM_{10} both decreased in 2020 when compared to 2019.

CHAPTER 2: Trends in Pollution Levels, 2001 – 2020

This chapter uses running annual mean calculations to illustrate trends in pollution levels as recorded by each continuous monitor in the network (see the 'How the charts work' section below for an explanation of running annual means).

Long-term pollution trends may be caused by changes in local emissions, i.e. fewer or cleaner vehicles or industrial processes, or changes in how these emissions are dispersed, i.e. weather patterns. For example, an unusually wet summer can lead to decreased levels of O_3, a cold settled winter can lead to increased levels of NO_2. These effects can obscure actual changes in emissions due to traffic management schemes or increased use of a particular road.

The longer a dataset is, i.e., the longer a site has been monitoring for, the more effective the trend analysis is. The effects of unusual weather conditions are smoothed out and sustained patterns due to changes in local emissions become clearer. Many years of monitoring data are required before firm conclusions can be made as to whether pollution levels are increasing or decreasing. For this reason, sites that have been in operation for less than three years are not included in this chapter but will become integrated into the analysis in the future.

How the Charts Work

The charts appearing in this chapter show running annual mean values (based on monthly mean concentrations and a minimum of 75% data capture) from a specified start date to January 2020. Running annual means are used so that gradual changes can be identified throughout the year, which are not apparent from a single annual figure.

For example, in Figure 6 the line for Hastings Bulverhythe is calculated in the following way;

- The first data we have for this site are from June 2001, so the first annual mean concentration can be calculated one year later on the 1st June 2002.

- The first mean is calculated from 1st June 2001 to 1st June 2002. The second is calculated from 1st July 2001 to 1st July 2002 and so on. This is what is meant by a running mean.

A chart showing percentage change is often more informative than simply showing changes in concentrations. In these charts, all sites start at zero, then concentrations are shown as the percentage change since the start date. As a common start date is required for this type of chart, they may show a shorter time period than the concentration charts.

Data from an inner London background site have been included in some charts to provide comparison with the Sussex network data.

PM_{10} Particulates

Running annual mean PM_{10} trends at all continuous monitoring sites since 2001 are shown in Figure 6.

Sites are shown one year after they joined the network, i.e., when the first annual mean calculation is possible. Sites that have not run for a complete year prior to January 2020 do not appear on the graph.

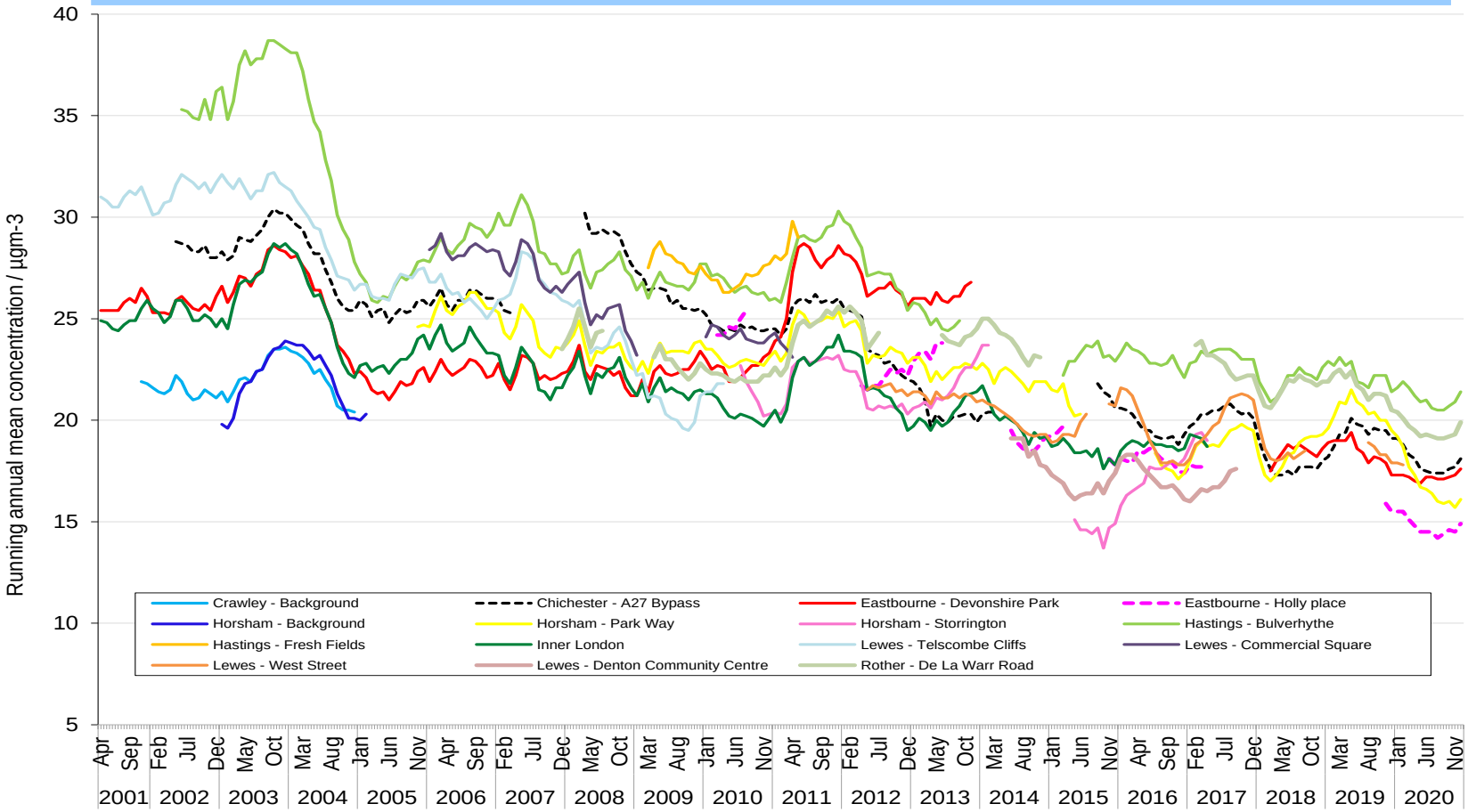
The running annual mean concentration for PM_{10} showed a general downward trend when compared with the previous year.

The overall trend is highlighted further when the percentage change rather than actual change in concentration is traced, as shown in Figure 7.

There are a number of sites that are not included in the percentage change plot as it is necessary for all included sites to have a common start date, in this case January 2006, the analysers that have been introduced into the network after this start date are not included.

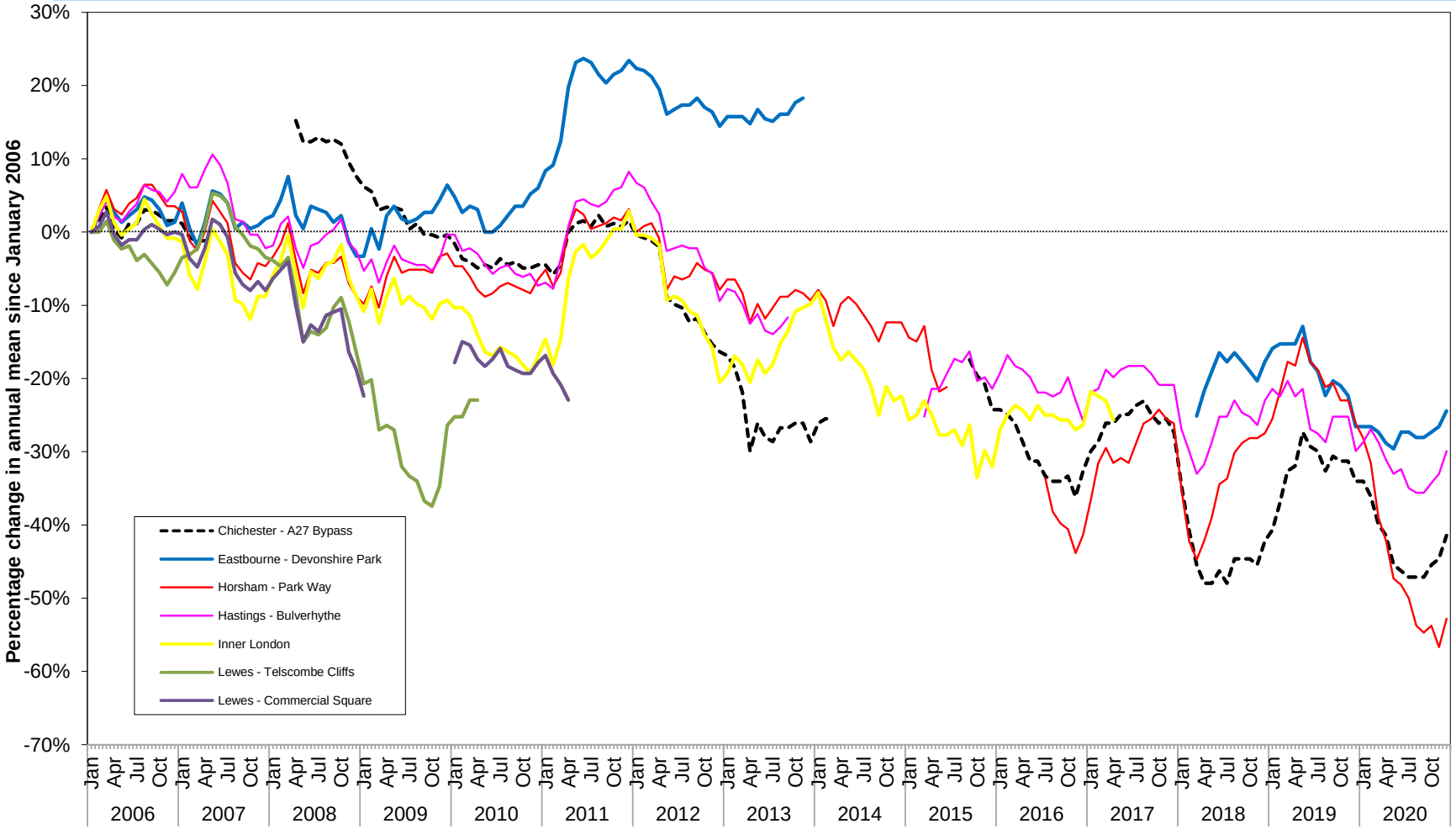
Roadside sites are generally expected to record higher levels than those monitoring at background locations due to their proximity to the local emission source that is mainly traffic related.

Figure 6 Trends in running annual mean PM_{10} concentrations, 2001 to 2020



N.B. The reduction in PM10 concentrations in 2004 can be attributed to TEOM data being corrected using VCM since 1st January 2004

Figure 7 Percentage change in running annual mean PM_{10} since January 2006



$PM_{2.5}$ Particulates

During 2020 $PM_{2.5}$ were measured at four network sites. Eastbourne – Holly Place and Worthing – Grove Lodge being in operation for long enough to be included in this part of the analysis.

There was a general decrease in running annual mean $PM_{2.5}$ concentrations during 2020.

The running annual mean concentrations are shown in Figure 8 and the percentage change plot in Figure 9.

Figure 8 Trends in running annual mean $PM_{2.5}$ concentrations, 2010 to 2020

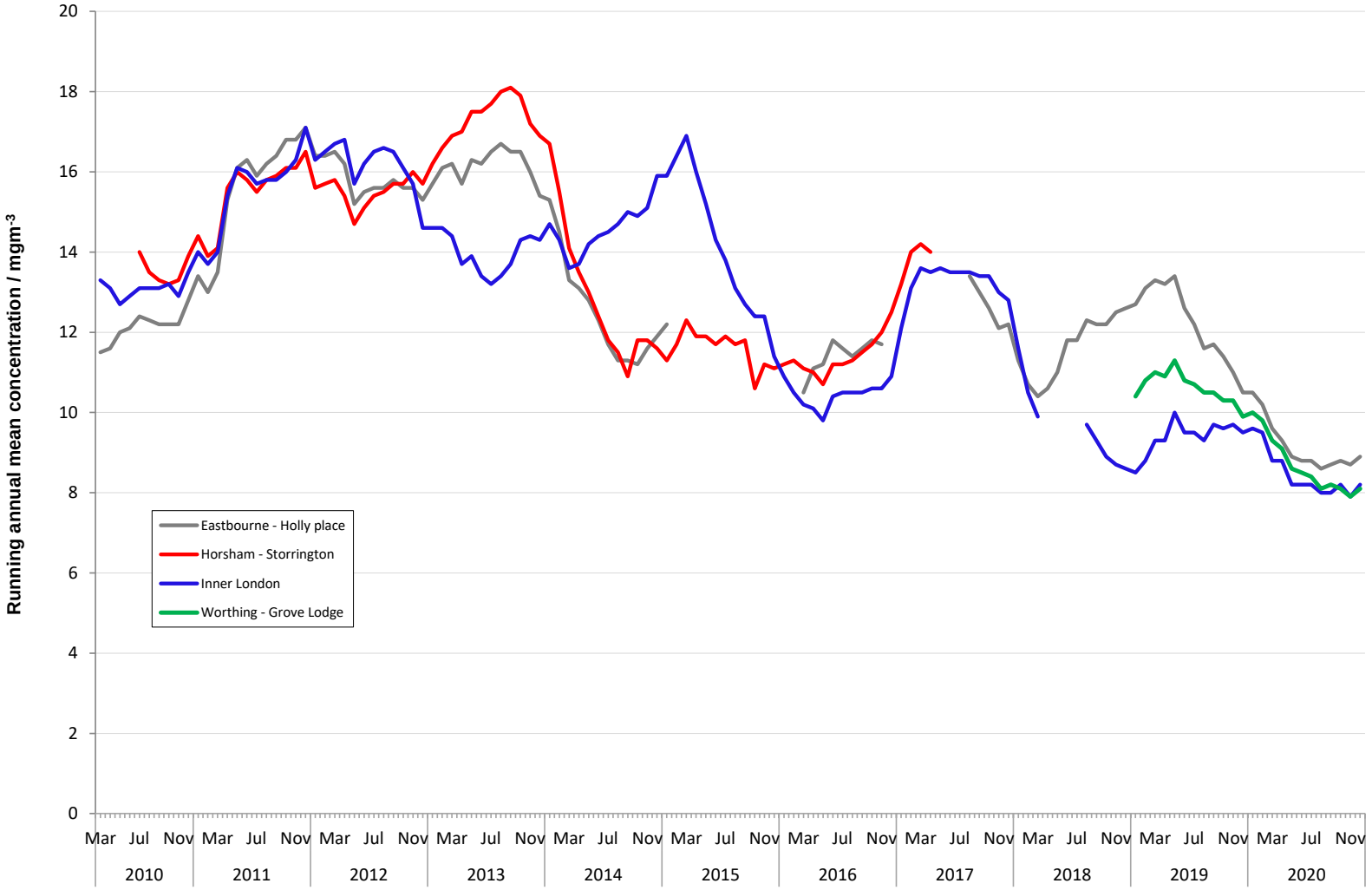
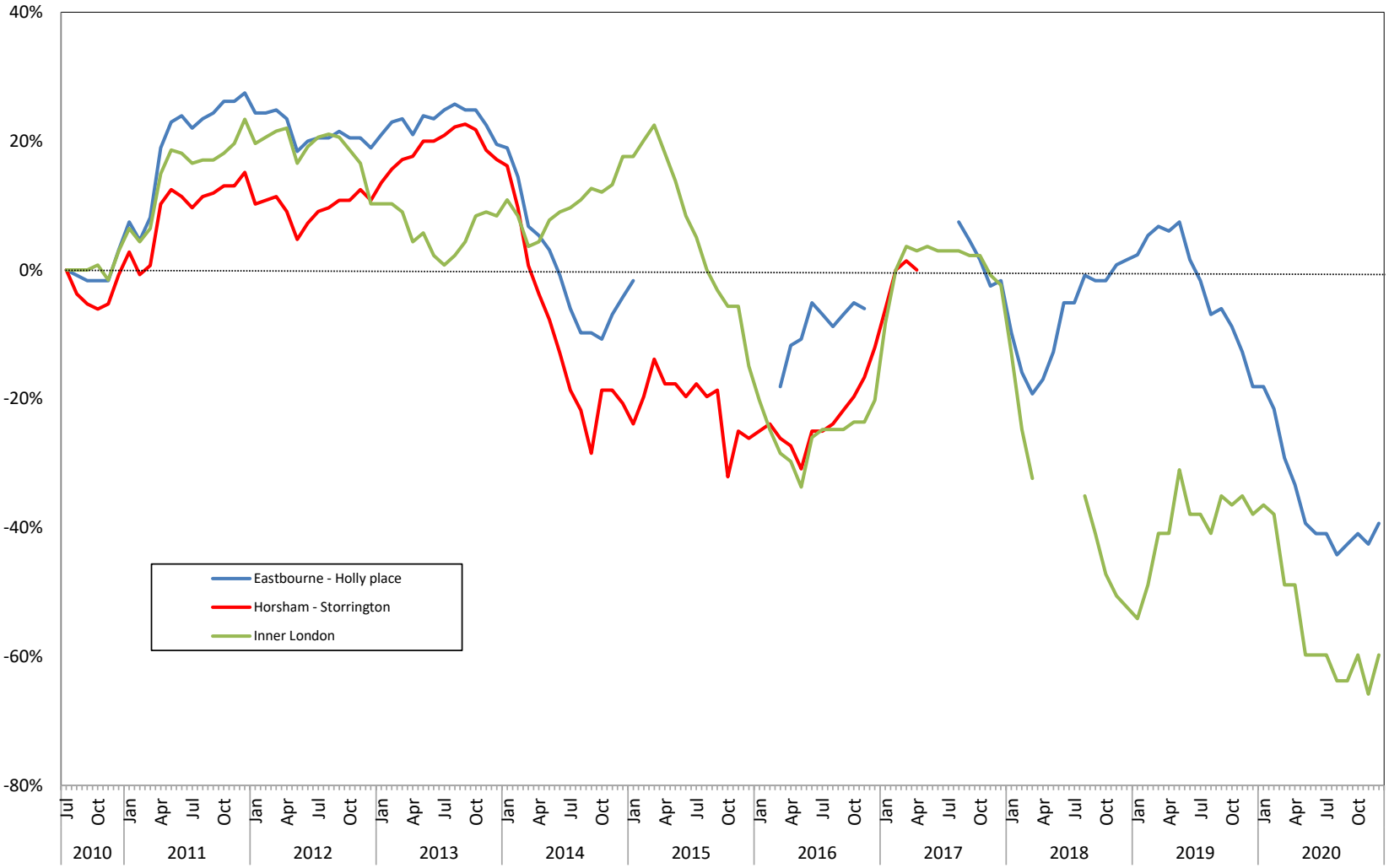


Figure 9 Percentage change in running annual mean $PM_{2.5}$ since July 2010



Sulphur Dioxide (SO_2)

There has been a national downward trend in SO_2 concentrations for several years.

Currently only the Lullington Heath site monitors for SO_2.

Nitrogen Dioxide (NO_2)

NO_2 is the most commonly monitored pollutant in the network. Charts of running annual mean concentrations are shown in Figure 10. Percentage change over a shorter period at longer-running sites is shown in Figure 11. Trends from the inner London background site are included in each chart for comparison.

The Air Quality Standard for annual mean NO_2 is 40 μgm^{-3} (21 ppb).

There was a downward trend during 2020, again highlighted in Figure 12 showing the percentage change since February 2006.

The levels recorded at the roadside sites are generally higher than those seen at background sites due to their proximity to the traffic which is the primary source of nitrogen dioxide.

Figure 10 Running annual mean NO_2 concentrations, 1999 to 2020

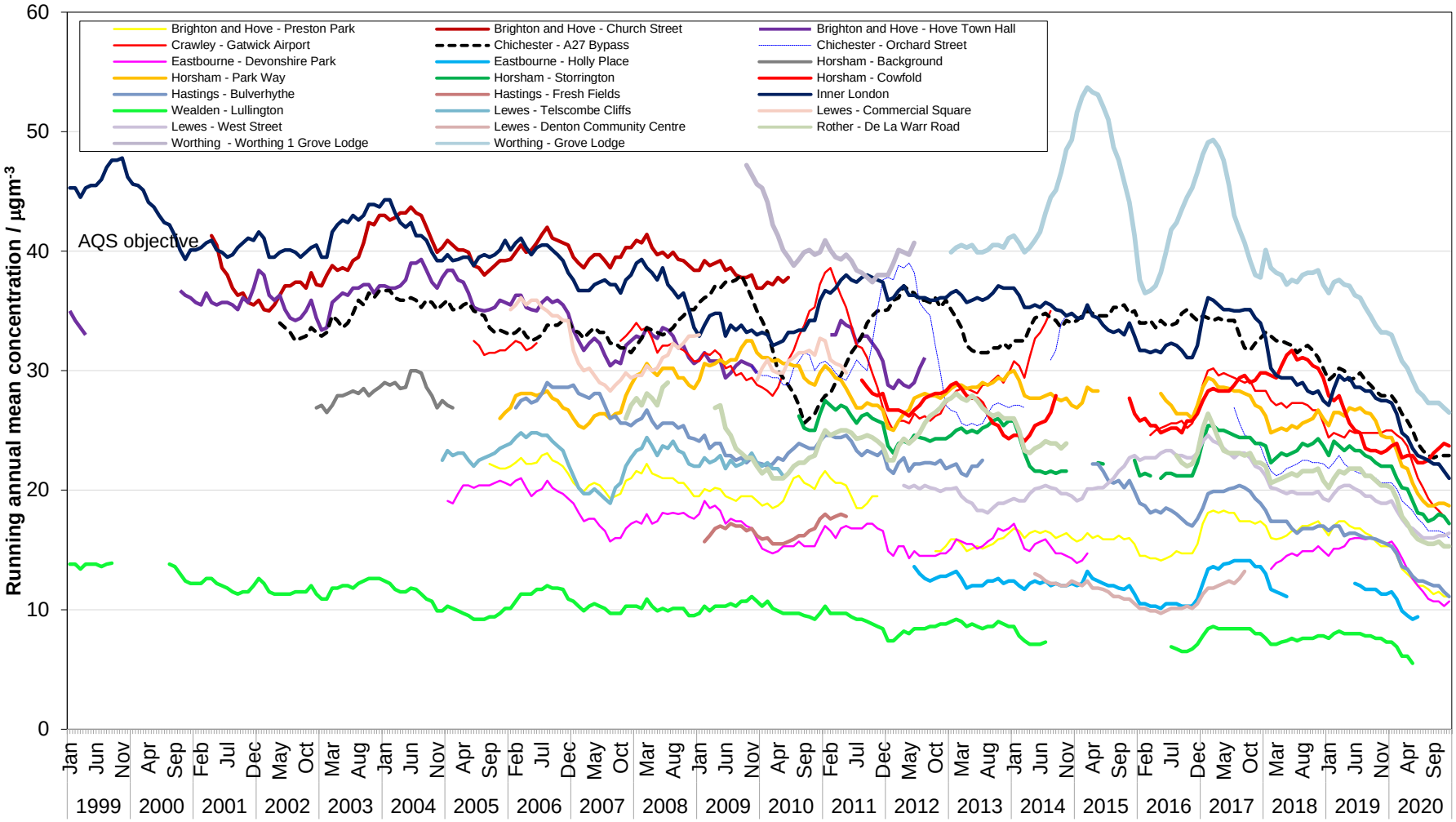


Figure 11 Percentage change in running annual mean NO_2 concentrations since February 2006

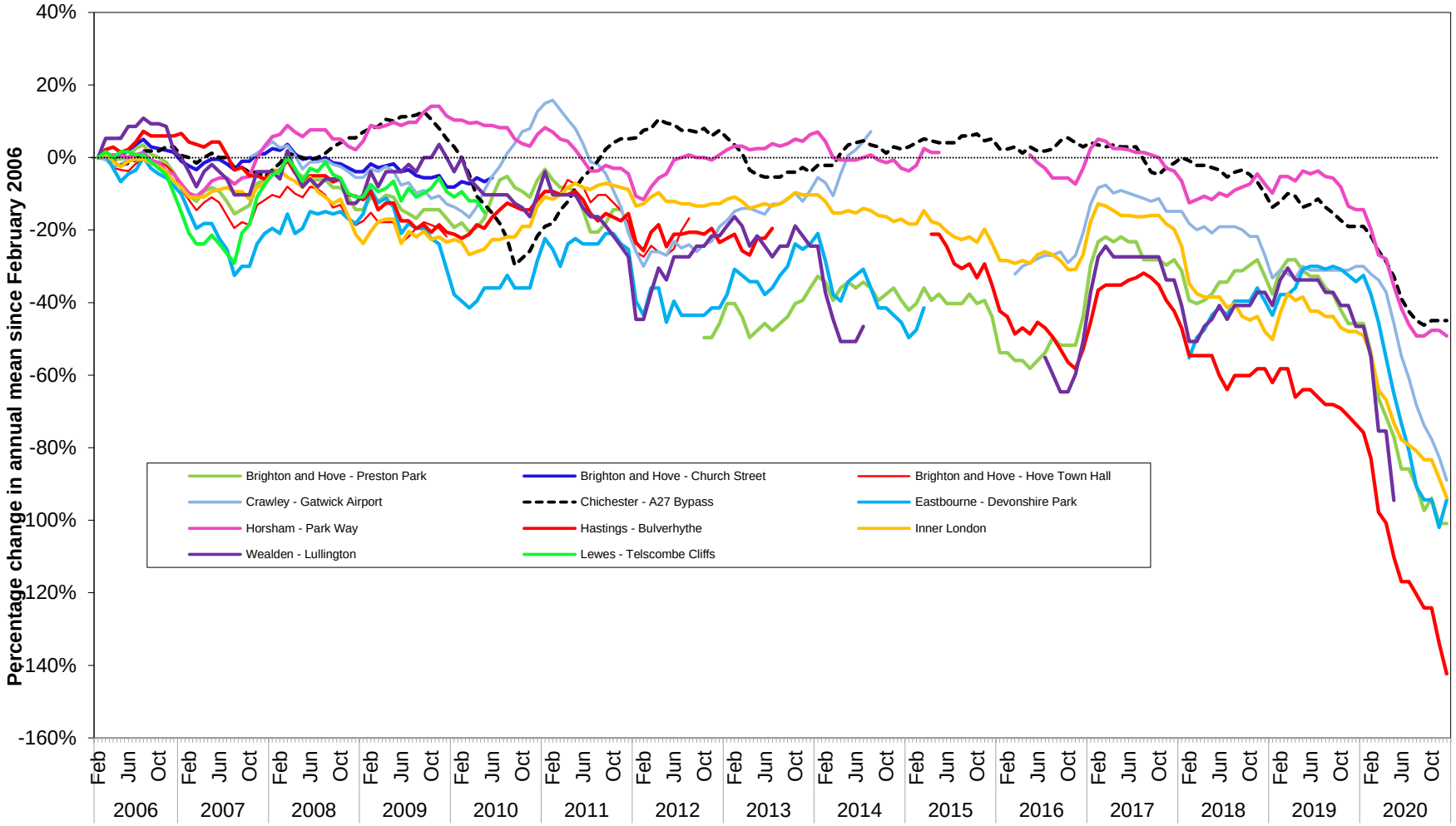
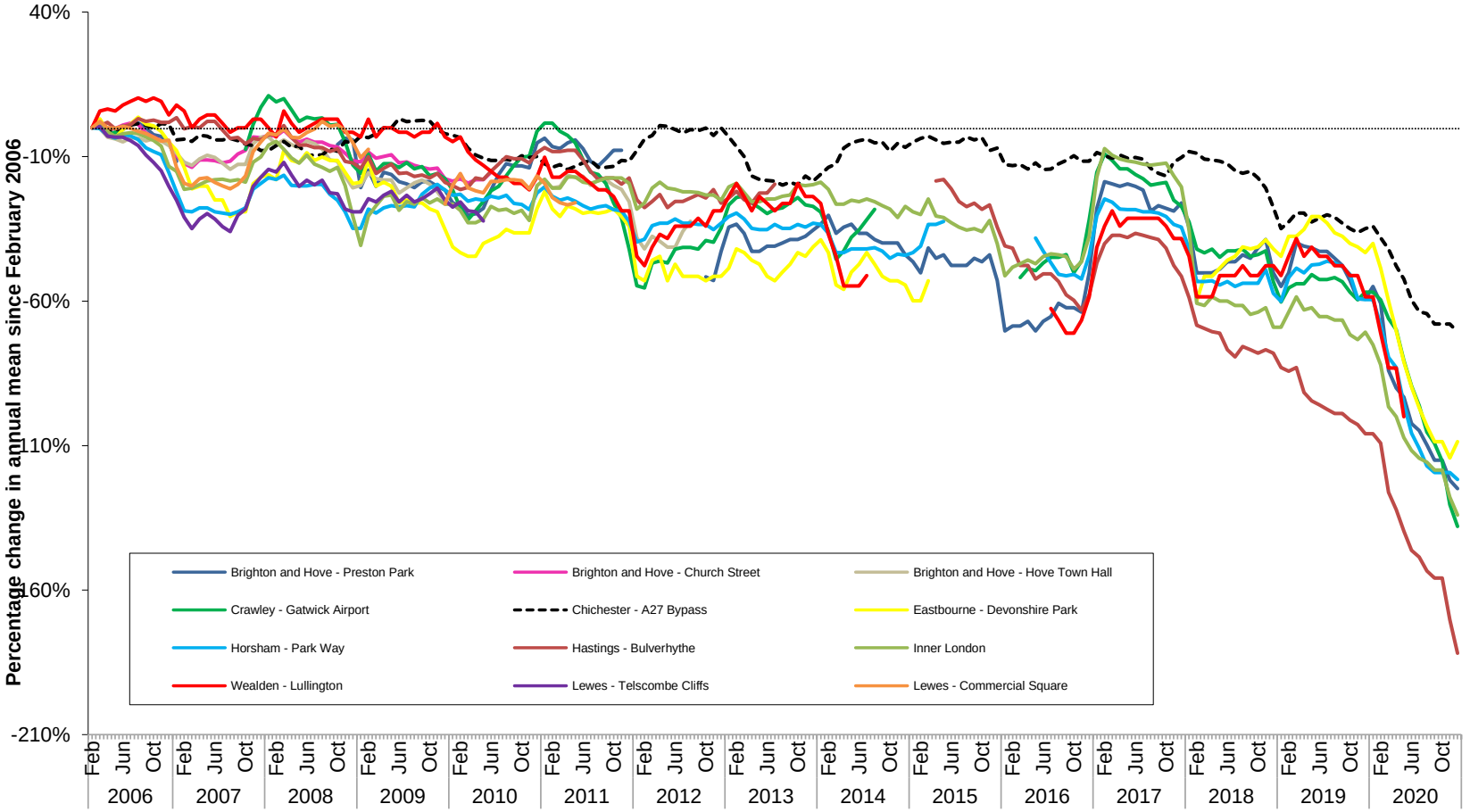


Figure 12 Percentage change in running annual mean NOx concentrations since February 2006



Ozone (O_3)

Figure 13 shows the running annual mean O_3 concentrations since 1999.

O_3 concentrations across the network showed a general increase during 2020.

O_3 levels are highly dependent on the weather and the warm sunny summer periods can cause a sharp increase in mean levels. It is also known that a proportion of the O_3 experienced in Sussex is transported from continental Europe under certain meteorological conditions.

The changes in O_3 levels throughout the year are also seen in the percentage change plot Figure 14.

Figure 13 Running annual mean O_3 concentrations, 1999 to 2020

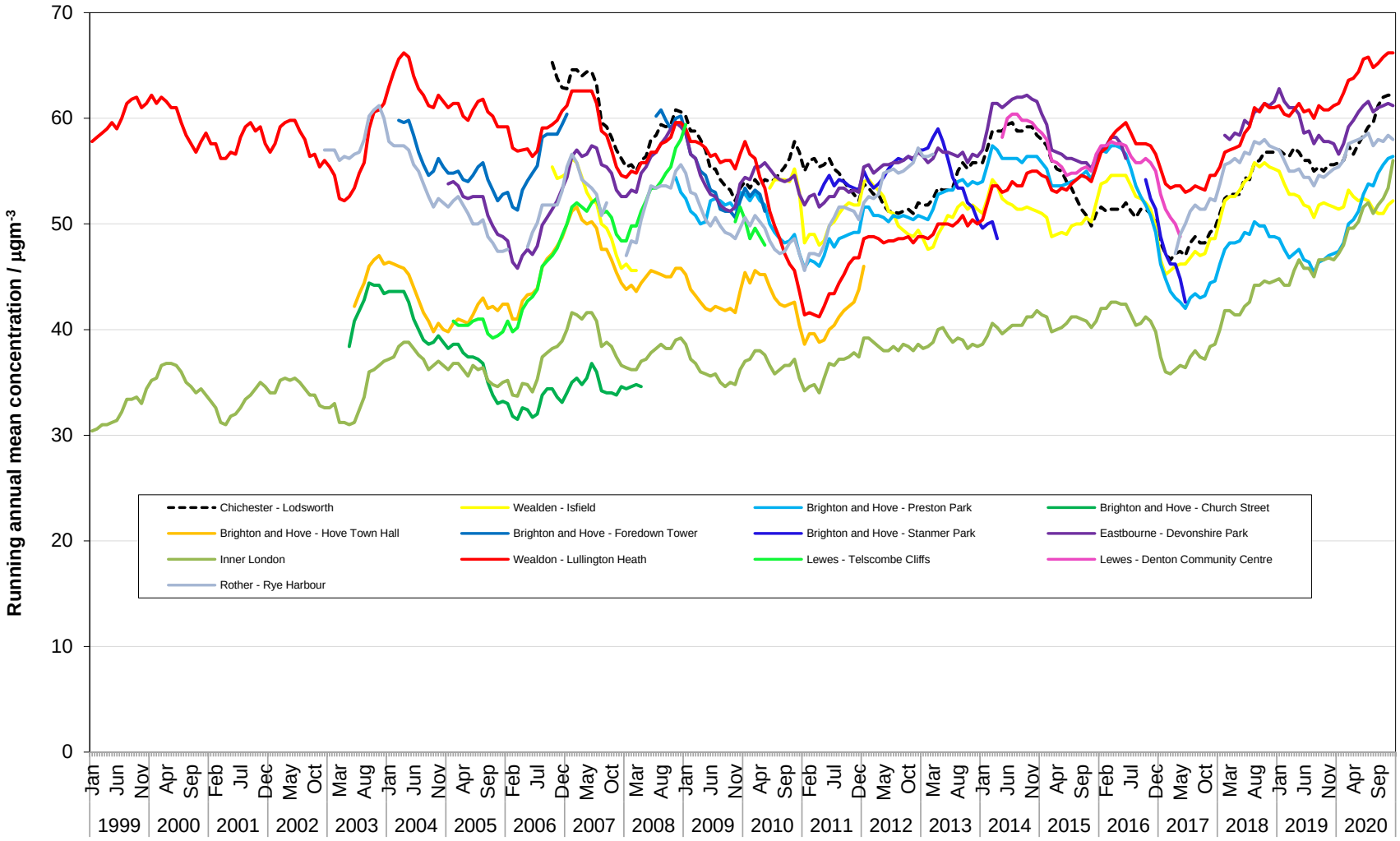
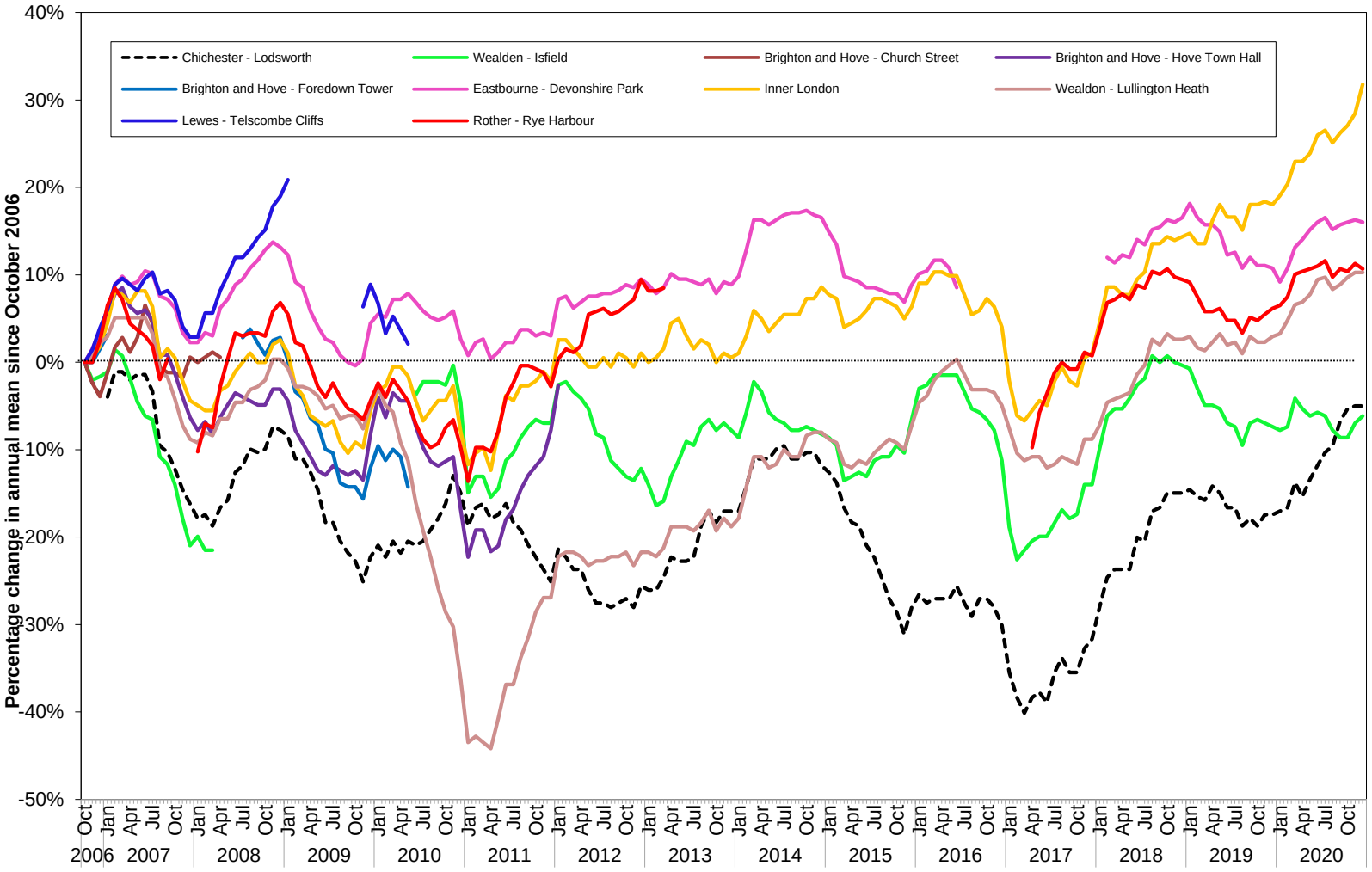


Figure 14 Percentage change in running annual mean O_3 concentrations since October 2006



Appendix

Air Quality Review and Annual Status Updates

Since 2016 each council is required to produce an Annual Status Report on air quality and any developments that may affect it.

For information concerning the responsibilities of Local Authorities with regard to local air quality management contact the council direct or visit Defra's web site at:

https://uk-air.defra.gov.uk/aqma/

For information on air quality in Sussex and the review and assessment reports go to:

http://www.adur-worthing.gov.uk/environmental-health/pollution/air-quality-and-pollution/local-air-quality-management/

http://www.arun.gov.uk/air-quality-including-bonfires

https://www.brighton-hove.gov.uk/environment/noise-pollution-and-air-quality/how-we-manage-air-quality-city

https://www.chichester.gov.uk/pollutioncontrolairquality

https://crawley.gov.uk/environment/environmental-health/air-pollution/air-quality

https://www.lewes-eastbourne.gov.uk/environmental-problems/air-quality-and-health/

http://www.hastings.gov.uk/environment_planning/pollution_noise_drainage/air/air_management/

http://www.horsham.gov.uk/environmentalhealth/environmental-health/air-quality/air-quality-assessment

http://www.rother.gov.uk/article/193/Air-quality

https://www.wealden.gov.uk/environment-and-pollution/pollution/environmental-protection-act-epa-permit-register/monitoring-air-quality/

Imperial College London
Projects

Environmental Research Group

Environmental Research Group
School of Public Health
Imperial College
Michael Uren Biomedical Engineering Hub
White City Campus
Wood Lane
London W12 0BZ

Telephone: +44 (0) 20 75931515
E-mail: erg-enquiries@imperial.ac.uk
hima.chouhan@imperial.ac.uk
Internet: www.imperial.ac.uk