BAS Ozone Bulletin 02/01
(Annual summary)

This is the second and final ozone bulletin for the 2001/02 season. Frequent updates on ozone observations at Halley, Rothera and Vernadsky are posted on the BAS ozone page at http://www.antarctica.ac.uk/met/jds/ozone/ during the observing season.

The 2001 ozone hole reached an area of over 25 million square kilometres at its maximum in mid September and remnants lasted until the summer solstice. Minimum ozone values were measured in early October. Autumnal ozone values were below the normal.

Satellite imagery gives a global perspective on the ozone hole. Our 2001/2002 ozone hole movies, produced from TOMS images, currently cover June 2001 to mid May 2002. Stratospheric clouds were sighted from Vernadsky, Rothera and Halley.

The ozone hole in 2002/03 is likely to be similar to this year's, with remnants of the hole persisting well into December 2002. Ozone depletion over the Antarctic Peninsula is likely to be more severe than in 2001/02.

1. Data from the British Antarctic Survey (BAS) **Halley station** (76-deg south, 27-deg west, on the Brunt ice shelf).

a) Ozone. Ozone measurements in the first half of August are made using moonlight and are of very low accuracy. In September values were dropping at around 2 DU per day from around 180 DU at the beginning of the month. From the equinox to late October values were around 125 DU, which is 60% below the normal. The minimum daily mean recorded this year was 116 DU on October 3. Maximum values were reached in late December, though at around 290 DU they were 25% below and over a month later than the pre-ozone hole peak. The highest daily mean was 317 DU on December 23. Thereafter values declined at around 0.6 DU per day until early March, giving values around 245 DU, nearly 20% below the normal. At the close of the observing season values were around 250 DU.

Halley preliminary mean daily total ozone, (DU)
Dobson No 103: Instrument constants revised 2001 October 26.
(0 indicates no data)

2001 August 1 – 2002 April 15

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  0 223 229 234 223 210   0   0   0   0
  0   0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0 168 164 172 184
174 158 158 144 144 137 146 148 142 125
121 120 126 144 136 133 144 127 161 169
136 121 116 120 125 135 132 127 130 147
132 129 130 136 130 125 120 146 137 132
123 138 139 152 142 134 140 140 173 176 222
186 196 179 169 173 177 160 160 160 160
164 157 172 186 167 164 180 194 190 247
283 275 203 248 282 290 269 311 273 290
246 204 201 197 301 310 281 250 241 222
214 255 239 252 258 248 250 268 285 281
301 272 317 315 284 294 292 288 282 283 269
266 255 274 305 280 300 273 286 290 309
298 292 294 291 289 275 276 280 279 287
289 278 279 283 280 283 285 282 278 261 264
263 264 257 260 265 273 264 285 250 250
265 264 269 278 279 274 267 267 258 255
259 256 260 272 264 257 250 229
227 242 248 228 234 247 254 257 261 244
248 241 241 251 248 241 229 237 238 262
263 273 273 267 240 251 243 239 218 218 251
243 239 256 270 255 246 245 262 249 244
258 259 231 225 268
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Halley provisional monthly mean total ozone (DU)

Period	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Year
2001/02	224	148	138	209	265	283	263	246	250	225
2000/01	179	151	137	267	299	286	261	251	245	231
1999/00	205	172	143	172	254	281	258	250	256	221
1998/99	221	162	140	183	255	272	259	254	267	224
1997/98	218	171	141	210	286	267	262	264	261	231
1957-72	295	285	300	355	350	320	300	295	285	310

Note that August and April do not have observations on every day, and that the routine measurement season is now longer than it was in 1957 - 72. Measurements made at the start of the season are of lower accuracy than in mid summer due to the low solar elevation or use of moonlight. Gif images showing the data are available on the BAS ozone web-page.

b) Radiosonde data. The 100 hPa temperature at Halley remained at winter values of around –83°C until late October. It rose to reach a broad maximum of around –43°C in late January, some 3° cooler than the normal and nearly a month later. The temperature was below the normal from early September until late March.

2. Data from the British Antarctic Survey (BAS) **Rothera** station (68-deg south, 68-deg west on Adelaide Island).

a) Ozone. Ozone measurements from Rothera are made using a SAOZ (Systeme d'Automatique Observations Zenithales) spectrometer. This research instrument has a preliminary calibration such that it reads about 15% low compared to Dobson measurements at 100 DU, and is in agreement at 300 DU. The mean daily total ozone values generally show a similar pattern of variation to that seen at Vernadsky, though day to day variation does not show such pronounced wave activity and minimum values are a little lower.

Rothera preliminary mean daily total ozone, (DU)
(0 indicates no data or data not available)

2001 July 1 – 2002 May 25

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321 329 304 311 334 316 314 345 348 316
311 291 324   0   0 268 265 258 285 279
285 227 253 294 293 270 196 194 187 211 272
  0 264 254 223 270 259 245 214 255 255
289 277 259 259 234 232 233 258 283   0
  0 266 206 199 205 229 185 213 192 205 214
206 199 177 246 246 200 186 170 171 169
  0   0 160 168 203 154 150 198 131 124
159 231 319 311 294 260 196 230 263 222
218   0 178 192 193 183 195 175 164 156
136 149 139 144 136 152 160 144 129 125
130 157   0 142 182 203 219 313 332 310 285
295 279 175 201 219 237 285 284 248 217
  0 168 192 204 227 314 324 306 288 312
312 323 347 354 337 308 305 297 231 227
196 197 286 296 291 259 233 222 204 258
310 319 325 310 282 293 304   0 271 270
283 291 276 285 285 277 267 264 275 277 275
286 288 286 280 277 280 279   0 285 289
289 289 301 294 288 290 288 286 285 287
278 270   0 269 267 254 248 252 257 259 250
258 273 277 266 265 269   0 279 294 299
291 291 284 265 271 271 265 260 271 285
303 294 290 287 286   0 270 271
270 273 275 265 248 249 260 271 263 284
296 274 251 250 265 241 247 265   0   0
261 252 245 250 271 286 312 298 275 252 284
284 302 287 303 286 272 260 277   0   0
254 247 240 265 289 324 315 322 322 306
300 335 296 266 296 334 296 294 280   0
328 303 299 295 324 290 244 263 265 292
261 238 277 245 237 272 268 280 279   0
311 268 258 276 293
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Rothera provisional monthly mean total ozone (DU)

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Period  Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun
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2001/02 283 238 205 184 270 273 278 278 267 291
2000/01 231 230 137 168 334 294 273 278 279 278 280 276
1999/00 274 243 157 175 229 289 282 265 264 290 282 293
1998/99 288 239 159 166 252 264 270 279 267 277 300 287
1997/98                                 270 280 267 263
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b) Stratospheric clouds. Nacreous or mother-of-pearl clouds are regularly seen from stations along the Antarctic Peninsula between early May and October, with a peak in July. There is some evidence that their frequency of occurrence has increased since the mid 1950s. This year, clouds were sighted from Rothera on August 3, 20, 27 and September 5, 6 and 25.

3. Data from the Ukrainian Antarctic Research Centre **Vernadsky** station (65-deg south, 64-deg west on the coast of the Antarctic Peninsula, formerly the BAS Faraday station).

a) Ozone. Ozone values at Vernadsky generally declined from about 280 DU at the beginning of August to around 180 DU in mid October (a depletion of about 50%). There was considerable day-to-day variation and the decline was broken by a rise to 280 DU at the end of September. The minimum daily mean was 146 DU on October 24. There was considerable diurnal variation in the ozone readings at Vernadsky when the station lay under a strong stratospheric ozone gradient. Smoothed maximum values of around 360 DU occurred at the end of November, close to the normal time, though the maximum daily mean value of 403 DU was on October 28. Values generally declined from the peak at a rate of around 0.5 DU per day, reaching a minimum of 250 DU in mid March (a depletion of over 15%).

Vernadsky preliminary mean daily total ozone (DU).
Dobson No 31: Instrument constants revised 2001 December 12

2001 August 1 – 2001 April 30

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 308 293 285 234 297 258 247 236 250 208
 306 299 248 256 243 236 249 232 252 222
 267 286 208 228 196 224 195 211 199 200 219
 279 224 190 245 285 253 268 244 184 202
 215 256 205 238 273 190 168 261 183 157
 161 228 365 344 322 296 263 238 289 299
 317 215 166 325 316 236 243 234 218 213
 195 182 187 185 180 190 234 177 173 183
 158 176 187 146 187 291 220 403 351 388 362
 366 372 297 249 264 267 298 345 342 336
 281 244 242 260 260 328 393 375 363 367
 359 352 351 374 360 344 370 399 375 283
 237 236 351 342 332 297 272 285 232 261
 316 336 336 321 309 315 338 311 313 299
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313 308 296 318 305 288 282 286 287 275 271
319 305 306 297 290 303 299 292 305 320
334 315 312 333 296 313 295 303 307 306
304 287 286 282 290 275 278 279 277 277 275
279 296 283 269 288 285 281 274 310 312
302 302 308 289 267 300 260 267 269 270
307 308 278 268 283 285 274 283
281 285 291 272 262 244 258 262 275 273
283 274 246 253 257 236 236 252 264 265
255 250 245 242 272 283 304 298 291 252 273
266 309 303 319 281 260 266 280 290 294
231 244 221 273 270 308 305 294 309 297
287 335 285 272 269 305 270 283 286 287
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Vernadsky provisional monthly mean total ozone (DU)

Period	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Year
2001/02	245	244	233	327	299	299	286	266	283	276
2000/01	242	162	193	343	308	293	284	279	276	264
1999/00	249	189	202	283	297	292	271	262	293	260
1998/99	241	200	218	305	278	288	289	273	279	263
1997/98	261	251	235	240	297	281	266	280	281	266
1957-72	310	330	345	370	345	320	300	295	310	325

b) Radiosonde data. The few available radiosonde flights from Marambio, Rothera and Polarstern show that the 100 hPa temperature along the Antarctic Peninsula was generally below the normal from mid October until February.
c) Nacreous clouds were sighted at Vernadsky on July 27, 28, August 6, 10 ,13, 15, 28, 29, September 4 and October 14.

4. Information from other sources.

The use of data from TOVS satellite images from the US NCEP/NWS/NOAA Climate Prediction Center and EP/TOMS images is acknowledged. BAS have made ozone hole movies from the TOMS images, and these are available on our web page. They are regularly updated. The NOAA Climate Prediction Center gives an overview of their satellite observations for 2001 at http://www.cpc.ncep.noaa.gov/products/stratosphere/winter_bulletins/sh_01/index.html

Further information is available on the BAS ozone web page at http://www.antarctica.ac.uk/met/jds/ozone. This contains earlier bulletins, data, graphs and general ozone information. It is often updated several times a week. Routine email ozone bulletins are no longer issued, but we plan to issue one in November to provide details of the 2002 ozone hole measurements.

Note that all ozone values in this bulletin are preliminary and are subject to revision from time to time when the instrument constants are re-evaluated. Final data will be archived with WOUDC, Toronto in due course, but preliminary data back to 1973 are available from BAS on request. All Dobson ozone data are reduced to the Bass-Paur scale as recommended by the WMO. The reference period used for the normals is 1957 - 1972. If you use or pass on data in this bulletin please make acknowledgement to J D Shanklin, British Antarctic Survey.