

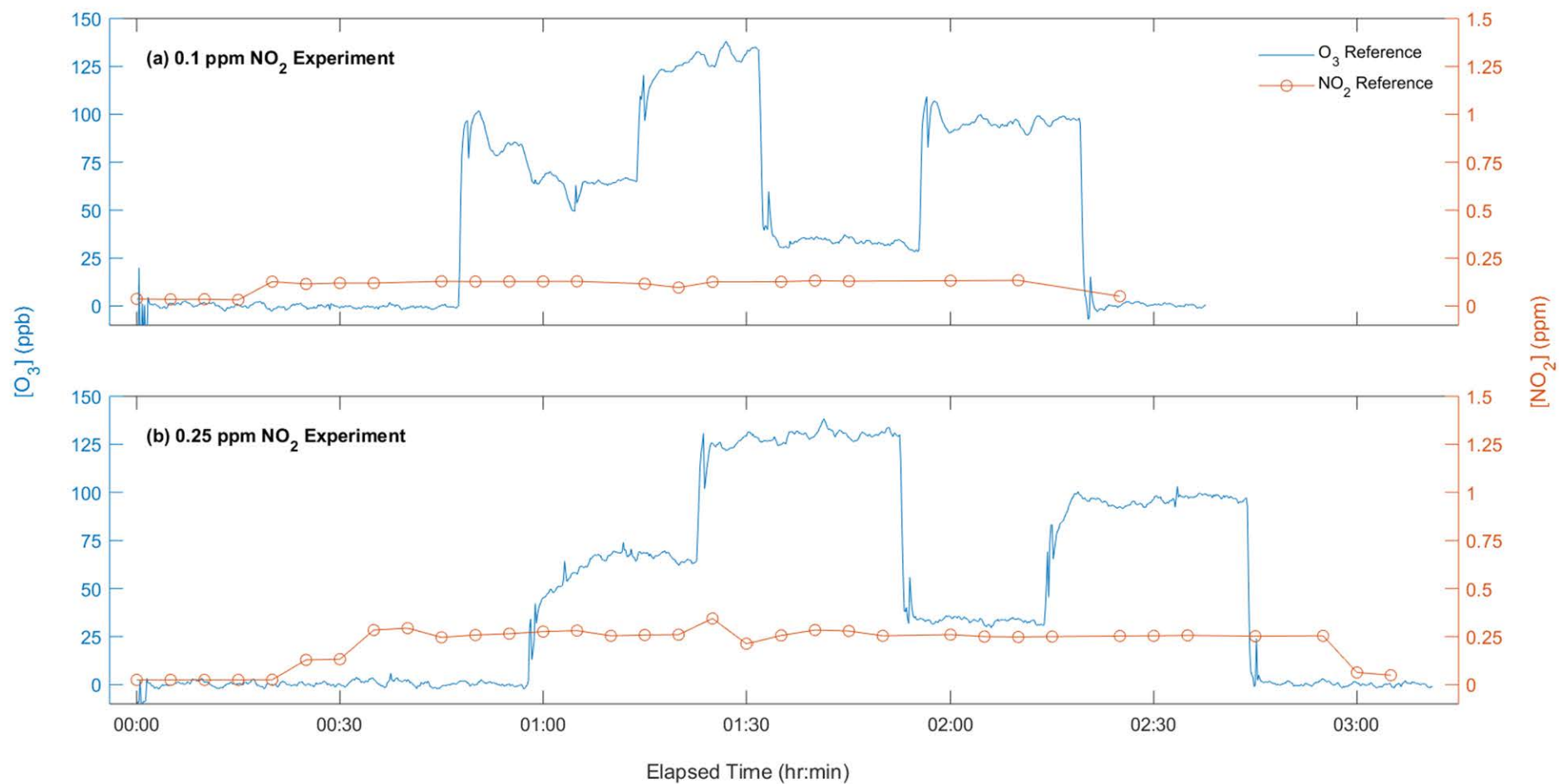
*Supplemental Material for:*

**Efficacy of Paired Electrochemical Sensors for Measuring Ozone Concentrations**

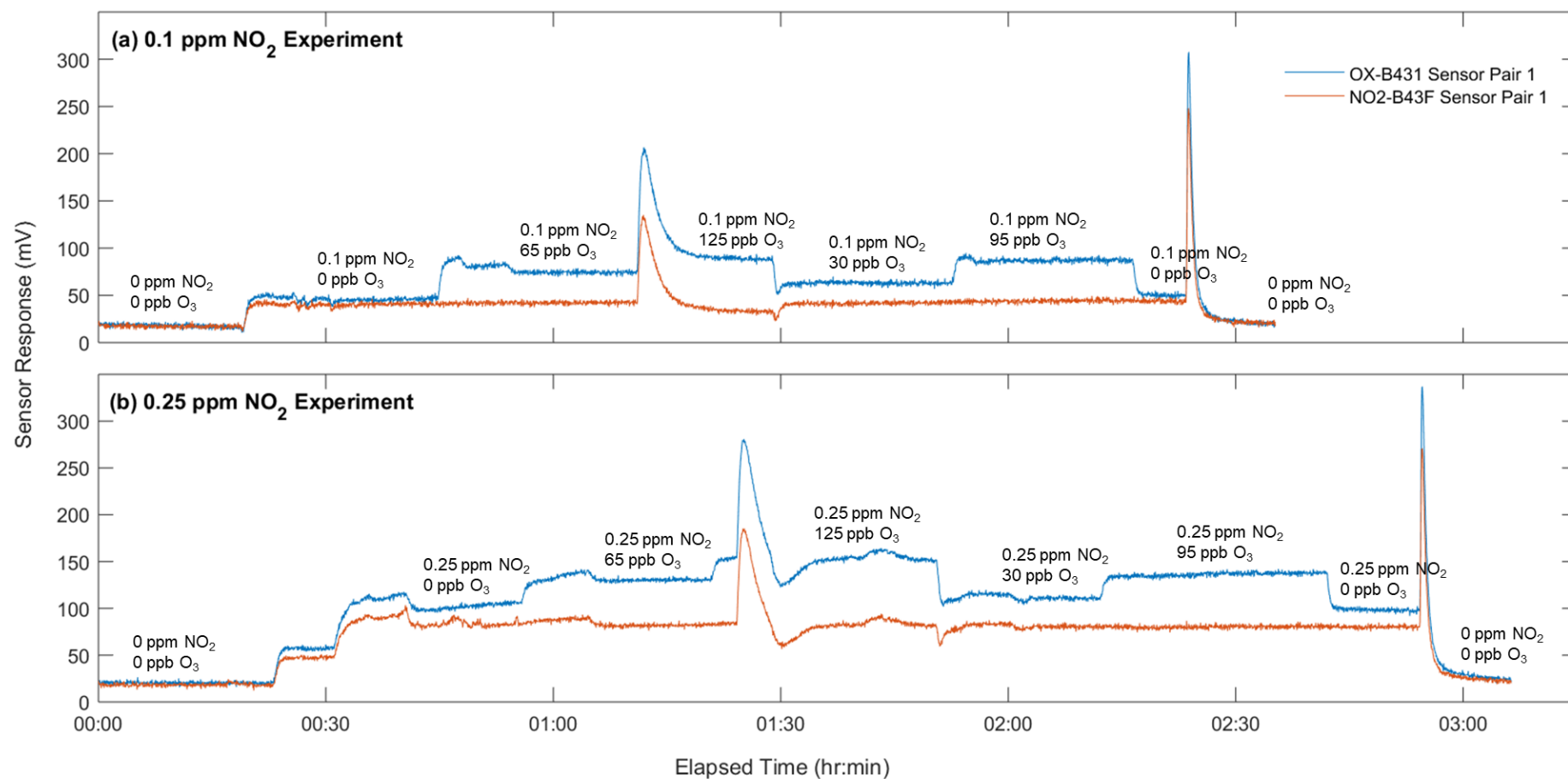
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**SA1. Reference instrument measurements from example experiments for (a) the 0.1 ppm NO<sub>2</sub> target concentration and (b) the 0.25 NO<sub>2</sub> target concentration. Ten-second average measurements were recorded by the 2BTech POM, whereas measurements from the Thermo 42c were recorded every five minutes.**



SA2. Examples of time series from exposure chamber experiments for sensor pair 1 for (a) the 0.1 ppm NO<sub>2</sub> target concentration and (b) the 0.25 NO<sub>2</sub> target concentration. Sensor response was recorded every 2 seconds.

**SA3. Comparison of sensor baseline response and calibration intercepts.**

| Sensor Pair         | Baseline for NO <sub>2</sub><br>calibration (mV) | Intercept for NO <sub>2</sub><br>calibration (mV) | Baseline for O <sub>3</sub><br>calibration<br>(mV) | Intercept for O <sub>3</sub><br>calibration<br>(mV) |
|---------------------|--------------------------------------------------|---------------------------------------------------|----------------------------------------------------|-----------------------------------------------------|
| a) NO2-B43F Sensors |                                                  |                                                   |                                                    |                                                     |
| 1                   | 10.1                                             | 5.5                                               | 13.4                                               | 14.5                                                |
| 2                   | 1.1                                              | -5.7                                              | 2.9                                                | 3.9                                                 |
| 3                   | 0.8                                              | 8.7                                               | 10.5                                               | 11.8                                                |
| b) OX-B431 Sensors  |                                                  |                                                   |                                                    |                                                     |
| 1                   | 10.5                                             | 7.4                                               | 10.5                                               | 13.2                                                |
| 2                   | -1.1                                             | -2.4                                              | 0.1                                                | 2.3                                                 |
| 3                   | 14.4                                             | 2.0                                               | 14.6                                               | 17.4                                                |

SA4: Experimental Data for Method 1

| Reference Instruments       |                            |           |           | Sensor Pair 1               |                            |                             |                            | Sensor Pair 2               |                            |                             |                            | Sensor Pair 3               |                            |                             |                            | 3 Sensor Pair Summary       |                            |                             |                            |                            |                           |
|-----------------------------|----------------------------|-----------|-----------|-----------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|----------------------------|----------------------------|---------------------------|
| [NO <sub>2</sub> ]<br>(ppm) | [O <sub>3</sub> ]<br>(ppb) | T<br>(°C) | RH<br>(%) | [NO <sub>2</sub> ]<br>(ppm) | [O <sub>3</sub> ]<br>(ppb) | [NO <sub>2</sub> ]<br>%Bias | [O <sub>3</sub> ]<br>%Bias | [NO <sub>2</sub> ]<br>(ppm) | [O <sub>3</sub> ]<br>(ppb) | [NO <sub>2</sub> ]<br>%Bias | [O <sub>3</sub> ]<br>%Bias | [NO <sub>2</sub> ]<br>(ppm) | [O <sub>3</sub> ]<br>(ppb) | [NO <sub>2</sub> ]<br>%Bias | [O <sub>3</sub> ]<br>%Bias | [NO <sub>2</sub> ]<br>(ppm) | [O <sub>3</sub> ]<br>(ppb) | [NO <sub>2</sub> ]<br>%Bias | [O <sub>3</sub> ]<br>%Bias | [NO <sub>2</sub> ]<br>%Var | [O <sub>3</sub> ]<br>%Var |
| 0.04                        | 0                          | 28        | 43        | 0.03                        | -21                        | --                          | --                         | 0.03                        | -21                        | --                          | --                         | 0.05                        | -29                        | --                          | --                         | 0.04                        | -24                        | --                          | --                         | --                         | --                        |
| 0.13                        | 0                          | 28        | 38        | 0.12                        | -28                        | -3                          | --                         | 0.12                        | -26                        | -5                          | --                         | 0.13                        | -30                        | 2                           | --                         | 0.12                        | -28                        | -2                          | --                         | 4                          | --                        |
| 0.13                        | 62                         | 28        | 35        | 0.12                        | 34                         | -4                          | -45                        | 0.12                        | 37                         | -5                          | -40                        | 0.13                        | 29                         | 3                           | -54                        | 0.13                        | 34                         | -2                          | -46                        | 5                          | 13                        |
| 0.11                        | 124                        | 28        | 34        | 0.10                        | 95                         | -10                         | -23                        | 0.09                        | 101                        | -12                         | -19                        | 0.11                        | 87                         | 0                           | -30                        | 0.10                        | 94                         | -8                          | -24                        | 7                          | 7                         |
| 0.13                        | 34                         | 28        | 35        | 0.12                        | 9                          | -6                          | -74                        | 0.12                        | 5                          | -4                          | -86                        | 0.13                        | 1                          | 3                           | -97                        | 0.13                        | 5                          | -2                          | -86                        | 5                          | 83                        |
| 0.13                        | 96                         | 28        | 35        | 0.13                        | 58                         | -1                          | -40                        | 0.13                        | 64                         | -3                          | -33                        | 0.14                        | 55                         | 4                           | -43                        | 0.13                        | 59                         | 0                           | -38                        | 4                          | 8                         |
| MAPE                        |                            |           |           |                             |                            | 5                           | 45                         |                             |                            | 6                           | 44                         |                             |                            | 3                           | 56                         |                             |                            | 3                           | 49                         |                            |                           |
|                             |                            |           |           |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                            |                           |
| 0.02                        | 0                          | 24        | 27        | 0.06                        | -21                        | --                          | --                         | 0.06                        | -21                        | --                          | --                         | 0.07                        | -31                        | --                          | --                         | 0.07                        | -24                        | --                          | --                         | --                         | --                        |
| 0.25                        | 0                          | 25        | 37        | 0.27                        | -29                        | 7                           | --                         | 0.28                        | -39                        | 10                          | --                         | 0.27                        | -35                        | 9                           | --                         | 0.27                        | -34                        | 8                           | --                         | 2                          | --                        |
| 0.26                        | 66                         | 26        | 40        | 0.26                        | 42                         | 3                           | -37                        | 0.28                        | 33                         | 8                           | -51                        | 0.28                        | 30                         | 8                           | -55                        | 0.27                        | 35                         | 6                           | -47                        | 3                          | 18                        |
| 0.27                        | 130                        | 27        | 39        | 0.28                        | 92                         | 2                           | -29                        | 0.29                        | 84                         | 7                           | -35                        | 0.28                        | 83                         | 5                           | -36                        | 0.28                        | 86                         | 5                           | -34                        | 2                          | 6                         |
| 0.28                        | 33                         | 27        | 39        | 0.26                        | 1                          | -7                          | -98                        | 0.26                        | -2                         | -6                          | -106                       | 0.26                        | -3                         | -6                          | -110                       | 0.26                        | -2                         | -7                          | -105                       | 1                          | 121                       |
| 0.26                        | 98                         | 28        | 39        | 0.26                        | 63                         | 2                           | -36                        | 0.27                        | 56                         | 5                           | -43                        | 0.27                        | 53                         | 5                           | -46                        | 0.27                        | 57                         | 4                           | -41                        | 2                          | 9                         |
| MAPE                        |                            |           |           |                             |                            | 4                           | 50                         |                             |                            | 7                           | 59                         |                             |                            | 6                           | 62                         |                             |                            | 6                           | 57                         |                            |                           |
|                             |                            |           |           |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                            |                           |
| 0.04                        | 0                          | 28        | 44        | 0.04                        | -36                        | --                          | --                         | 0.05                        | -24                        | --                          | --                         | 0.06                        | -33                        | --                          | --                         | 0.05                        | -31                        | --                          | --                         | --                         | --                        |
| 0.53                        | 1                          | 28        | 44        | 0.54                        | -51                        | 2                           | --                         | 0.58                        | -53                        | 9                           | --                         | 0.53                        | -27                        | 1                           | --                         | 0.55                        | -44                        | 4                           | --                         | 4                          | --                        |
| 0.43                        | 65                         | 28        | 44        | 0.54                        | 13                         | 26                          | -80                        | 0.58                        | 10                         | 35                          | -84                        | 0.54                        | 34                         | 25                          | -48                        | 0.55                        | 19                         | 29                          | -71                        | 5                          | 69                        |
| 0.54                        | 125                        | 28        | 44        | 0.58                        | 56                         | 8                           | -55                        | 0.62                        | 63                         | 15                          | -50                        | 0.57                        | 82                         | 6                           | -34                        | 0.59                        | 67                         | 9                           | -46                        | 4                          | 20                        |
| 0.49                        | 33                         | 28        | 44        | 0.53                        | -35                        | 8                           | -208                       | 0.57                        | -29                        | 15                          | -189                       | 0.52                        | -4                         | 6                           | -113                       | 0.54                        | -23                        | 10                          | -170                       | 5                          | 72                        |
| 0.50                        | 94                         | 28        | 45        | 0.54                        | 27                         | 8                           | -71                        | 0.57                        | 33                         | 16                          | -65                        | 0.52                        | 54                         | 6                           | -42                        | 0.54                        | 38                         | 10                          | -60                        | 5                          | 38                        |
| MAPE                        |                            |           |           |                             |                            | 11                          | 104                        |                             |                            | 18                          | 97                         |                             |                            | 9                           | 59                         |                             |                            | 12                          | 87                         |                            |                           |
|                             |                            |           |           |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                            |                           |
| 0.03                        | -2                         | 23        | 26        | 0.06                        | -24                        | --                          | --                         | 0.06                        | -21                        | --                          | --                         | 0.07                        | -29                        | --                          | --                         | 0.06                        | -25                        | --                          | --                         | --                         | --                        |
| 1.06                        | 2                          | 25        | 36        | 1.14                        | -55                        | 8                           | --                         | 1.23                        | -100                       | 16                          | --                         | 1.11                        | -22                        | 5                           | --                         | 1.16                        | -59                        | 10                          | --                         | 5                          | --                        |
| 0.96                        | 65                         | 26        | 39        | 1.03                        | 24                         | 7                           | -63                        | 1.09                        | -11                        | 14                          | -117                       | 1.00                        | 54                         | 4                           | -17                        | 1.04                        | 22                         | 8                           | -66                        | 4                          | 146                       |
| 1.11                        | 131                        | 26        | 41        | 1.16                        | 81                         | 5                           | -38                        | 1.24                        | 37                         | 12                          | -72                        | 1.13                        | 114                        | 2                           | -13                        | 1.18                        | 77                         | 6                           | -41                        | 5                          | 50                        |
| 0.96                        | 31                         | 27        | 43        | 1.05                        | -23                        | 9                           | -174                       | 1.14                        | -64                        | 18                          | -305                       | 1.04                        | 6                          | 8                           | -82                        | 1.08                        | -27                        | 12                          | -187                       | 5                          | 129                       |
| 1.01                        | 97                         | 28        | 43        | 1.10                        | 26                         | 9                           | -73                        | 1.20                        | -6                         | 19                          | -106                       | 1.09                        | 61                         | 8                           | -37                        | 1.13                        | 27                         | 12                          | -72                        | 5                          | 123                       |
| MAPE                        |                            |           |           |                             |                            | 8                           | 87                         |                             |                            | 16                          | 150                        |                             |                            | 5                           | 37                         |                             |                            | 10                          | 91                         |                            |                           |
|                             |                            |           |           |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                            |                           |
| Total MAPE                  |                            |           |           |                             |                            | 7                           | 72                         |                             |                            | 12                          | 88                         |                             |                            | 6                           | 53                         |                             |                            | 8                           | 71                         |                            |                           |

SA5: Experimental Data for Method 2

| Reference Instruments       |                            |           |           | Sensor Pair 1               |                            |                             |                            | Sensor Pair 2               |                            |                             |                            | Sensor Pair 3               |                            |                             |                            | 3 Sensor Pair Summary       |                            |                             |                            |                            |                           |
|-----------------------------|----------------------------|-----------|-----------|-----------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|----------------------------|----------------------------|---------------------------|
| [NO <sub>2</sub> ]<br>(ppm) | [O <sub>3</sub> ]<br>(ppb) | T<br>(°C) | RH<br>(%) | [NO <sub>2</sub> ]<br>(ppm) | [O <sub>3</sub> ]<br>(ppb) | [NO <sub>2</sub> ]<br>%Bias | [O <sub>3</sub> ]<br>%Bias | [NO <sub>2</sub> ]<br>(ppm) | [O <sub>3</sub> ]<br>(ppb) | [NO <sub>2</sub> ]<br>%Bias | [O <sub>3</sub> ]<br>%Bias | [NO <sub>2</sub> ]<br>(ppm) | [O <sub>3</sub> ]<br>(ppb) | [NO <sub>2</sub> ]<br>%Bias | [O <sub>3</sub> ]<br>%Bias | [NO <sub>2</sub> ]<br>(ppm) | [O <sub>3</sub> ]<br>(ppb) | [NO <sub>2</sub> ]<br>%Bias | [O <sub>3</sub> ]<br>%Bias | [NO <sub>2</sub> ]<br>%Var | [O <sub>3</sub> ]<br>%Var |
| 0.04                        | 0                          | 28        | 43        | 0.00                        | 0                          | --                          | --                         | 0.00                        | 0                          | --                          | --                         | 0.00                        | 0                          | --                          | --                         | 0.00                        | 0                          | --                          | --                         | --                         | --                        |
| 0.13                        | 0                          | 28        | 38        | 0.09                        | -7                         | -30                         | --                         | 0.08                        | -5                         | -33                         | --                         | 0.08                        | -1                         | -35                         | --                         | 0.08                        | -4                         | -33                         | --                         | 4                          | --                        |
| 0.13                        | 62                         | 28        | 35        | 0.09                        | 55                         | -30                         | -12                        | 0.09                        | 59                         | -32                         | -6                         | 0.08                        | 58                         | -34                         | -7                         | 0.09                        | 57                         | -32                         | -8                         | 3                          | 4                         |
| 0.11                        | 124                        | 28        | 34        | 0.06                        | 116                        | -42                         | -7                         | 0.06                        | 122                        | -44                         | -2                         | 0.06                        | 116                        | -45                         | -7                         | 0.06                        | 118                        | -44                         | -5                         | 2                          | 3                         |
| 0.13                        | 34                         | 28        | 35        | 0.09                        | 29                         | -32                         | -12                        | 0.09                        | 26                         | -31                         | -23                        | 0.09                        | 30                         | -34                         | -11                        | 0.09                        | 28                         | -32                         | -15                        | 2                          | 8                         |
| 0.13                        | 96                         | 28        | 35        | 0.10                        | 78                         | -26                         | -18                        | 0.09                        | 86                         | -29                         | -10                        | 0.09                        | 84                         | -32                         | -12                        | 0.09                        | 83                         | -29                         | -14                        | 4                          | 5                         |
| MAPE                        |                            |           |           |                             |                            | 32                          | 12                         |                             |                            |                             |                            |                             |                            | 34                          | 10                         |                             |                            |                             |                            |                            |                           |
|                             |                            |           |           |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                            |                           |
| 0.02                        | 0                          | 24        | 27        | 0.00                        | 0                          | --                          | --                         | 0.00                        | 0                          | --                          | --                         | 0.00                        | 0                          | --                          | --                         | 0.00                        | 0                          | --                          | --                         | --                         | --                        |
| 0.25                        | 0                          | 25        | 37        | 0.21                        | -9                         | -17                         | --                         | 0.24                        | -24                        | -6                          | --                         | 0.20                        | -4                         | -21                         | --                         | 0.23                        | -13                        | -10                         | --                         | 4                          | --                        |
| 0.26                        | 66                         | 26        | 40        | 0.20                        | 63                         | -20                         | -5                         | 0.23                        | 47                         | -8                          | -29                        | 0.20                        | 61                         | -21                         | -8                         | 0.23                        | 56                         | -12                         | -15                        | 3                          | 14                        |
| 0.27                        | 130                        | 27        | 39        | 0.22                        | 113                        | -20                         | -13                        | 0.25                        | 98                         | -9                          | -24                        | 0.21                        | 114                        | -23                         | -13                        | 0.24                        | 108                        | -12                         | -17                        | 4                          | 8                         |
| 0.28                        | 33                         | 27        | 39        | 0.20                        | 21                         | -29                         | -35                        | 0.22                        | 12                         | -21                         | -63                        | 0.19                        | 28                         | -33                         | -16                        | 0.21                        | 20                         | -23                         | -39                        | 4                          | 40                        |
| 0.26                        | 98                         | 28        | 39        | 0.20                        | 84                         | -22                         | -14                        | 0.23                        | 70                         | -11                         | -28                        | 0.19                        | 84                         | -24                         | -14                        | 0.22                        | 79                         | -14                         | -19                        | 3                          | 9                         |
| MAPE                        |                            |           |           |                             |                            | 22                          | 17                         |                             |                            |                             |                            |                             |                            | 11                          | 36                         |                             |                            |                             |                            |                            |                           |
|                             |                            |           |           |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                            |                           |
| 0.04                        | 0                          | 28        | 44        | 0.00                        | 0                          | --                          | --                         | 0.00                        | 0                          | --                          | --                         | 0.00                        | 0                          | --                          | --                         | 0.00                        | 0                          | --                          | --                         | --                         | --                        |
| 0.53                        | 1                          | 28        | 44        | 0.50                        | -15                        | -6                          | --                         | 0.53                        | -28                        | 0                           | --                         | 0.48                        | 6                          | -10                         | --                         | 0.50                        | -12                        | -5                          | --                         | 5                          | --                        |
| 0.43                        | 65                         | 28        | 44        | 0.50                        | 48                         | 16                          | -25                        | 0.54                        | 35                         | 24                          | -46                        | 0.48                        | 67                         | 12                          | 4                          | 0.51                        | 50                         | 17                          | -23                        | 5                          | 33                        |
| 0.54                        | 125                        | 28        | 44        | 0.53                        | 92                         | 0                           | -26                        | 0.57                        | 87                         | 6                           | -30                        | 0.51                        | 116                        | -4                          | -7                         | 0.54                        | 98                         | 0                           | -21                        | 5                          | 16                        |
| 0.49                        | 33                         | 28        | 44        | 0.49                        | 0                          | 0                           | -98                        | 0.52                        | -5                         | 6                           | -114                       | 0.47                        | 29                         | -5                          | -11                        | 0.49                        | 8                          | 0                           | -75                        | 6                          | 220                       |
| 0.50                        | 94                         | 28        | 45        | 0.49                        | 63                         | 0                           | -33                        | 0.52                        | 57                         | -6                          | -39                        | 0.47                        | 88                         | -5                          | -7                         | 0.50                        | 69                         | 0                           | -27                        | 6                          | 23                        |
| MAPE                        |                            |           |           |                             |                            | 5                           | 46                         |                             |                            |                             |                            |                             |                            | 8                           | 58                         |                             |                            |                             |                            |                            |                           |
|                             |                            |           |           |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                            |                           |
| 0.03                        | -2                         | 23        | 26        | 0.00                        | 0                          | --                          | --                         | 0.00                        | 0                          | --                          | --                         | 0.00                        | 0                          | --                          | --                         | 0.00                        | 0                          | --                          | --                         | --                         | --                        |
| 1.06                        | 2                          | 25        | 36        | 1.09                        | -31                        | 3                           | --                         | 1.17                        | -78                        | 11                          | --                         | 1.05                        | 7                          | -1                          | --                         | 1.10                        | -34                        | 4                           | --                         | 6                          | --                        |
| 0.96                        | 65                         | 26        | 39        | 0.98                        | 48                         | 2                           | -26                        | 1.03                        | 10                         | 7                           | -85                        | 0.93                        | 84                         | -3                          | 28                         | 0.98                        | 47                         | 2                           | -27                        | 5                          | 78                        |
| 1.11                        | 131                        | 26        | 41        | 1.10                        | 106                        | 0                           | -19                        | 1.18                        | 58                         | 7                           | -56                        | 1.06                        | 143                        | -4                          | 9                          | 1.11                        | 102                        | 1                           | -22                        | 6                          | 42                        |
| 0.96                        | 31                         | 27        | 43        | 1.00                        | 1                          | 3                           | -97                        | 1.08                        | -43                        | 12                          | -237                       | 0.97                        | 35                         | 1                           | 12                         | 1.02                        | -2                         | 6                           | -107                       | 6                          | 1753                      |
| 1.01                        | 97                         | 28        | 43        | 1.05                        | 50                         | 4                           | -48                        | 1.14                        | 16                         | 13                          | -83                        | 1.02                        | 90                         | 1                           | -7                         | 1.07                        | 52                         | 6                           | -46                        | 6                          | 72                        |
| MAPE                        |                            |           |           |                             |                            | 3                           | 48                         |                             |                            |                             |                            |                             |                            | 10                          | 115                        |                             |                            |                             |                            |                            |                           |
|                             |                            |           |           |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                             |                            |                            |                           |
| Total MAPE                  |                            |           |           |                             |                            | 13                          | 31                         |                             |                            |                             |                            |                             |                            | 16                          | 55                         |                             |                            |                             |                            |                            |                           |