Supplementary material

Description of the ICOS-SIRTA atmospheric sampling site and analytical methods used there.

Similar surveys were carried out over the Saclay Plateau in 2014 and 2015 at the ICOS and SIRTA (zone 5) sites. SIRTA stands for Site Instrumental de Recherche par Télédétection Atmosphérique. It is a French national atmospheric observatory dedicated to cloud, reactive gases and aerosol research and belongs to the European-ACTRIS network. The two sites are separated by about 4 km. This is a typical sub-urban area where urban infrastructures, main roads, agricultural fields, forests and lawns are found. At the ICOS-SIRTA site, the air inlet is located 7 m above ground level and the instruments located at a distance of ~40 m are also supplied through a 3/8'' Synflex tubing which is flushed permanently. CO_2 atmospheric mixing ratios were measured with a gas chromatograph (HP-6890N from Agilent) with flame ionization detector (Lopez et al., 2012). The two instruments have been coupled and optimized at LSCE in order to perform semi-continuous measurements of ambient air, as well as flask analysis, and standard calibrations. The ambient air pumped at an elevation of 7 m above ground level is dried using a glass trap in an ethanol bath maintained at -45°C by a cryocooler. Two working standards, with high and low concentrations, are used to calibrate the measurements. They are themselves regularly calibrated against a suite of six standards provided by NOAA for consistency with international reference scales (Lopez et al., 2012). Atmospheric CO was analyzed using gas chromatography (PP1 from Peak Performer) equipped with a reduction gas detector (RGD, model PP1, Peak Laboratories) as in Yver et al. (2009). ^{222}Rn is a natural radioactive gas emitted by soils which is a good tracer of the planetary boundary layer circulation. ^{222}Rn is measured at the ICOS-SIRTA station with the active deposit method, that is, via the radioactive decay of its daughters attached to aerosols (Yver et al., 2009; Belviso et al., 2013). The radon instrument has a random error of 10%.

Belviso, S., Schmidt, M., Yver, C., Ramonet, M., Gros, V., and Launois, T.: Strong similarities between nighttime deposition velocities of carbonyl sulphide and molecular hydrogen inferred from semi-continuous atmospheric observations in Gif-sur-Yvette, Paris region, Tellus B, 65, 20719, doi:10.3402/tellusb.v65i0.20719, 2013.

Lopez, M., Schmidt, M., Yver, C., Messager, C., Worthy, D., Kazan, V., Ramonet, M., Bousquet, P., and Ciais, P.: Seasonal variation of N2O emissions in France inferred from atmospheric N2O and 222Rn measurements, J. Geophys. Res.-Atmos., 117, D14103, doi:10.1029/2012JD017703, 2012.

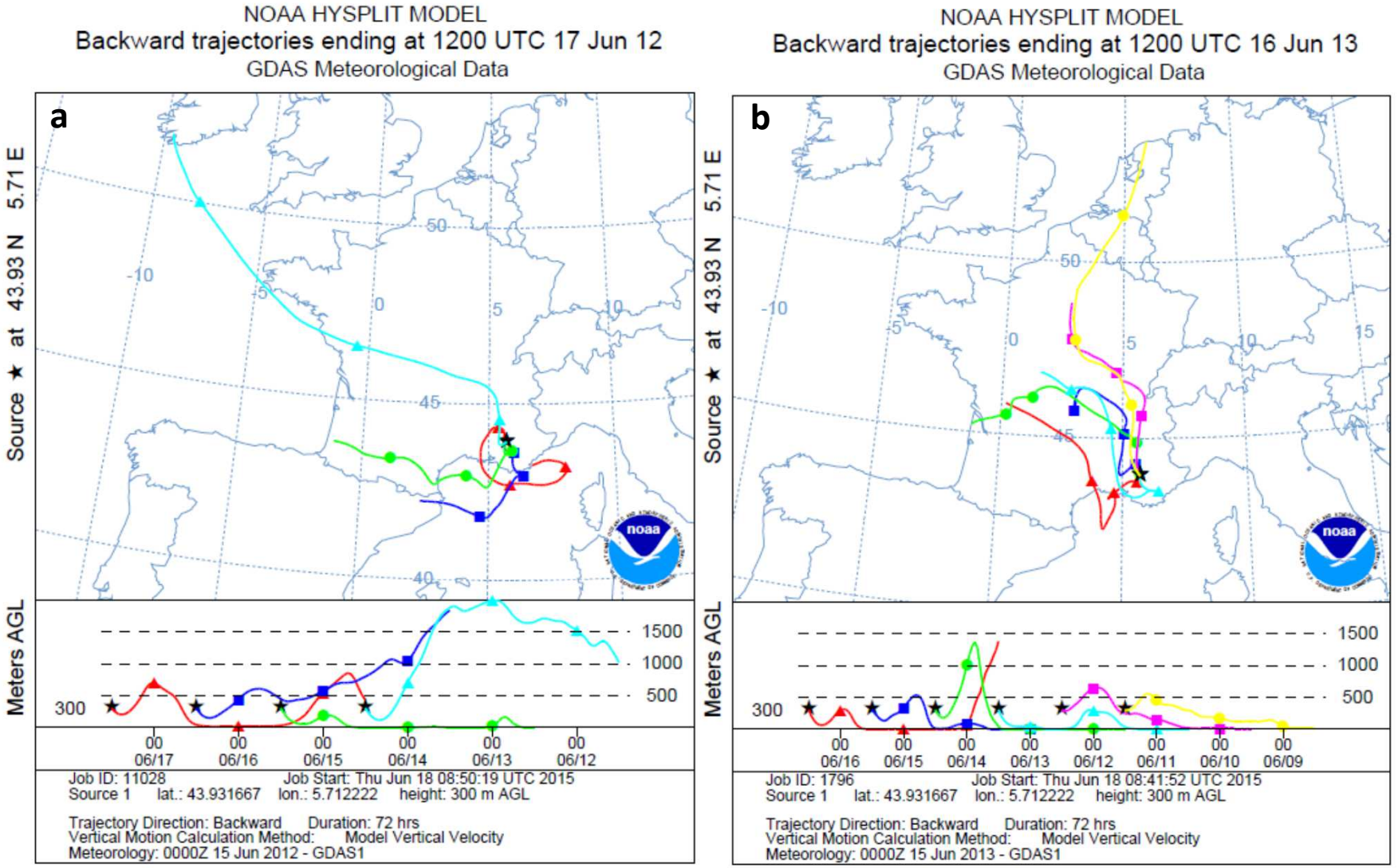
Yver, C., M. Schmidt, P. Bousquet, W. Zahorowski, and M. Ramonet (2009), Estimation of the molecular hydrogen soil uptake and traffic emissions at a suburban site near Paris through hydrogen, carbon monoxide, and 222Rn semicontinuous measurements, J. Geophys. Res., 114, D18304, doi:10.1029/2009JD012122.

Figure captions

Figure S1. 3 days back trajectories, calculated by the NOAA HYSPLIT MODEL, ending at the O3HP site at 12:00 UTC, 300 m above ground level. (a) June 2012, (b) June 2013.

Figure S2: Stomatal conductance to water vapour (a) calculated using the Penman-Monteith equation or the Lamaud et al. (2009) approach (shown as diurnal averages over the May 29 to June 3 period) or (b, c, d) measured 06/16/2013 using a transit-time porometer in the sun and shade crowns of (b) 6 oak, (c) 3 maple trees, accessible by the scaffolding, and (d) 3 smokebushes in the undergrowth on the O3HP field site. HL and LL stand for High Light (sun crowns) and Low Light (shade crown, leaf area index around 1.5-2.0) conditions. Note that nighttime measurements of stomatal conductance of the smokebush in the undergrowth typically took very long (20 s - 70 s transit time) to complete, and were considered to be too low as to be correctly predicted by this method. The time scale is UTC time and the grey vertical bands correspond to the night time.

Figure S3. Time series of ambient mixing ratios of OCS, CO_2, CO and O_3 in a suburban area of the Paris region (Saclay Plateau, ICOS site, April 2015; c,d) at 7 m height above ground level (a.g.l.), respectively, in relation to incoming global radiation and thermal stratification a.g.l. ($\Delta T/\Delta H$ in °C m^{-1}; a) and wind speed (b). Note that global radiation and temperature vertical gradients in the Saclay area (a) were recorded at the SIRTA site located about 4 km East of the ICOS sampling site (data downloaded from http://sirta.ipsl.polytechnique.fr/sirta/data/data_search/). The same OCS and O_3 analyzers were used to monitor the diurnal variations of those compounds at the O3HP and ICOS-SIRTA sampling sites. The ICOS-SIRTA time series is meant to illustrate the atmospheric signature during periods of low atmospheric turbulence of strong OCS and O_3 deposition events. Periods of low atmospheric turbulence were evaluated using ^{222}Rn accumulations (b). The time scale is UTC time and the grey vertical bands correspond to the night time. Analytical methods are described in the main text and in the supplementary material.


NOAA HYSPLIT MODEL
Backward trajectories ending at 1200 UTC 17 Jun 12
GDAS Meteorological Data
a
Source ★ at 43.93 N 5.71 E
Meters AGL
1500
1000
500
300
00 06/17
00 06/16
00 06/15
00 06/14
00 06/13
00 06/12
Job ID: 11028 Job Start: Thu Jun 18 08:50:19 UTC 2015
Source 1 lat.: 43.931667 lon.: 5.712222 height: 300 m AGL
Trajectory Direction: Backward Duration: 72 hrs
Vertical Motion Calculation Method: Model Vertical Velocity
Meteorology: 0000Z 15 Jun 2012 - GDAS1
NOAA HYSPLIT MODEL
Backward trajectories ending at 1200 UTC 16 Jun 13
GDAS Meteorological Data
b
Source ★ at 43.93 N 5.71 E
Meters AGL
1500
1000
500
300
00 06/16
00 06/15
00 06/14
00 06/13
00 06/12
00 06/11
00 06/10
00 06/09
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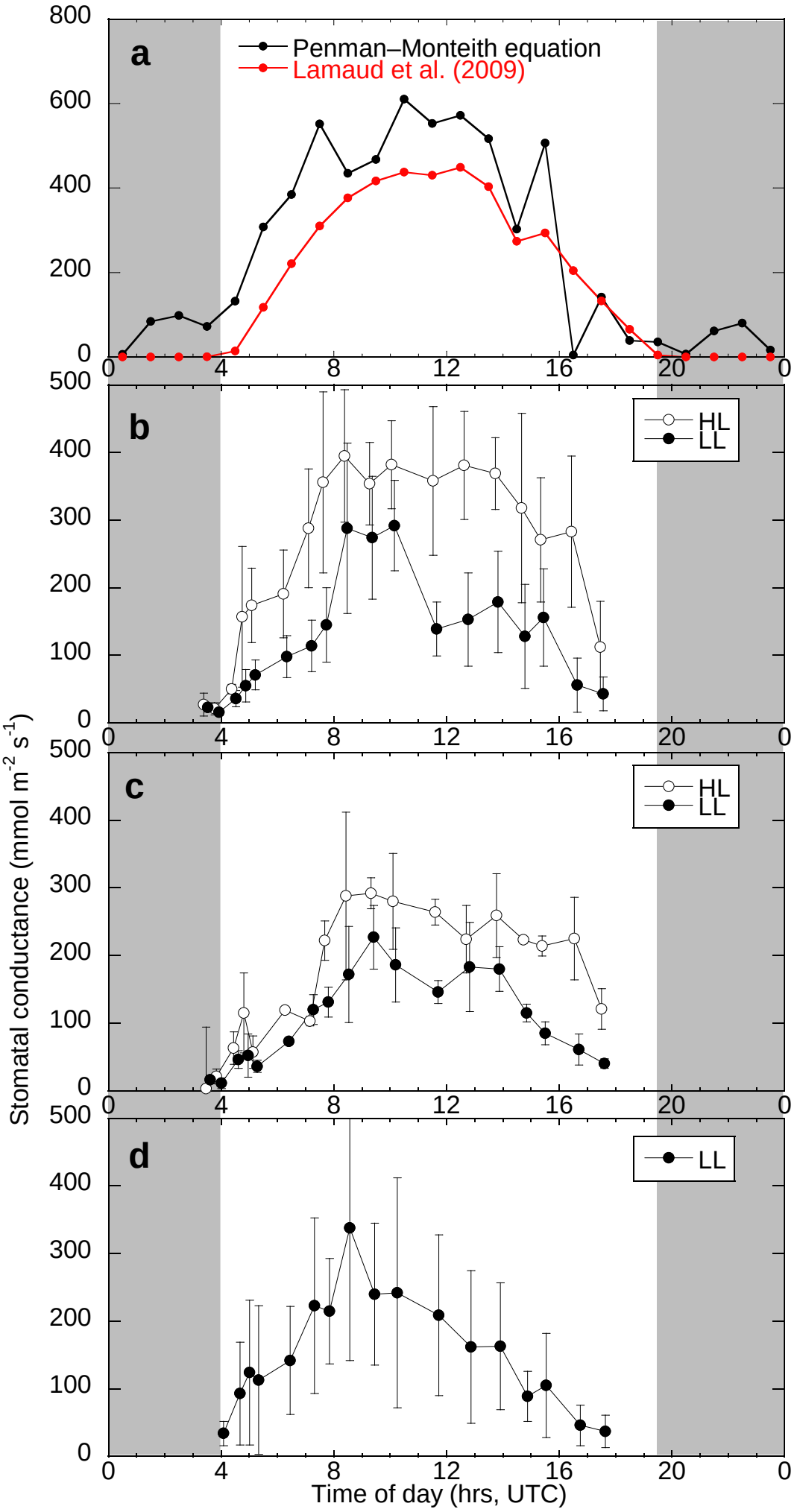
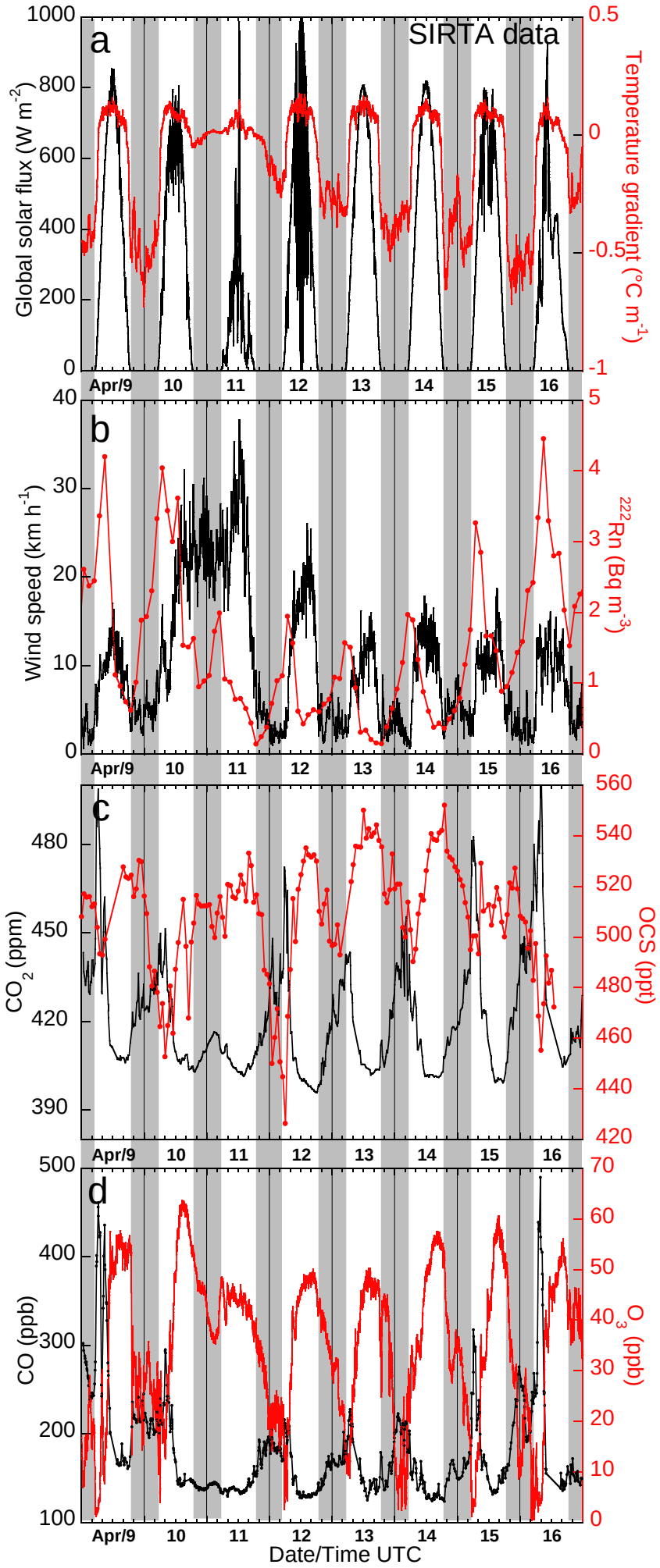
Source 1 lat.: 43.931667 lon.: 5.712222 height: 300 m AGL
Trajectory Direction: Backward Duration: 72 hrs
Vertical Motion Calculation Method: Model Vertical Velocity
Meteorology: 0000Z 15 Jun 2013 - GDAS1


a
Penman–Monteith equation
Lamaud et al. (2009)
b
HL
LL
c
HL
LL
d
LL
Stomatal conductance (mmol m-2 s-1)
Time of day (hrs, UTC)


a
SIRTA data
Global solar flux (W m-2)
Temperature gradient (°C m-1)
b
Wind speed (km h-1)
222Rn (Bq m-3)
c
CO2 (ppm)
OCS (ppt)
d
CO (ppb)
O3 (ppb)
Apr/9
10
11
12
13
14
15
16
Date/Time UTC