Analysis of black carbon and PM10 vertical profiles measured over three Italian valleys

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MOTIVATIONS
- Analyze the behaviour of the vertical profiles of black carbon (BC) and PM10 in Italian Valleys
- Information on the BC vertical distribution and its hourly trend
- The link of BC and PM10 with the local meteorology.

CONCLUSIONS
- Vertical profiles of BC and PM10 have a strong hourly variability
- Vertical profiles in Valleys are strongly dependent by local atmospheric circulation.

METHODS
- The vertical profiles of BC and PM10 have been acquired by helium-filled tethered balloon, on which the instrumentation for the analysis has been mounted: meteorological station, an OPC, a cascade impactor and a micro-Aethalometer.

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<th>Sampling site</th>
<th>Coordinates</th>
<th>Terni</th>
<th>Milano</th>
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<td>Launches: Month and Year</td>
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<td>Number of Launches</td>
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<td>Local Sunrise UTC</td>
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RESULTS

b. Daily calendar of PM10 at the ground in μg/m³
c. Trend of meteorological variable (temperature, relative humidity, precipitation, wind direction, wind speed) and PM10

Three phases have been individuated for the trend of PM10 vertical profiles for every city.

- **Terni**
  1. The first phase involves launches of January 28 in which there is a high intra-daily variability. PM10 concentrations at ground are between 60 and 100 μg/m³. The explanation is in the variability of the wind directions that change throughout the sampling day. The winds turn from east to north. When the wind blows from south, where the city center is located, it has been observed peaks on PM10 concentration along the vertical profile.
  2. The launches of January 29 are characterized by an increase in concentrations with values of 120 μg/m³ and winds from the north.
  3. During February 2 there was a decrease of concentrations with values of 50 μg/m³ and still winds from the north. The BC profiles have a strange configuration: the concentrations grow first and then decrease with altitude. The BC concentrations are generally amounted around 2 μg/m³ in February, 2, until the peak of 12 μg/m³ in the launch of 06:30 on January 29.

- **Milano**
  1. The launches performed on February 15 show a PM10 accumulation with values between 100 and 150 μg/m³. The vertical profiles show concentration peaks at an altitude of about 200 m. The winds blowed from NE, nort from the city, probably, the concentration peak is due to a rapid transit of air mass coming from the west.
  2. The launches of the February 23 show a decrease of the PM10 concentrations, with values of 40 μg/m³ medium, probably due to rains fall in the days before and ventilation from west, which has contributed to the presence of high values.
  3. The third phase of launches on February 24 presents a strong increase of concentrations (almost tripled), due to the local production and a massive transport from the south. Concentrations of BC on 23 are equal to 5 μg/m³ after the rains in the morning, and fast growing up to 20 μg/m³ in the evening. In general, the profiles of BC and PM10 have great hourly and vertical variability.

- **Merano**
  1. The first launch shows low values of PM10, due to the presence of weak rains in the previous day and ventilation from NE which helped to clear the air. Subsequent launches show PM10 accumulation, due both to local production that the transport from the city (winds from NW).
  2. The second phase there were rains that helped to reduce PM10 values, bringing them on average values of 25 μg/m³ with winds blowing predominantly from west. The third phase shows an initial increase of PM10 with concentrations around 50 μg/m³ medium, with turning winds from SW.
  3. Launches of 12 March shows a subsequent decrease, probably due to the winds from NE, that clear the air. As regards the BC profiles, there is a positive correlation with all kinds of particulate matter (PM1, PM2.5, PM10) and especially with PM10. Generally the values of BC are always very low and are between 1 μg/m³ (Thursday, 11) and around 7 μg/m³ (Wednesday, 3). For all the launches BC fraction of PM10 is around 5-10%.