


Balneario Vigna di Valle Centre of
 Atmospheric Experimentations

Chemical analysis of meteoric wet atmospheric deposition. Comparison between daily and weekly precipitation samples.

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Balneario Vigna di Valle

Introduction

In the work of the Meteorological Station of Vigna di Valle (Italy), site of the R.S.M.A., 20 years' experience in meteorological measurements has been enriched by "atmospheric wet-deposition collectors", of which one working from 1998 and dedicated to the collection of weekly precipitation samples and the other working from 2007 to collect daily precipitation samples.

In the same Centre is located a Chemical Laboratory that carries out the chemical analysis of meteoric wet atmospheric precipitation, within an international project of the IAGP (International Geosphere and Chemical Cycle) called "Wet Deposition Chemistry" (WDC) coordinated by IAGP and the activities, between the others, the previous program called "Atmospheric Acid Pollution Monitoring Network", started from 1975 and then the "G & W" for the main goal to realize quantification of patterns and trends in the composition of atmospheric precipitation at global and regional scales, to identify global processes of acid-deposition and investigate long-range transport from remote source areas and to provide the information for modeling effect of acid deposition on forest ecosystems and for developing countermeasures.

The comparison of such activity, from July 2007, a limited period of experimentation begins to evaluate the practical data characterise in the two types of sampling and to measure the differences found in terms of acidity and other chemical parameters and trace the wet-deposition period in the precipitation.

Based on a simple model, with a pH of around 5.4. This model is a result of several reactions between atmospheric CO_2 which dissolves into water together to the absorption:

$$CO_2 + H_2O \rightleftharpoons H_2CO_3 \rightleftharpoons HCO_3^- + H^+$$

So, when the pH level of meteoric precipitation is considered and used:

Balance between ions in the case of total ions for each group, result in the relation of sulfate, nitrate, CO_3^{2-} and various cations (Ca^{2+} , Mg^{2+} , Na^+ , K^+ , Li^+ , Fe^{3+} , Fe^{2+} , Al^{3+} , Al^{2+} , Al^{+} , Al^0), where the cations are divided by the decrease of balance between cations and anions to be made in the form of dry particles and precipitation.

Calculations in the absorption, CO_2 and H_2O , mean only water vapour to form acid, without of water and without acid.

$$[Ca^{2+}] + [Mg^{2+}] = [SO_4^{2-}]$$

$$[Ca^{2+}] + [Mg^{2+}] = [NO_3^-]$$


Sample collection, storage and analytical procedures

The daily sampling (weekly samples) has been carried out in the meteorological station of Vigna di Valle Centre (see 42° 41' N, 12° 12' E, 700 m a.s.l.), in an open field from the top edge of the hill and the distance of 40 m from the air sampling station and located 200 m from a highly wooded mountain and forest from the distance approximately 10 km.

PRECIPITATION COLLECTION

When the rain is falling, the precipitation is collected in a 1000 ml plastic container with a lid and a funnel. The container is placed in a sheltered area to avoid wind and direct sunlight. The container is placed in a sheltered area to avoid wind and direct sunlight. The container is placed in a sheltered area to avoid wind and direct sunlight.

PRECIPITATION STORAGE

The precipitation is stored in a 1000 ml plastic container with a lid and a funnel. The container is placed in a sheltered area to avoid wind and direct sunlight. The container is placed in a sheltered area to avoid wind and direct sunlight. The container is placed in a sheltered area to avoid wind and direct sunlight.

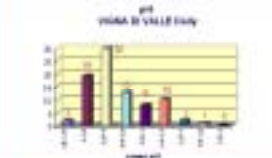
ANALYTICAL PROCEDURES

The precipitation is analyzed in a laboratory. The analysis is carried out using a titration method. The analysis is carried out using a titration method. The analysis is carried out using a titration method.


Parameter/Element	Method	Equipment
pH	Titrimetric	Titration
Sulfate	Titrimetric	Titration
Nitrate	Titrimetric	Titration
Calcium	Titrimetric	Titration
Magnesium	Titrimetric	Titration
Iron	Titrimetric	Titration
Aluminum	Titrimetric	Titration
Sodium	Titrimetric	Titration
Potassium	Titrimetric	Titration
Lithium	Titrimetric	Titration
Ammonium	Titrimetric	Titration

Results

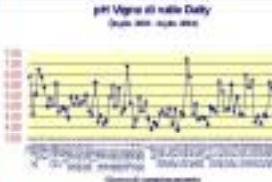
pH VIGNA DI VALLE Daily



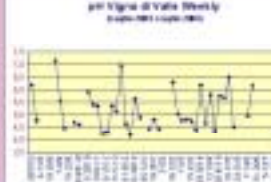
pH VIGNA DI VALLE Weekly



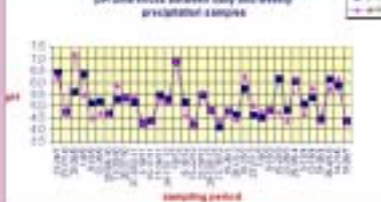
pH Vigna di Valle Daily (July 2007 - June 2008)



pH Vigna di Valle Weekly (July 2007 - June 2008)



pH difference between daily and weekly precipitation samples



Conclusions

In the work the meteoric acidities and relative state of an about a period of experimentation (started in July 2007 at the meteorological station of Vigna di Valle) are shown. They're focused to comparison of analysis of chemical data carried out by meteoric precipitation samples, collected weekly and daily. When the experimentation will be concluded, this work would have to consist to develop the two sampling data and to discriminate every event that have brought acidity from those that have done with "acid without" acid, at the same time, to be able to associate these phenomena at a meteorological specific situation.

This study comes from the opportunity of having in the same site two complete controlled systems: the chemical laboratory is responsible of collected samples analysis, of successive daily analytical calibration and statistic elaboration.

It's not a novelty in the world of atmospheric pollution monitoring activity, and therefore also of analysis carried out by "GVSPP", which the A.M.E. is member of since 1977, managing a net of collection stations, that also comprises the site of Vigna di Valle (from 1998). Finally, through pH diagrams and other chemical-physical parameters, it's possible to represent a first indication emerged from the analysis of two different kind of samples collected, and also it's possible make a valuation about differences and future perspectives of this experimentation.