FROM TRADITIONAL METEOROLOGY TO ASTROPHYSICS: OBSERVATION AND INTERPRETATION OF LOCAL TIME-RESOLVED STRUCTURES OF WEATHER, AND BRAINSTORMING.

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Abstract: By observing local weather with bare eyes and with a physicist's mind inspired by some proverbs on fixed dates and moon phases, typical structures have been selected. Several proverbs still alive are found to correspond to meteorshowers, with a few days delay, and typical structures do occur very often during the cold season around full or new moon. Joint exploratory observation and preliminary theory yield fuzzy interpretation of local weather evolution, in terms of meteorshowers and oceanic tides, and put new light on Bowen's extensive numerical studies performed decades ago. The superiority of cooperating human look and intelligence, illustrated by proverbs, ahead of numerical and technically sophisticated studies, is discussed using complex spectra classification as a scientific model, including both initial and later developments. The " butterfly effect " imaging " meteorological chaos " gets more realistic as reversed into " observing butterflies ", meaning that extensive interpretation of selected details hints to unaccounted interactions of global importance. Questions are proposed, in relation with major enigms such as thunderstorms or El Nino, but also sunspots, earth's magnetic field, Zetta machines and biological effects.

Key-words: accretion, atmosphere, atomic spectra, classification, cosmic rays, ethnology, intelligence, meteorology, methodology, oceanic tides, solar system

1. Introduction

Prediction of weather is an activity probably as old as humanity. The major influence of the sun has often been implemented by that of other astronomical objects in the sky (under the name of astrology). On the other hand, regularities have been traditionally described by empirical laws, transmitted as proverbs. These are more or less local, as are details of climate, but transmission corresponds to a similarity with experience which is difficult to evaluate. The scope of the present article is not a description of the initial cultural background, both scientific and traditional, but the collection of a few facts together with possible interpretations and subsequent hypotheses. Moreover, stress will be put on astrophysical aspects, because this field is in rapid evolution and its new measurements and questions come as a confirmation of the relevance of the present approach. Two preliminary reports, used since 1996 as a basis for discussion, are given in annexes A and B.

Although it does not happen every year, rain on the 15th of august in the southern french Alps is a locally well-known feature: a period of thunderstorms at the begining of August usually breaks into plain rain during a few days, with snow on the summits. It is noticeable that, a few days earlier, there occurs another effect with a constant date, the meteor shower of the Perseids. See annex A. Actually, this 1999 year, the rainy days began on the 16th, with very heavy rain and mud floods (after spectacular new moon with the eclips on the 11th).

Such coincidences of meteorshowers with meteorological anomalies several times along the year had been noticed for a long time. Sophisticated numerical studies

performed by Bowen [1-6] in the fifties, and continued by Kviz[7], conclude on dates and periodicity in relation with dust orbits. These investigations do not mention explicitely any traditional dates, they are produced as analysis of compiled available data recorded in a wide number of places around the world (including British Isles, Australia, New Zeland, United States and Japan), over tens to hundreds of years. Since they were initially unknown of the author, similarities in dates appear as a confirmation. The fact that previous interpretation produces time-delays after meteorshowers different from the present one (one month there instead of a few days here) will need a discussion concerning a possible coexistence of different effects; these discrepancies confirms that interpretation of numerical data is delicate when the selection of data is not typical of the physical interaction under study.

The corresponding traditional proverbs still excite some curiosity. They often have only a mythic status, or sometimes are hold in contempt by scientists. This may be understood from the general variability observed in such phenomena, that makes statistics not obvious. An inadequate explanation, by the shadow of dust, quoted as rejected, in [8], might have encouraged discarding the effects themselves.

Some other observed coincidences concern moon phases; some meteorological proverbs are still alive on the subject, and they are again paid attention to by a wide number of gardeners [9]. "If weather is fine at full moon, it rains three days later", and also "cold at full moon". The first of these french proverbs takes into account a certain variability, and both give a good representation of some effects that have been observed near Paris by the author. A precise study of weather according to moon phases did show many interesting details for temperature, wind, moisture, when guided by the fruitful hypothesis that these effects might be caused by another moonsensitive phenomenon related to terrestrial water, namely variations of evaporation on the shores associated to the oceanic tides amplitudes. See annex B. This study is in agreement with the lunisolar periodicity found in numerical data by Bradley et al.[10], and by Adderley and Bowen [11] and with the geographic variations of phase they obtained.

A third traditional subject is associated with comets. These have been relatively uncommon in the past decades, as concern observation with the naked eye. The recent occurence of two of them in a one-year interval has been an interesting occasion for refining initial hypotheses. They have been accompanied by an unusually intense - and long - El Nino event, associated with the same well known series of catastrophs traditionally attributed to comets. Locally, in France, an enhancement is suspected as concerns effects which coincide with cosmic matter fall.

Since 1996, coupled local observation and interpretation have been continued so as to understand part of the complexity observed; the general scheme is probably correct, but is still preliminary and needs discussion; some other astrophysical effects seem to be still missing. It is not clear wether cosmic water is involved or not. The moon position probably has some influence on dust trajectories, with immediate effects in relation with proverbs still alive such as " moon eats clouds " or " moon of evening, cold at evening; moon of morning, cold at morning ". Anyhow, it seems clear that a large part of the complexity is due to the mixing of the different periodicities.

As an extradisciplinary contribution, the present article cannot compete with

specialized work as concerns bibliography, for both academic and, particularly, non-conventional aspects, but efforts have been made in order to summarize relevant knowledges in distinct physics fields, and some welcome help did bring to surface less common relevant references reporting on currently ignored advances. Some discussions within the concerned scientific communities, on the basis of the unpublished papers given in annexes A an B, have shown that the proposed ideas have not yet been worked out, and do not appear as obviously false, nor wellknown, but belong to fields where precise descriptions are missing. Therefore, rather than changing to a more advanced numerical study, the accent has been put here on examples and on the underlying methodology. The importance of case studies refering to isolated or cooperating effects is demonstrated. Eventually, positive results obtained in numerical studies of some selected data from Bowen [2] and Arakawa [12] support the pertinence of the present approach.

2. The "cloud chamber" as an image for the "atmospheric chaos"

Indeed, the idea that such proverbs describe a reality associated to a physical cause appears to be either accepted or rejected among physicists.

The usual arguments against it generally involve the absence of significant statistical studies, and the variability observed; they are usually associated with the idea that education should eradicate such remnants of ignorance. Another argument concerning an homogeneous repartition of falling cosmic matter assumed to bring uniform effects does not resist comparison with solar radiation, and, moreover, is in contradiction with general information concerning cosmic rays, which are sensitive to earth rotation and magnetic field.

On the contrary, intuitive agreement relies on spectacular coincidences that do not look like fortuitous, and on the idea that some country people do know much about weather. What is new in the present approach, is the confidence that links this problem to the existence of an interaction between incoming cosmic matter and atmosphere, that would yield currently observed weather perturbations and might be of global importance, and the subsequent conclusion that other proverbial features should be related to physical causes.

Indeed, the english expression "cloud chamber" [13] does provide a striking image. It helps understanding the nature of involved phenomena of different origins and time constants, one corresponding to a process of moisture production, a second one corresponding to incoming particules, and a third one concerning the gravitational and magnetic accelerator that provides them; the first two phenomena interact because clouds created do screen radiations that produce moisture. It is clear anyhow that underlying physics is not simple, in particular because relative velocities involved in accretion are not common in laboratories at a mesoscopic scale.

3. The jigsaw puzzle approach and the model of atomic spectra.

Compared to the earlier scientific publications quoted, the present contribution refers to a new precise description based on patient and delicate, physical but non-numerical observation, caring for dates and moon-phases, explicitely guided by both proverbs and over-simplified evolutive theoretical ideas. The underlying attitude is partly inherited from atomic spectroscopy, towards the giant atmospheric jigsaw puzzle where any detail deserves attention.

Actually, the interpretation of very complex spectra looks like a model for the

present study, and numerous analogies are found at any level. The recorded intensity of light emitted by atoms in given conditions, as a function of wavelength (or of wavenumber) is to be compared to the evolution of any of the quantities that describe the weather, as a function of time. There is no repeatability on either of these scales. Actually the meteorological problem is indeed much more complex because there exist so many parameters that cooperatively influence the recordings, and every place in the world has its own specificity.

The study of very complex spectra [14-16], such as, for example, those of praseodymium [17-21], protactinium[22] and uranium[23], as extreme cases of spectrum analysis[24], show how high-resolution details (such as Zeeman effect, result of the action of an external magnetic field, or hyperfine structure) that seem to make the system even more complex, are helpful for its interpretation. It demonstrate the interest of recording and handling thousands of data and of studying the structures visually as well as numerically. It shows the advantages of increasing resolution, which confirms correct hypotheses and limits the number fortuitous coincidences that would hide rare significant ones. It is also an example of access to fundamental phenomena, such as interactions of the electronic structure with the nuclear spin and the magnetic and electric nuclear moments, as detected through the details of hyperfine structure. Moreover, the study of Zeeman effect or hyperfine structure details do provide sensitive tests as concerns the major effects, represented by the electronic wavefunctions. The analysis of spectra relies partly on simple empirical notions such as multiplets and Landé rule, partly on semi-empirical parametric calculations involving sophisticated group theory, which gives precious predictions concerning what is to be found, by using what is already known.

The most important notion may be that of intermediate coupling, which corresponds to situations where electrostatic interaction and spin-orbit interaction are of similar importance, leading to features which are not typical of any of the pure cases. In the same way, some meteorological features seem typical of either one interaction or of the other, while, most often, others do correspond to a mixing that makes interpretation more difficult; the " Red moon ", occurring in april-may seems to be typical of such an intermediate effect, and the strong rains on the 16th of august 1999 a precise example.

Complex spectra is a fundamental field that has reached a high degree of elaboration. As concerns aims and publications, a first hint was given by a non-specialist, Balmer, who gave the mathematical law for the wavelengths of the hydrogen spectrum, then a number of teams have produced sophisticated observation and theory and computorized procedures, and still continue. By now, publications relie either on large amounts of new numerical results, or on examples illustrating new techniques[25]. The first and last attitudes have been chosen here. Because of the more complete non-repeatability of weather, the interest of recorded facts is essentially in the interpretation they allow. The object of the present article is to provide some models that could be extended to similar situations, and to show the rough theoretical ideas that have been useful for questioning reality with more accurate observations and for disentangling mixed effects.

4. Observation means

It was initially a nature-watching hobby, but it gets clear that it is real scientific preliminary work where a detailed non numerical description provides bases for a more general understanding of unaccounted phenomena. The method used for weather observation remains close to that of people who did transmit the proverbs. A

more or less conscious simultaneous process of interpretation does characterize this type of data acquisition. It includes an access, rather large but nevertheless limited by other activities, to weather observation, and non-technically-sophisticated means using bare human sensitivity to temperatures, winds and transported noises, aspect of sky, clouds, rain... Some biological detectors have been appreciated for their high sensitivity to frost: dahlias and nasturtium in automn, wisteria or magnolia in spring. Squirrels and bullfinchs in winter do appear in the garden when a cold period is to come. In the cold season, observing the morning frost on the neighbour's roof oriented to the north did provide useful evidences. Whereas some people do feel coming rainfalls in their bones, the author rather noticed a personal mental sensitivity, namely impulsions to gardening or washing with an advance ranging from two days to a few minutes, which remains an open question. Is it trained, or rather native, inherited from former generations? is it related to hygrometry, or rather to air ionization [26]?.

It is clear that all these data are not reproducible, but weather is not, either. The orientation of the observation place deserves a description: it is on the north side of the valley between Gif/Yvette and Orsay, almost in front of the perpendicular Gometz valley. The east-west direction of the valley at that place is probably favourable in the sense that the dominant winds, from the west, less often from the east, are channelled, while south wind seems unstable because it comes straight onto the slope. The direction of winds is, indeed, most important as concerns the moon phases study. As concerns rain, numerical evaluation has never been performed, although the notion of intensity is often referred to. The aspects and evolution of the clouds are typically visual information of high interest. The Gif-Orsay site informations have been complemented (and limited) by visits to other sites, most often in southern Alps or on the french Mediteranean coast, which give living examples of the variability throughout the country, and by orally transmitted descriptions. Broadcasted information has been most often ignored, an unusual habit that preserves autonomy in weather prediction, with some exceptions on critical days, for comparison.

5. Extensive observation of structures

As said in the introduction, the initial idea for the present study came from a typical structure, observed so many times in the southern Alps where sun is usually present almost every day. Stormy weather ending with rain for a few consecutive days, at the fixed date of 15th of august, and afterwards fresher clear fine weather. Looking at a list of the major meteorshowers, several dates come just before proverbial dates. Although the hypothesis of such an interaction of cosmic matter with atmosphere is not a mediatized idea, it has been reported on different occasions [1-7], [8], [27-28] and meteorological effects of cosmic rays are under study, e.g. [29]. But collisions of solids with a gas with relative velocities up to tens of km/s is not laboratory physics. Probably electrons are ejected, while positive particles continue their way down, interacting and creating magnetic fields. At that point, no precise theory is needed for exploring the facts. Assuming that such perturbations do occur around some half a dozain of specific dates, a few days after major meteor showers, it comes out that, due to the seasons, they each have their own characteristics. Since the observation is possible only once a year, it may need a long time for seeing similarities. Therefore such effects are not easy to prove, but actually they seem to explain spectacular events.

The tide hypothesis is much more easy to handle. Moon revolution is only one month, and oscillations of the tide amplitude do occur with half that period. Moreover

effects are more characteristic, at least in the cold season. It is easily noticeable that clear nights at full moon in automn do often end with deadfrozen flowers, and, with little more attention, that new moon (less visible) does the same. Afterwards, quite often, a warming comes with rain. This too is only once a year or so, but it is spectacular. Similarly, during a not too cold winter, the majority of isolated frosty mornings do coincide with either new or full moon (within 2 or 3 days) in a short period with east wind and clear cold weather. And afterwards dappled sky, then (strong) rain comes, then a rainy period with the dominant wind from west. This oscillation of weather is really a major effect near Paris. and needs to be well understood because it does interact with the other phenomena. In some cases, wind comes from south or from north, sometimes after cold periods that could correspond to more southern evaporation, but maybe to anything else. The typical feature does evolve accross France, for example moving from west to east near Paris, but the general scheme is much more complicated. This is a reason why simple non-local statistics do not give easy evidences, but the local variability is another one. As concerns gardening, traditions and recent research [9,30] do take into account the heigth of the moon, and many more details of the solar system state. This has not been studied here, neither did the tides amplitudes.

As concerns the comet hypothesis, the double recent occurrence may be the best objective proof for it; but it also relies on historical data and on similarities between El Niño events and effects traditionally attached to comets, illustrated by the last occurrence, and on an intuition of possible trends in the observations performed. The underlying physical phenomena could be recondensation on dust and/or gravitational perturbation of dust trajectories.

6. Interpretation of weather evolution

These two kind of predominant effects have a different period, and this yields a wide variety of situations. The result of this proposed coupling seems to fit reasonably well the chaotic aspect of the evolution of the weather in many cases. Some satisfying fuzzy predictions have been obtained, earlier or better than broadcasted ones (but this is no proof!), especially on critical days. For the moment it is clear that the respective importance of the different components is the most important question in order to obtain reliable predictions, whatever the real causes. As concerns interpretation, high resolution in time is necessary, in order to see typical variations whenever they happen, even if they are negligeable as concern their effect on mean values, and do not occur at the precise dates of the proverbs. Up to now, very simple hypotheses have been sufficient for progresses in the exploration of this renewed subject, following the ideal process of theory evolving in cooperation with observations, with the help of existing material. As an example, the idea of oceanic tide effects supposed almost no differences between new moon and full moon, and that was not obvious from the quoted proverbs. Indeed, similar effects have been systematically observed for both, and a proverb concerning new moon does exist in different places in France[31]. Much more work is needed in order to obtain a more global point of view, including a global description of clouds, and probably complementary hypotheses will be necessary.

7. Typical results

An object of the present article is a description according to a new theoretical point of view, in order to initiate new data analysis and observations. Some examples will be given here, from uncomplete daily notes written down according to noticeable

features observed at any relevant time in the day, but often limited by the author's disponibility to observation. These observed details are intended to show how real but delicate is the intuitive analysis performed, based on non-numerical intelligence (excepted for dates) and on a selection of similarities. They should also suggest how to copy it and transpose it to numerical data acquisition and analysis, maybe from existing databanks describing the same events. It is clear that pure effects are not the most frequent but that they do exist, and that sensitive situations have been detected.

The most demonstrative effects concern the structures around new moon or full moon and are most visible during the cold season; they are tentatively explained as follows: assuming that wider tide amplitudes causes a stronger evaporation on the western shores, winds bring air masses for compensation, from a direction that is different from that of the dominant wind (from west); these winds are often cold or cool because they come from colder places (in the cold season), but in summer they may just become colder by drying places which were wet before, before getting hot. When this effect stops, wet air from the west coast brings rain. The adequation of the model to such different circumstances is noticeable, and a number of specific structures have been observed in a close vicinity of these dates (e.g. february- march 1997, 3 occurences in succession); systematic displacement - a few days- often takes place for several occurences in succession (e.g. around march 1999, 3 " early " occurences in succession, neighbouring 3 occurences " on time "). This year 1999, the first, and isolated, occurence of frost on grass was seen on november the 7th, one day before new moon, but clear weather came earlier. In the preceding month two structures with clear weather were observed as " early occurences" Frequent similar successions and coincidences cannot be considered as fortuitous, but their definition is often somehow fuzzy. Some atypical structures have been identified as coincidences with perturbations associated to meteorshower, with their own typical skies; enhancement may then occur, as for example in december 1997, with two snowy events, one after full moon, next after next new moon (unexpected by official forecast).

The different seasons show different aspects, and it is important to notice that observed features correspond to a balance between competing effects, and are most obvious in sensitive situations (e.g. temperatures near 0C with frost in exposed places only).

As concern the vicinity of meteor showers dates, it seems clear that specific forms of clouds are observed (white veils or feathers, or diffuse low round isolated clouds), in addition to a frequent thundery trend, and often to strong rain later, and sometimes, later on, nice very clear cool weather. These dates and effects have been found to concern many more unusual proverbs than initially expected (see annex A). In the dates of proverbs given in [32], typical accumulations of perturbation descriptions do occur in correspondance with the main meteor showers. A striking example takes place at the begining of january, with an intense meteorshower around the 4th: a proverb says that on the 12th and 13th of january, rivers get frozen. This does not often correspond to a reality near Paris, nowadays, but especially cold days at these dates have been observed as recently as 1998 and 1999. Is it a transposed effect of the same kind that gave an icy catastroph in january1993 in Canada, or the same type of weather in France in 1979? Most probably coincidences with moon phases should be considered there, as in the analysis of Arakawa's data, where moonphases appear as much more strictly selected on the 5th than on the 12th. These

spectacular events need further study in this respect. In [32], a proverb associates seeing many stars on the 6th of january with a dry summer to come. It may concerns just the number and intensity of shooting stars, but also circonstances such as clear weather or moon phase. Such predicting proverbs need further study.

The last occurrence of the " Red Moon " (1999), between 17th of april and 15th of may, during the Meudon International Workshop (Dark Matter in the Solar System), was reasonably typical as concerns " unpredictable " evolution, but no frost occured: the periods around new and full moons were almost dry, while wet weather did occur in the meanwhile. As concerns the expected " Ices Saints ", the 4th of may was unexpectedly grey, as was the 12th, both one day late, and thundery clouds were often present on other typical dates. An isolated atypical grey rainy day, with east wind, preceeded by veiled sky, occured on the 17th of may, 2 days after new moon, and, on the same day, dramatic hailstorms destroyed vineyards in the south of France; it might sign another cause of rain in the vicinity of new or full moon, found in other atypical cases. On 24th and 25th- the last Ices Saint-, abnormal grey weather occured and ended abruptly.

Recent spectacular events in november 1998 and 1999 associated with the Taurid and Leonid meteorshowers should be commented here: observers of the predicted spectacular meteorshower certainly noticed the very cold period around the maximum, probably ignoring the french proverbs [32] for the 15th and 19th of november:" On St Leopold, cover your shoulders " , " On St Elisabeth all that wears fur is not beast ". Typical " abnormal " weather and clouds were observed in 1999 between these days, with snowflakes neighbouring clear weather. As concern the severe floods in the south of France in 1999, they occured very close to the St Martin anomaly (associated to Taurids), a few days after new moon, whereas near Paris a typical grey cold rainy day occured on the 11th, between nice clear days. Another french proverb is reported as: " St Elisabeth tells what a fellow winter will be ", another proverbial example of details providing information on general circumstances.

The problem with proverbs is that they are local: if their native place is not known it is less safe to identify relevant observations, or to interprete discrepancies, although the exactitude may be spectacular. In atomic spectra analysis, this kind of selections of possible coincidences are considered, at least, as hints for a solution, and then the next question concerns further coincidences, and possible enhancing effects, and their causes. Since weather observation is available anywhere, all readers are encouraged to try selecting typical structures in their own local climate, and see wether a similar explanation could hold.

8. Discussion in relation with other works and references

Some of the fixed dates studied in the present work are coherent with independant previous work by Bowen[1-6], in the fifties, continued by Kviz[7] up to the eighties. Performing data selection and reduction, these authors have extracted dates that are common to sets of data from different places, and some of these coincide with some proverbial dates. Such similarities between these independant approaches are in favour, at least, of the reality of dates reported by proverbs. Their

analysis deals with very wide data sets, from stations all over the world, and over very long periods, e.g. for more than three centuries for the dates of first snow cover in Tokyo. But their comparison with dates of meteorshowers yields a delay of one month, while delays of a few days have been found here, independantly.

The discussion is not straightforwards because information is still missing as concerns the exact physical phenomena involved, and therefore numerical analysis lacks of adequacy. The main new idea here in is the interaction between meteor and moon effects, which replaces the arguments of dust periodicity discussed by Bowen[2,3,5,6] and Kviz[7]. Actually, the solilunar periodicity of events has been discussed by Adderley and Bowen [11], in relation with the work of Bradley et al.[10], but not as mimicking a dust periodicity, which is the present conclusion. On the other hand, Kviz [7] does consider that meteors act as a trigger in favourable conditions, but does not consider moon effects. These questions are discussed as follows.

The month delay corresponds to wide numbers of coincidences, with small discrepancies on a common delay, whereas here a slightly larger variability is accepted according to the different fixed dates considered, supported by the variety of the dustfalls characteristics and by the restriction to events that are most noticeable, but may be other than rain or snow falls. As reported above, and in Annex A, a noticeable date in their work, the 11th of january, initially unknown in the present approach, was independantly searched for because of a major meteorshower a few days earlier: actually, the corresponding proverb (12th and 13th as very cold days) is not commonly reported but does exist in [32], and agrees with some observations. This, too, appears as in favour of a delay of a few days. As concerns precipitations of september, " on time " this year (1999) according to their statistics and noticeable, a proverb does exist in [32]; they could be associated as well with the Perseids of august, as with the september 9th Sculptoridis minor meteor shower, both quoted in [5].

Fortuitous coincidences are often observed in atomic spectra, and make misinterpretation possible and often reported, but here both approaches seem reasonable, maybe both effects do cooperate? Are there enhancing effects, so as to allow both numerical interpretation? The principle of parallel evolution of dust clouds and precipitations over years, for periodic dust clouds, in two different cases [3,5] is reasonable, but some details do not seem consistant, as concern the synchonism between years of major dustfalls and snow falls. Moreover, the description of the Bielids and of the Perseids should be confirmed by more recent observations and compilations. But such a synchronisation could have another meaning than the effect of the dust falling during one month in the atmosphere from the passing-by comet residue, namely an enhancement of the effect of the next dust cloud, e.g. of the Ursids on december 22th. This would provide another example of interaction between comet and dust. Actually, in the data in [2], during the years where the Bielids were visible (before 1899) there seems to be an anihilation of haviest falls in the month at the end of december, i.e. a month later, on the years of maximal dustshower, meaning that strong rain occured earlier in the month, maybe a few days after the meteorshower? This is not discussed in [2]. Whole sets of data seem necessary for a better understanding. The problem is complex because previous events do interfere - the first snow cover occurs when there is a good reason for it, but only if it did not occur earlier in the year for any other reason.

Actually, a 6 years pseudo-periodicity concerning the rainfalls at the end of december proposed in [2], is not obvious, and serious differences are visible

comparing different locations. Moreover, later work propose further interpretation including moonphases.

A recent attempt for including moonphases in the interpretation of a few data from Bowen's work has given results that seem significant, just before reading the relevant 1962 references [10-11] where similar, but extensive, calculations are described. Effects have been reported by Adderley and Bowen in [11] as depending on the location, and as mixed in global studies. On the contrary, Arakawa's data [12] concern purely local observations, 189 dates of first snow cover in Tokyo from the 17th century to 1950; it is noticeable that the moonphase distribution obtained for these data looks similar as concerns the first half and the last half of the recordings, with some phases where events never occur. Further detailed study is needed for interpreting the moonphase distributions obtained on the different calendar dates. The example of the 5th of january probably means that snow fall ocurs on such a date of metorshower only for favourable moonphases, while a wider distribution is observed on proverbial dates, less sensitive to moonphase because more constrained by meteorshowers.

Another general remark concerns the concentration of the effects on precise dates, which is visible as well on numerical data, as on current examples of proverbial situations: it does not seem credible after such a long delay, if Bowen's justification by the miscroscopic dimensions of dust grains is accepted. Should moon-phase effects involving a replication one month later be considered? Could it come from trajectories changes due to the moon (a trapping?).

These comparison with previous work again supports the idea that really cooperating effects of both kinds need further study, and that an extension of detailed observation and interpretation is needed for other places in the world.

Computerized simulations, which were not available at the date of the earlier works, should be of great help in this problem.

The tiny comets reported by L.Frank et al. in [27] and later, but still in discussion [28], could be a confirmation of the importance and modalities of accretion on earth. It could be also information on the possible importance of cosmic water in the phenomena presented here. Then variations of their observed density as a function of the date might help distinguish real effects from artifact, if accessible.

10. Brainstorming concerning methodology

This examplary study does not rely only on the proverbs and on the observations of the author. Actually it contains essentially many mediatised ideas concerning meteorology and astrophysics, coexisting with empirical traditions. Trying to understand why such ideas do not fit in existing scientific projects has been an occasion for a reflexion on methodological aspects.

It seems clear that meteorology had a phase of expansion based on semi-empirical analysis concentrating on hydrodynamics and parametric calculations. Actually, entities such as anticyclones or ocean streams are useful even without the notion of a physical elementary cause, and the accepted image of the " butterfly effect ", describing complexity as chaotic, eliminates the need for understanding details.

But, actually, a recent trend of detailed local interpretation is being developed, in particular for dealing with pollution problems, and the methodological analogies obtained from spectra analysis seem relevant for it. How the appreciated

spectroscopic data are created could deserves now wider mediatisation and teaching, replacing or supporting the previous approach, by classification, of complex systems in nature sciences such as botany or zoology. Maybe a renewed interest in training such skills could revalorize spectra analysis among physicists, but also help reintegrate traditional knowlewdges from outside fields? The meaning of the present work is illustrated by a more realistic and reverse acception of the " butterfly effect " as " observing butterflies ": the extensive observation of details such as the motion of a butterfly's wings does provide information on more global effects, e.g. the system of winds and their causes (it goes further than a recent paper which already shows that butterflies observation is consistant with climate information[33]). In other words, two different aspects are to be considered: theories that diverge are limited in their use by the influence of unaccounted minor effects, a manifestation of the non-independance of far-apart scales, but also, global characteristics can be evidenced by empirical studies including smaller scales. It is efficient not to ignore tiny effects in complex systems. Extensive observation is needed for that, but it might concentrate on spectacular details.

Actually, another aspect is the importance of striking features; human intelligence has a real ability for selecting them and interpreting spectacular coincidences in order to obtain some hypotheses. In order to have it copied by artificial intelligence, that should be used and investigated more thoroughly. The present report indeed deals with a typical example.

11. Brainstorming concerning physics, astrophysics and meteorology: the roles of accretion.

The initial report of the preliminary interpretation of coincidences with meteors, given as annex A, was rejected when presented for publication, and, among the arguments was the idea that uniform cosmic effects all around the earth should not be related to proverbs, which are essentially local. This argument should be discarded by comparison with solar radiation effects, but it guided a further attempt to justify the interest of the results obtained, because, on the opposite, the distribution of particles is not so obvious. Some questions concerning global effects and characteristics of accretion are not currently seen in that perspective, even when they already have got some answers. This new point of view on some old problems suggests some ideas, that need reflexion or more sophisticated observations:

- what kind of charged or uncharged particles are created in the phenomenon of accretion on earth, for the different sizes of dust grains?
- are some thunderstorms due to the fall on earth of cosmic matter from the solar system, with fire balls corresponding to a matter in extremely rapid rotation, maybe with calefaction? This year 1999 has been often thundery, especially around dates of major accretion. How are distributed, in different regions or at different times, different types of fall, of neutral matter, and of positive or negative charges?
- are some winds linked to magnetic forces on charged particles (perpendicular to the velocity)? some typical clouds simulating traces of dust in water and curved trajectories do occur before thunderstorms. How do magnetic forces cumulates with the so-called Coriolis forces?
- has accretion any role in the formation of cyclones?
- how does accretion contribute to the earth magnetism and to its variations?
- is there something like a periodic shielding effect of the moon? or something like the " shepherding effect " observed around other satellites?
- is accretion in the atmosphere involved in the correlated rotation of earth and

moon?
- is the Toungourska event the real source for the 1910 floods (rather than Halley's comet as questionned in annex A)? is it related to Halley's comet? are some unusual comets in relation with special configurations of planets or with the occurrence of major comets?
- do comets correspond to El Nino? they have so many reported identical characteristics, but which comets then? does one of the closest comets, C/IRAS-Arki-Alcock on the 11th of may 1983, correspond to the noticeable 1982-83 event (or was it too late for that)?
- do some comets correspond to typical configurations of the solar system where accretion is enhanced?
- are El Nino atmospheric pressure effects due to incoming impulsion?
- could earthquakes and volcanic eruptions be related to corresponding pressure effects, or to cosmic rays interacting with internal matter, or to both?
- what about some water coming with that cosmic matter? increasing when comets did pass by? are there other measurements possibilities than L.Frank's [27,28]? what about an analogy with other planets or with the moon?
- could the ozone concentration depend on such phenomena ?
- if accretion effects do need more attention, could sunspots correspond to accretion ? incoming matter is cold as are sunspots, and may be icy(water detected), while the sun is a target for matter in gravitational motion[34].
- is the 11 year period of the sunspots in relation with that of Jupiter, with gravitation forces influencing comets and dust motion with a slightly different period corresponding to a pseudoresonance.
- are " Zetta-machines ", these extremely high energy cosmic rays neighbouring 1021 eV, detected by cascades of particles called " extensive air showers ", linked with incoming matter from the solar system? this hypothesis agrees with the idea of a nearby source, and the date of the first event, 22th of April, 1962, does coincide with that of the maximum of the April Lyrids, while the Akeno event on the 3th of december 1993 is one day later than the Bielid II meteor stream, quoted by Bowen[2,3] but ignored by Bendjoya [34]. This needs further details . A third major event, on the 15th of october 1991, is just at the beginning of the Orionides (16-26 october). " These events, while only two, must be taken seriously ", these words written initially for the first particles themselves [35], should hold for the date coincidences. Could it be that effects of that type might differentiate from a background only for such high energies? For a relative velocity around 30km/s, the energy of 1 ZeV (1021 eV) corresponds to a mass of the order of half a milligram, and therefore a diameter just below one mm for a dust particle, at the higher limit of dimension of currently collected micrometeorites. How do behave such objects? Will the Auger project facilities become a meteorological device?
- what is the importance of nucleosynthetis on earth, due to collisions or to subsequent effects of accretion?
- is accretion involved in the empirical relation between isotopic ratios and temperature, in the sense that it would both influence the ratios, and create meteorological effects that change temperature?
- is that model of interaction in the terrestrial atmosphere a demonstrative case for others planets or stars, or the conversely?

Some of these proposals may be excessive brainstorming, but the essential is showing that the scope is wide for a new cooperation between meteorology and astrophysics... This shameless display of naïve unusual questions is encouraged by the

existence of numerous enigms that need new points of view and new hypotheses, and by the experience that these subjects need reflexion and a better communication between distant specialities.

12. Discussion in relation with spectroscopy

Now comes the necessity of discussing the whole content of the present article and the validity of its demonstration, in comparison with published work in spectroscopy.

It might seem strange to claim similarity with spectroscopic work while presenting an article exempt of any numerical data, with results limited to descriptions, except for a few dates and delays, and while quoted author's publications are obviously full of numerical results.

Some differences are essential: by now, the study of the very complex meteorological system, with respect to phenomena studied here, needs exploration and definition of pertinent numerical data. It cannot rely on previous studies as does nowaday's procedures of spectra classification. Numbers that could be used here would measure delays between dates that characterize astronomical features and meteorological ones. This is much simpler than line wavenumbers and level energies, but values are comparable to uncertainties, therefore of limited interest, and these date coincidences are not as important as structure characteristics, i.e. typical dated coincidences of aspects and time evolution, that are not yet numerized.

In order to find similarities, looking backwards to the past of spectra classification is a possibility, but still now strong analogies do exist. In both cases, there is no point in doing plain statistics when looking for an effect, because selection of relevant data is essential for finding any classification or hypotheses. Typical meteorological events that have been selected here should be compared to simpler spectra, which were first understood and interpreted so as to introduce elements of the present state of complex spectra theory. Considering that meteorological events usually do correspond to a mixing of effects with different causes, the present preliminary attempt simply tries to understand basic features thanks to almost pure events. As concern coincidences, they are founded on varied and adaptative non numerical observations inadequate for numerical treatment. Such studies are commonly performed in spectroscopy, but, most often, are not considered as deserving a presentation: the analysis of pure hyperfine structures or Zeeman effects, as well as combined structures [36] is theoretically wellknown; experimental results with insufficient resolution are interpreted by reference to these theoretical descriptions and yield a visual classification of line aspect, with the help of relative intensities and components disposition that still remain visible.

In reference [19] are given details concerning the classification of 4 strong hitherto unclassified lines, with intensities around one forth of the maximum recorded, and ranging between 22th and 36th in decreasing intensity order, in the spectrum of singly ionized praseodymium, where thousands of lines have been studied (172 most intense classified lines presented in [10], implemented by 716 others in[20]). The reason why classification was not found earlier is that the missing levels have typically unfavourable transitions with unresolved records of hyperfine structure which makes coincidences uncertain, due to unaccurate wavenumbers that needed visual reestimation from recorded charts, and by lack of sufficient information from the hyperfine structure and Zeeman effect. The classification relies on the idea

that such strong lines are transitions to very low odd levels, and on a search for solutions consistant with relevant data available, except for some fortuitous coincidences. In the same way, the hypotheses given here for the analysis of meteorological evolution, have been systematically confronted with observations, and seems reasonably consistant although many question marks still exist. Here, information needed is not theoretically well-defined, because phenomena are still under exploration, and what is presented to discussion is a set of selected cases where typical structures appear but are not yet clearly characterized by numerical data. For that reason, extensive numerical interpretation is premature.

An aspect of data selection has been worked out in the case of Pr and Pa hyperfine structure spectra, and up to now only briefly presented, in particular at the ASOSALP meeting in Meudon in 1995 [21]. It concerns the efficiency of weighted least square fits of hyperfine structure wavenumbers as a form of easy data selection. Although this example is numerical, its general principle is essential in the present study, in the following way: data that best obey a relation under study are selected; if the selection is reasonably consistant with the assumed law, its interpretation provides at the same time characteristics of the phenomena involved, an estimation of the accuracy of the data or of the relations under study, and a determination of cases where larger deviations are found. Interpreting these deviations is the next step, which provides jointly further knowledge and a verification of the process.

Although a first attempt of numerical studies of meteorological data seem promising, an author's priority is in publishing spectroscopic examples in Pr and Pa spectra, because they show numerically the efficiency of selected data analysis, on a straightforward subject. The extension of the present type of analysis to other fields, in relation with health and with evaluation of therapeutics is another important project for close future. Indeed, for very complex systems, a numerical study needs extended preliminary understanding of the nature of the phenomena involved.

13. Conclusion

An exploratory study of local weather near Orsay has been performed, trying to understand the meaning of older descriptions, with unsophisticated equipment, but guided by simple physical hypotheses and mediatized information. It is supported by strong analogies with a non-statistical methodology adapted to complex systems that does underlies spectroscopic analysis, stressing on the importance of detailed analysis of structures and coincidences together with a global approach. Several general aspects and results emerge:

- some typical effects do occur with a time dependance that involves earth and moon periods, in relation with annual cosmic dustfalls, and suggest, in addition, an influence of comets passing by, in natural continuity with meteoritic influences on climate. This study reactivates the interest for Bowen's work and hypotheses, on the relation between major precipitations, meteor showers, and moonphases.
- moon-phase dependant effects have been evidenced on selected events. They combine most often with the meteor shower effects.
- the classical image of meteorological chaos is transformed into the idea of detailed interpretation: details of the chaoslike disorder should be interpreted in terms of interactions which were unaccounted for, up to now.
- this renewed approach needs being widely tested in a reinterpretation of past events, but also suggests new types of observation, adapted to the pending questions. It might induce a revolution in meteorological forecasting projects as well as in an

interdependance of meteorological and astrophysical survey. Simulations are needed for comparison.

- proverbs do contain, indeed, relevant information, that need interpretation for a limited recovery of earlier data still available; they should be preserved and collected before disparition; they could guide scientific observation and interpretation of meteorological events.

- the present study shows the validity of the widely distributed intelligence of people who maintained these knowledges - a general result of philosophical interest- .

- artificial intelligence is concerned by that kind of organisation of information: some persons are able to store in their memory wide amounts of data and of pending questions, and do obtain correct results inaccessible to current scientific analysis.

- the interpretation of moon-phase dependant meteorological effects is essential because it provides a scientific link with other fields or cultures where moon-phase is considered as relevant. Then wider pluridisciplinary observations become possible.

The whole problem is complex, as is the studied system, which now comprises not only the atmosphere, but the solar system and its dust. The only certainties are that unsophisticated statistics are not adapted to it and that underlying physics need further studies. New routes are proposed for solving old enigms, although experimental laboratory work on the basic phenomena seems out of reach. It is great satisfaction that basic research in atomic physics, using and improving available computerized methods with essentially no practical aim ahead, does contribute to the solution of problems in other fields and provide a representative model of noticeable simplicity.

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Annexe A:
GEOPHYSIQUE EXTERNE / EXTERNAL GEOPHYSICS,
CLIMAT ET ENVIRONNEMENT / CLIMATE AND ENVIRONMENT
PLANETES / PLANETS

MAUVAIS TEMPS PROVERBIAL A DATES FIXES: CORRELATIONS AVEC DES EVENEMENTS ASTRONOMIQUES (METEORES, COMETE), A DES ECHELLES DE L'ORDRE DU JOUR OU DE L'ANNEE

METEORES ET METEOROLOGIE

PROVERBIAL PERTURBATIONS OF WEATHER AT FIXED DATES: DAY- AND YEAR-SCALED CORRELATIONS WITH ASTRONOMICAL EVENTS (METEORS, COMET)

METEORS AND METEOROLOGY

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Résumé: L'observation courante du temps qu'il fait, comparée à la description donnée

par certains dictons français, prend un sens lorsque l'on remarque la corrélation entre les dates traditionnelles de perturbations et les dates principales d'observation des météores. Des effets sur la haute atmosphère semblent devoir être mis en cause, de même qu'au passage de la comète de Halley. Une étude pluridisciplinaire de ces effets est proposée, afin d'obtenir la confirmation d'une hypothèse obtenue à peu de frais, dont la validité aurait des conséquences importantes.
Mots-clés: perturbations météorologiques, nébulosité, météores, comètes, rayons cosmiques, haute atmosphère, ethno-histoire météorologique.

Abstract: unsophisticated weather observation, compared to a description given by some french sayings, get sense when a correlation is pointed out, between traditional dates of perturbations and dates of the main meteors showers. Effects on high atmosphere should be involved, as well as for Halley's comet coming. A pluridisciplinary study of these effects is proposed, so as to obtain a confirmation of a costless hypothesis, which, if valid, would have important consequences.
Key-words: meteorological perturbations, nebulosity, meteors, comets, cosmic rays, high athmosphere, ethno-history of meteorology.

Version abrègée en français

Introduction: L'observation courante du temps, par des générations successives, a fourni des renseignements mis sous forme de dictons. Une observation simple mais attentive, sur plusieurs décades, nous a semblé en confirmer certains, alors qu'aucune explication logique n'en est donnée. En fait, le traditionnel mauvais temps du 15 août dans les Alpes du Sud intervient quelques jours après une pluie d'étoiles filantes bien connue, qui pourrait donc apparaître comme la cause d'une perturbation à date fixe, en supposant un effet de cet impact sur l'atmosphère. En comparant les dates des principales pluies de météores citées par Ridpath et Brunier, (1982) et celles qui sont concernées par certains dictons, on trouve une corrélation difficilement attribuable au hasard, qui semble confirmer un tel effet. Pourtant, en 1993 encore, Chaboud (1993) décrit ces dictons avec beaucoup de détails, mais sans les considérer comme significatifs de faits physiques. Après quelques années de réflexion et d'observations supplémentaires, il semble que les corrélations trouvées ont bien un sens, et qu'il convient de proposer cette hypothèse à des spécialistes, d'autant plus que l'effet envisagé parait bien compatible avec les effets bien connus de météorites sur les climats anciens, et, très récemment, avec les corrélations observées par Veretenenko et Pudovkin (1995) et par Pudovkin et al.(1995) entre nébulosité et rayons cosmiques.

Les caractéristiques des 10 pluies de météores principales, citées par Ridpath et Brunier (1982), sont confrontées dans le tableau avec des détails concernant les proverbes les plus courants qui semblent leur correspondre et qui nous paraissent décrire effectivement des événements météorologiques. La variabilité du temps selon les lieux et les années, au moment des phénomènes étudiées est un obstacle important leur étude statistique, mais il semble que l'apparition d'une nébulosité d'allure assez caractéristique y est assez constante.

Il est étonnant d'observer que les 5 perturbations à date fixe les plus connues se situent quelques jours après l'optimum d'observation de météores. Bien sûr, le nom des saints n'était qu'un moyen mnémotechnique pour retenir les dates utiles! Ce sont:

- les Saints de glaces St Georges et St Marc, les 23 et 25 avril, juste après le maximum des Lyrides d'avril (b), St Vital, St Eutrope, St Philippe et Ste Croix, les 28 et 30 avril, et les 1er et 3 mai, peut-être effet de la superposition des Lyrides et des Aquarides (b)

et (c)?; St Servais, St Mamert et St Pancrace les 11, 12 et 13 mai, une semaine après le maximum des Aquarides d'Eta (c). La lune rousse, lunaison commençant en avril, est probablement une expression imprécise d'observations où se trouvent mélangées l'influence des météores et celle des phases de la lune par l'intermédiaire des marées océaniques (effet nettement plus important, qui sera décrit dans un prochain article). Les effets de brûlure, observés sur la végétation dans ces moments là, semblent bien expliqués par une augmentation de l'impact des rayons cosmiques.

- la St Médard, qui, associée à la St Barnabé (8 et 11 juin) suit les Lyrides de juin (d). Les effets observes ces jours là sont-ils un test de la tendance générale qui amènera ou non une longue période de pluie?
- le 15 août et les jours suivants, après le maximum des Perséides (f). La pluie y est quasiment assurée dans les Alpes du Sud, mais un autre proverbe signale plutôt une certaine variabilité.
- l'été de la St Martin. Anomalies météorologiques, beau temps, ou mauvais temps, à la date du 11 novembre (temps gris souvent en région parisienne), après le maximum des Taurides (h).

Le 1er novembre (g), et la Ste Catherine (i) sont moins réputés pour ce qui est du temps, mais sont sans doute de la même famille.

Comètes

Le lien qui existe entre météores et comètes impose de se pencher aussi sur l'effet possible des comètes, qui sont réputés être souvent accompagnées de cataclysmes. La comète de Halley, qui revient tous les 76 ans, est bien connue. Son passage peu fréquent permet difficilement l'observation de répétitions par une même personne, mais certains faits méritent d'être étudiés avec attention: des tempêtes "séculaires" ont eu lieu en Ile de France, en 1990, et aussi quelques années avant, tout comme en 1910, année reste longtemps célèbre pour ses inondations. L'évolution des glaciers fait intervenir une période analogue. Il s'agirait ici d'un effet important, apparenté au précèdent, mais avec des temps de réaction nettement plus longs, donc probablement des mécanismes assez différents. L'évolution de la concentration en ozone peut-elle correspondre à des effets de ce genre?

Discussion

L'hypothèse proposée n'est pas le résultat d'une pure fantaisie, mais s'appuie sur une longue expérience dans une activité scientifique - la classification des spectres atomiques complexes - qui présente beaucoup d'analogies avec la météorologie (traitement de données en grand nombre et calculs paramétriques en particulier, voir par exemple Ginibre (1990), et aussi notion de mouvement planétaire). L'habitude de chercher des détails significatifs pour trouver des résultats impossibles à obtenir par une étude systématique d'un trop grand nombre de données numériques, a été mise ici à contribution.

Perspectives

Trouver des coïncidences significatives fait partie du quotidien lorsque l'on s'occupe de classer des spectres complexes, par contre la confirmation des hypothèses proposées demande un travail pluridisciplinaire hors de la compétence de l'auteur, mais qui est bien dans la ligne des efforts actuels d'acquisition de données, par exemple pour les rayons cosmiques (voir Klecker (1995)), ou les données météorologiques. Le présent article est ainsi un appel aux spécialistes, afin qu'ils fournissent des données adaptées au problème; l'interprétation proposée ici devrait permettre de choisir ce qu'il y a de plus caractéristique à mesurer, et les circonstances

les plus favorables aux mesures. La mise en évidence de tels effets devrait permettre une meilleure prévision du temps, au moins au voisinage des évènements considérés, mais surtout une meilleure compréhension de phénomènes de la haute atmosphère.

1. Introduction

The present work roots in decades of unsophisticated observation of weather, and of questionning the reality of sayings still alive in France. While trying to explain the perturbed weather currently observed on the 15th of august, in the southern Alps, a hint was given in an informal conversation mentioning the privileged position of western Europe for the observation of cosmic rays. For sure, well known events do happen in the sky in the vicinity of 15th of august, i.e. shooting stars showers. Looking in a vulgarisation book of astronomy by Ridpath and Brunier (1982), it comes out that a good proportion of the quoted meteor showers correspond to weather perturbations for which sayings have been transmitted. Such a correlation would agree with mediatised discussions about the influence of large meteorites on past climate changes, if an effect on the atmosphere of the impact of particles and dust is assumed, but it seems that nothing similar has come to the public. Moreover, later, Chaboud (1993) quotes some sayings, and even the presence of meteors, but without such a general hypothesis. He discards them because of an unsatisfactory interpretation involving a negligible change in the transmission of sunlight.

After a few years more delay for further observation and reflexion, trying to discuss informally about the subject, we consider definitely the correlations as non fortuitous, and the hypothesis worth asking a confirmation to specialists. Actually, the present article deals with subjects in rapid evolution, as shown by recent studies of correlations between cosmic rays and nebulosity by Veretenenko and Pudovkin (1995), and by Pudovkin et al.(1995) - an encouraging surprise in an attempt for a minimum of specialised bibliography. If the present hypothesis is correct, it is most probable that it would have come out anyhow, just from the work of geophysicists. So, maybe the present paper will only point out that the study of non-understood transmitted traditions can be included in scientific research and give valuable results, saving efforts and cost. Its first aim, anyhow, is presenting the facts to discussion.

2. Weather perturbations: sayings and correlated astronomical data

Correlations that are found between meteor showers or passages of a comet and meteorological events will be presented here. The description of the observed events, instead of involving numerical data usually required for scientific proofs, will try to suggest what is reproducible, and what may correspond to available data.

2.1 Meteor showers

In the table are confronted data concerning the 10 main meteor showers (from Ridpath (1981)) and the corresponding dates concerned by current french sayings (which we do consider as describing correctly atmospheric events, despite a certain variability).

General remarks can be made: - there is almost every times a delay of a few days between a meteor shower maximun and the perturbed days, which seem to occur with a precision of a day.

- unsophisticated observation notes as a relatively constant characteristic a special form of grey nebulosity which does not fit the usual aspects of current perturbations

Following the order in the year, each case will be commented here:

(a) is there any saying around the 10th of january? if not, is the total impact

insufficient despite a high maximum frequency? comments by Ridpath and Brunier (1982) about this shower are: very short optimal period, and also, pale meteors.
(b) In France, the moon beginning in April is called "red moon". This supposed colour has been said to be related to the presence of dust on the light path. During this lunar month, frost or burning of vegetation without frost are traditional, with a maximum at full moon. This burning of tender vegetation without frost seems definitely an argument in favour of the present hypothesis of effects of cosmic rays; the explanation quoted by Ridpath and Brunier (1982) of lower temperatures on vegetation (but without frost?) seems much poorer. The interpretation proposed here is a mixed influence of meteors and of another phenomenon, the effects of oceanic tides on the weather (article in preparation). Is the dust cloud wider, with still some efficiency, or is there simply an imprecise formulation of the occurences of these perturbations, due to the importance of the moon in traditional meteorology?
Most of the "Ices saints" ("les Saints de glaces" in french) are no more on the calendar, but some people (and books) can still tell the old dates. At the end of april, and beginning of may, St Georges and St Marc, 23 and 25th are just after the Lyrides maximum, St Vital, St Eutrope, St Philippe, Ste Croix,(28, 30th of april, 1st, 3rd of may) are about a week later than the Lyrides maximum; maybe the superposition with the beginning of (c) helps the feable impact of (b).
(c) St Servais, St Mamert, St Pancrace, on may the 11, 12, 13th are currently noticed near Paris; These days have been particularly grey and cold this spring, and followed by very strong rain and thunderstorms; again one week delay with the maximum (of Eta Aquarides); the last "Ices saint" is St Urbain (25th of may), are there meteors around the 18th?
(d) Here occurs St Médard and St Barnabé (8, 11th): "if it rains on St Médard, it rains 40 days after, unless St Barnabé cut the herb under his foot"; this refers to a long period of rain which often takes place after that date. Rain on both dates probably tests at its beginning a variable effect concerning the following period. The occurence of a variability of the dust cloud seems, finally, improbable. The last occurence(1996), near Paris, was an interesting exemple, where it seemed clear that the effect was existing - a special nebulosity, and a cool day in the middle a heat period (and a predicted storm delayed?) - but was probably insufficient for changing the trends of the weather.
(e) Are there such sayings in july?
(f) Here is the most significant fact. A french saying says something like: "it rains on 15th of august and the 3 days after" It is easy to observe in southern Alps, where consecutive full days of rain are scarce, but almost certain at that precise date; on 15th of august, the Guides Day keeps the alpinists in the valley, and protect them from bad weather in altitude. Moreover, it may appears as a good day for a cool travel throughout France. Another saying (elsewhere probably) says; "weather of the 13th of august lasts 4 days", pointing out a noticeable effect but with a certain variability.
(g) +(h) " A weather for Allsaintsday " is currently said in France; it means a cold and grey day. Ten days after the maximum of Orionides,
(h) "A weather for a 11th of november" less than one century old saying (>1918), meaning often the same kind of sad weather near Paris. However, this date was, for a much longer period, that of St Martin's summer, where unusual weather was traditional, (fine or bad), as quoted by Chaboud(1993). This apparent contradiction probably should be related to the usual opposition of fine and bad weather throughout France on the same day, depending on the position of the air masses.
(i) A saying for 25th of november: "On St Catherine, any wood roots". It is known

that november is a good season for planting, but are there favourable atmospheric (hygrometric?) conditions on this day? this recent attempt for interpretation seems to agree with recollections of traditional "Défilé des Catherinettes" in Paris, with wet pretty hats under the rain.

(j) Is there a saying about snow a few days before Christmas? When winters used to be colder than now, it was almost regular, near Paris. About one week delay from the maximun of Geminides.

2.2 Comets

Comets have often been said announcing catastrophs.

Halley's comet is one of the most famous. It is noticeable that the year 1910 remained famous for floods. There were also very strong wind-storms (a locomotive in the fields for example), but also boreal aurora in Paris, signing an influence on high atmosphere. In the vicinity of its last coming, unusually strong wind-storms occured, throwing down enormous trees such as beeches and oaks, in particular in the region of Paris in 1990, and a few years before. A few decades ago, a period around 80 years was given for glaciers growth in geographic classes. Are these informations relevant for the study of a possible action from the comets on the high atmosphere? This would mean delays of the order of a few years. Is there a corresponding variation of ozone?

3. Discussion

A scientific justification has to be given, for such an extradisciplinary contribution of an atomic spectroscopist. It is provided by the strong analogy which exists between complex spectra analysis and meteorology - study of wide sets of data and parametric calculations (see for example Ginibre (1990), and also images of planetary motion (of the electrons) and spin.

The theoretical description of physical phenomena involved in the complex puzzle of spectrum analysis is relatively simple; this allows the training of intuition to the detection of correlations worth checking. Actually, although several thousands line wavenumbers are available for one rare earth atom, some of the energy levels are involved in only one or a few lines. In such cases, statistical methods are definitely unadapted, and any clue is good for identifying the transitions. It can be predictions from theoretical models and parametric calculations, or detailed study of line structures observed at high resolution -hyperfine structure due to interaction between electrons and nucleus, or Zeeman effect (splitting in a magnetic field). Another aspect is that, due to the density of the recordings, blends are often perturbing the data and it is often necessary to deal with inexact coincidences, drowned among numerous fortuitous ones. For all these reasons (and many more) we are trained to detect what statistical studies ignore.

It has been easy to find meteorological perturbations for almost all these dates of astronomical events. Several of these should not be considered as proofs, because the reported observations are obviously scientifically unreliable, but this works exactly as when, in spectroscopy, faint and noisy lines come in confirmation of a possible new energy level. They simply mean that a detailed check of the hypothesis may be worth beeing tried.

4. Perspectives

If the reported coincidences do have a meaning, the introduction of the corresponding effects in the representation of the weather should improve previsions around those dates. It is not clear wether these effects on the high atmosphere may be determinant

for the evolution of the weather or if they only create minor disturbances, but even then, the interest of the study is probably wider, because it is a way to the understanding of high atmosphere phenomena.
Although the reality of the studied weather features seems well established to numerous persons, it is essentially based on intuition (non-numerical data stored in human brain) and may looks as a matter of faith. On the contrary, an accurate study of correlations between numerical data should give unquestionnable proofs, but it has to deal with the variability of the circumstances. Data which are needed now belong to fields where special efforts for data acquisition are made presently (in particular, detection of cosmic rays, see for example Klecker (1995), and metorological observations). It is not clear wether a statistical check of the present hypothesis will be easy or not. It probably needs selected input, corresponding to the exact phenomena to be detected, because fluctuations due to other effects may blur out such a reality. In particular it might happen that the most favourable localisations would not coincide with existing measurement sites, or that the usual data would not be the most relevant. As an example, it may be necessary to take care of the direction in the sky (quoted by Ridpath and Brunier(1982)) where meteors come from, and to begin with the most visible case, 15th of august in southern Alps, so as to test the procedure.
An ambition of the present paper is asking specialists to provide data, with a sufficient time- and space-resolution, in several disciplins concerned by the subject, and to compare them so as to obtain unquestionable conclusions.
a) ethno-history of meteorology: first, are there, in fact, many more sayings so that there is one correlating with any date, meteors or not? but the answer should not be yes. Then, what is the localisation of the sayings, and their variations. This may be the most urgent question because people by which the sayings stay alive may disappear soon.
b) cosmic rays: what is known about the cosmic rays associated with meteors and comets (composition, energies, time evolution, localisation...)
c) high atmosphere: are there systematic data available about nebulosity (time and space distribution, spectroscopy?)
d) comets and dust clouds: what is known about time and space evolution, analysis...

5. Conclusion

The correlations which have been found between traditional weather perturbations and meteor showers (and Halley's comet) seem significant after a few years of unsophisticated study, with spectroscopist.'s trained intuition. These correlations are assumed to correspond to effects of cosmic rays on the high atmosphere, and this hypothesis needs pluridisciplinar work for confirmation, which is not of the scientific competence of the author. However, suggestions are made concerning a restriction of the observations to specific conditions of dates and localisations. In that direction, there is a precise aim for future measurements, or a valorisation of available data, because detecting and understanding an effect of such impacts on the high atmosphere should have important consequences.

6. Aknowlegements

Vulgarisation articles published in "La Recherche", concerning geophysics, have been the author's main source for keeping up with the scientific evolution in that field.

7. References

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Name	coordinates of the radiance point	optimal period date	maximum of visibility	index frequency per hour
Quadrantides (a)	15h28m +50 deg.	jan. 4th	jan.1-6 th	100
April Lyrides (b)	18h08m +32 deg.	april 22th	apr. 19-24th	12
Eta Aquarides (c)	22h24m +00 deg.	may 5th	may 1-8th	20
June Lyrides (d)	18h32m +35 deg.	june 16th	june 10-21th	8
Delta Aquarides (e)	22h36m 00 deg. and -17 deg.	july 28th	july 15th- aug. 15th	35
Perseides (f)	03h04m +58 deg.	aug.13th	july 25th- aug. 18th	68
Orionides (g)	06h24 +15 deg.	oct. 21th	oct. 16-26th	30
Taurides	03h44m	nov. 8th	oct. 20th -	12

(h)	+14 deg. and +22 deg.		nov. 30th	
Leonides	10h08	nov. 18th	nov.	10
(i)	+22 deg.		15-19th	
from Gemini	07h28m	dec.	dec.	60
(j)	+32 deg.	14-15th	7-15th	

Remarks	saying	dates
many pale meteors	?	
Brilliant meteors	"Red moon" beginning in april and "Ices saints" apr. 23, 25, 28, 30th and may 1st, 3, 6th	
meteors with persistant traces	"Red moon" and "Ices Saints"	may 1st, 3, 9, 11, 12, 13 ,25th
bluish meteors	St Médard St Barnabé	june 8, 11th
double radiance	?	
brilliant and incandescent meteors with traces	aug. 15th	aug.15-18th
meteors with traces	nov. 1st	nov. 1st

double radiance light coulour	nov. 1, 11th St Martin	nov. 1, 11th
Irregular and rather uncertain	Ste Catherine?	nov. 25th
numerous and brilliant	(snow for Chrismas)?	dec. 22th

Table I:
Correspondance between principal meteor showers (data taken from Ridpath (1981)), and some french usual sayings.
Correspondance entre les principales pluies de météores (d'après Ridpath et Brunier (1982)), et des dictons français courants.

Annexe B:
MOON - ATMOSPHERE COUPLING INVOLVING OCEANIC TIDES.

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Unsophisticated weather observation, guided by a description transmitted as popular wisdom, concerning the influence of the moon phases, gets sense when the magnitude of oceanic tides is assumed to influence winds, temperatures and pluviosity. Characteristic structures in the time-evolution, correlated with moon phases, have been observed repeatedly around Orsay. But statistics performed on mean values of data such as temperature or pluviosity could hardly detect them, because of a variability corresponding to the interaction with other atmospheric phenomena. Our simple physical model of evaporation on the shores increasing with tide amplitude invites to interprete exceptions and discrepancies.

Moon phases were demonstrated by Newton as explaining tides long ago, but their effects on weather still appear as a matter of faith lacking satisfying positive scientific study. Chaboud (1), describing the present state of meteorology, quotes sayings widely, but discards an influence of the moon because a statistical study was unsuccessful, and because the gravitational interaction on air masses is small.
But a few years ago, after decades of unsophisticated observation of weather, questionning the reality of current meteorological sayings, we observed a correlation between traditionally perturbed weather at fixed dates and meteor showers (article

submitted for publication). That upraised our confidence in a physical explanation for sayings, and then we found that the simple question "where does the rain water come from?" has, most often, near Paris, a simple answer "from the ocean". This suggests a coupling involving oceanic tides, with, as a limit case, the well-known equinox tempests.

Initially, we had noticed that the sayings "frost at full moon", or " if weather is fine at full moon, it rains three days later" were obeyed more often than fortuitously, at our site. Our first idea was that increased evaporation on the shores, due to tides of larger magnitude, favoured by sunny weather, was responsible for a cooling, then for rain, but there were problems about transmission of the cooling and no differences between full moon and new moon. Anyway, it was a basis for a more detailed observation around these characteristic dates.

Actually, the present contribution is that of an atomic spectroscopist, almost ignorant of the details of sophisticated observational data and of geophysical theories, but conscious of the similarities that exists between complex spectra analysis and meteorology (both deal with large sets of numerical data, parametric representation, and also, planetary motion). Indeed, after 20 years studying hyperfine structures in rare earth spectra and tackling significant details for line classification (2), it was natural to study the observed typical scenario (a structure in the time-evolution) as an evidence of a moon-atmosphere coupling, in analogy with the discovery of nuclear spin and of the interaction between nucleus and electrons from the observation and interpretation of typical line structures (hyperfine structure).

We observed that, in addition to temperature and rain, the wind direction is indeed a typical feature: around Orsay, where the dominant wind comes from west, often, at about both new or full moon (larger tides), wind changes and comes from east, bringing clear cold weather except in summer. Is the east wind responsible for cold weather more than cooling by evaporation? Does that depend on the season? Anyhow, this observation agrees with our hypothesis, if evaporation on the western coasts is assumed to yield an ascension of wet air masses which have to be replaced from neighbouring regions. Assuming that these cold winds lower the evaporation, while tide amplitude is decreasing, a rapid come back of west winds bringing evaporated water is explained.

Actually, traditions distinguish full moon from new moon, while the simple tide-model does not; other informations, such as the heigth of the moon and its variations, of slightly different period, are also traditionally important in moon influence. Focusing essentially on the simple aspect of moon phases, we have progressively improved our description of the weather around Orsay, trying to interprete the variability observed, in relation with our model.

For any reason - was it because maximum heigth in the sky and full moon were almost coincident?- the last cold season (1995-96) was particularly demonstrative, and almost all freezing periods near Paris did occur very close to new or full moon, then, a few days later, strong rain came most often. We observed many events time-correlated with moon phases with an accuracy of the order of three days (with larger shifts, the interpretation would become dubious). Such shifts are small compared with the periodicity, but seriously affect statistics because any quantities such as temperature or pluviosity show rapid and wide variations at these dates, e.g.: on a clear day swept by east wind, there are wide variations of temperature between hot sunshine and cold shadow or night. We believe these shift are related to the variability of the atmosphere state, be it worldwide or local, and to phenomena controling evaporation. They probably give an opportunity for observing the effects of

coincidence of periodic phenomena with different periods, day, moon revolution and nutation periods, year, solar cycle, maybe comet periods...
According to our model, the absence of rain after full moon in june 1996 was no wonder: in the middle of a hot period, east wind, no more cold, does not stop the evaporation, which remains determinant whatever the tide amplitude. The scheme we observed during the cold season does not fit for summer, nor, anytime, in the southern part of France, where weather is often opposite to that of Paris. This invites for a more general wiew of the problem, which seems out of our own possibilities!
At our site, in winter, east wind, frost, then strong rain form a typical structure of rather unusual conditions, and, thus, are noticeable. In a general sense, whatever the season, meaningful phenomena should be observable if the influence of the tides happens to be sufficient for inducing phenomena in contradiction with the general trends of the local climate.
We have not been able to observe nor interprete a traditional difference between new moon and full moon, but, maybe, the question "where does rain water come from?" should have a second answer, valid in many places, that is: "from vegetation", leading to the following question: is the influence of moonlight on vegetation perspiration visible on worldscale?
In conclusion, our simple model already includes centuries of observations in favour of moon influence. It also invites to observe the variability, in particular according to regions and seasons, and to study its possible causes. Insisting on the difficulties of statistics in such cases, and on the efficiency of detailed analysis of structures and of selected data, we do hope that the present contribution will encourage pluridisciplinary work on related subjects.

References

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