

# **Cosmic Ray/Solar Activity & Current Problems of Global Change**

## **Ozone and greenhouse scare: the evidence the sky isn't falling**

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First cause of long- and short-term variations in ozone layer as well as in the whole climatic system of the planet are the processes which occur in equatorial zone forced and stimulated by CR/solar activity and by inner layers and nucleus of the Earth [1,2,3]; a gravity tide and other tides in space where rotating masses are available play fundamental role in any star "activity" [3] (to be discussed in preprint of this paper).

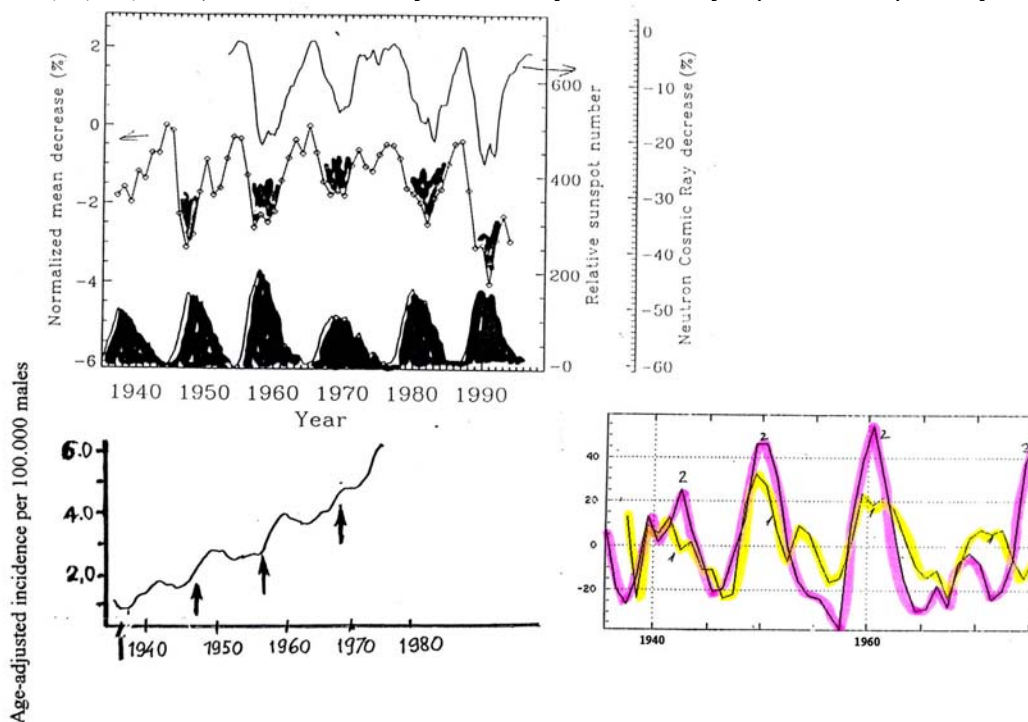
### **1. Introduction**

It is believed that the greatest crisis that humankind will face in the coming decades, which threatens the very survival of human and biotic species on this planet, is the continuous global warming, ozone layer (OL) depletion and resulting climatic changes. It is widely accepted now that the anthropogenic impact is mainly responsible for current global changes. The natural cycle of controlled cybernetic relationships in nature which, for millenniums and centuries, held the balance of global climatic system is being violently disturbed by the increasing anthropogenic activities pumping various harmful gases into the atmosphere and affecting the entire greenhouse equilibrium. This includes CO<sub>2</sub>, CFC, CH<sub>4</sub>, N<sub>2</sub>O, troposphere O<sub>3</sub>, which absorb the thermal radiation from the earth, reduce the outgoing heat radiation from the atmosphere and the surface of the planet. (Note that the major natural greenhouse gas is H<sub>2</sub>O and it seems to be increasing too!). The quantitative effect of global warming resulting in change of climate, depletion of ozone, rise of sea level, affecting the agricultural output and biotic species regeneration are yet to be clearly appreciated. For an accurate prediction of climatic changes, we have to clearly understand three fundamental issues (i) the forces such as solar irradiation (strong forcing), its variation and Cosmic Ray (weak forcing), atmospheric dynamics and chemistry which initiate global changes; (ii) the response of the Earth to these forcing functions involving complicated interactions between the climate, ocean, land, biota, solid Earth and the atmosphere and (iii) accurate (physically realistic) modeling and reliable long range prediction of global changes. While it is relatively easy to formulate the problem, the answers require a quantum jump in our understanding of the various phenomena which need to be backed up by an intensive space and network effort and a special field campaigns to obtain continuous and meaningful set of measurements of a variety of connected parameters. We present new experimental findings obtained in field observations at tropical/extratropical regions by space-and air-borne instruments: the evidence of strong and nonlinear phenomena of exiting wide spectrum of planetary, tide, gravity waves in the troposphere, middle atmosphere and lower thermosphere, the most important role of the tropics in that as well as interrelations of some important atmospheric parameters both in space and time and CR/solar activity indexes [1-4].

### **2. The most important findings**

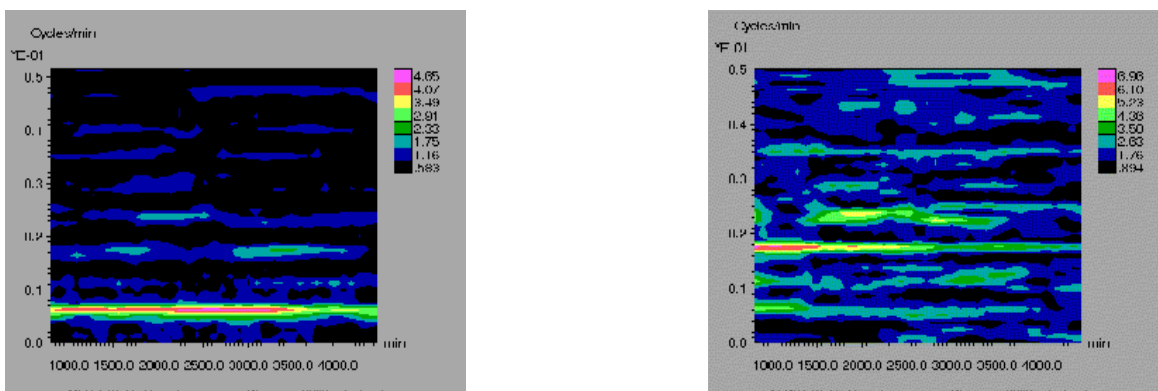
(\*) Observed long-term trends and variations/oscillations of ozone layer are related mostly to the changes of termobaric and circulation regime in the atmosphere; restoration of OL has begun exactly over the equator since 1989 and is propagating poleward (5...7 lat. degrees/year); (\*) all kinds of negative ozone anomalies in both hemispheres (f.e. Antarctic "hole", Sybirian "hole" in spring) as well as "mini-holes"

elsewhere can primarily be accounted for by changing the atmospheric dynamics (rather than changing the chemistry); (\*) total ozone (TO) diurnal variation with minimum during the noon period has been observed with the help a Brewer spectrophotometer throughout the operational time of 12 March - 23 May 1990, which included three 30-days periods of solar activity with double amplitude of about 120 units of the Ottawa Index (2.8 GHz) with background value of 130 units. While the pattern of this variation remained generally the same, the amplitude of this main harmonics (with variable period 250 to 500 min), varied from day to day from 4 to 15 D.U., representing a change of 1.6 - 4% in TO. The most important results of statistically careful analysis of all data sets at Thumba are that the amplitudes (1 to 15 D.U.) and periods (5 to 500 minutes) of variations in TO show a good correlations with 30 days (a possible combination of solar activity and moon periodicity). This seems to confirm the dynamical nature of TO oscillations and their connection with vertical wind variations caused by GW and tides [1, 2, 3] (\*) Balloonborne measurement of ion conductivity/ion concentration over Hyderabad (18 N,78 E) and over Thumba (TERLS, 8,5 N, 77 E) show so called 11 years solar cycle and 27-day dependence respectively in



**Figure 1** Results of the analysis of an indirect relationship GCR and cloudiness. **Upper part.** . Top curve is Cosmic Ray flux from neutron monitor in Climax, Colorado (1953-1996). Middle curve is the annual mean variation in Cosmic Ray flux as measured by ionization chambers (1937-1994). The neutron data has been normalized to May 1965, and the ionization chamber data has normalized to 1965. Bottom curve is the relative sunspot number. Note that even though there is a clear solar cycle modulation of the Cosmic Ray flux, amplitudes are not well correlated (H.Swensmark, Nov. 1998. Talk at Bonn). **Bottom., left.** Incidence of malignant melanoma in the state of Connecticut (North-East area of USA) for the period of 1935-1975. (Data taken from Houghton et al., Halocarbon: environmental effect of chlorofluoromethane release, N.A.S., Washington D.C., 352 p). **Bottom, right.** Statistical analysis) seems to reveal “fingerprints” of climate changeability and intercorrelation: solar activity – Cosmic Ray flux – cloudiness – doses of UV-B irradiation. You can see results of the regression analysis of two data set: GCR (ionization chamber) mean variation (curve 1) and “cloudiness” (inversed value of the cases of melanoma or the variation of UV-B doses) (curve 2) the analysis of G.Kruchenisky and S.Perov [3]. Note that the lag is about two years.

the range of heights of 15...35 km: higher conductivity/concentration during high solar activity and vice versa [2,4]. These results are corresponded to conclusions from analysis of OLO observation at Thumba in March-May 1990 (see above). This is a manifestation of influencing gravity waves propagating from below and their changeability of reflection from upper stratosphere/mesosphere layers under "SA conditions". It means that for the equatorial stratosphere/upper troposphere there is a positive correlation in the chain SA - UV flux - ozone - temperature - wind - reflection coefficient of GW – decreasing of air upwelling in equatorial Hadley cells - decreasing effective aerosol sink for ions - increasing of ion concentration. Investigation of the vertical structure of such the waves namely of the equatorial planetary Kelvin/Rosbi waves as well as of tide and short-term (min., hrs) gravity waves have been carried out in rocket (India/USSR ozone campaigns, DYANA in India) and space (CRISTA-1, -2) experiments. (\*) Tide amplitudes for temperature and wind . obtained in our observations in 20 - 40 km height range are 10 - 100 (and even 1000 at 26...28 km height range) much more than those period theoretically predicted for 24 hrs and 12 hrs harmonics; 8 hrs harmonic has been observed in the stratosphere; height dependence of amplitude and phase has a layered structure with opposite phase propagation some times, 12/13 March a height zonal wind phase dependence has the opposite direction of propagation (from upper part of altitude range to below). (\*) In some works the hypothesis of the influence of modulation of GCR due to SA on global cloudiness is discussed. Such a correlation is not seen over the territory of the former USSR when soviet actinometers network data obtained for last decades were analyzed. Our analysis of which results are presented in fig.1 confirm such a correlation for the part of USA. This conflict situation must be explain only by existing coherent-resonance structures in the atmosphere (including OL and ionosphere) and in others geospheres; ( to be shown at ICRC presentation). (\*) Important role in the time-spatial structure of ozone layer play cloud's fields: first, as a result of the change of ascending photochemical - active visible (basically) and the UV- radiation of the Sun due to the change of Earth's albedo and, in the second place, formation and evolution of clouds are connected with the release of the latent heat of condensation, which influences formation and propagation of the entire spectrum of the internal gravity waves, which act upon the ozonosphere (see Fig.2).



**Figure 2.** Variation in the equatorial total ozone (left) and in equatorial cloudiness (measured as an higher albedo from an orbit) (right) for 30 days in August 1997. The basic "harmonics" are wave number distribution in both parameters along the equator. "Minutes" (1000 – 4500 in X-axis) are numbers of observations of TO from the satellite Earth Probe equipped by TOMS instrument. Y-axis means a frequency in cycles per minute: ~0.06 (maximal amplitude in Dobson units – see the scale in upper-right part of left diagramme) is consistent with wavenumber 1 (the wavelength of ~40000 km), ~0.12 - with wavenumber 2 (~20000 km) etc.

### 3. Discussion and Conclusions

This paper is further evolution and development of idea in the CERN talk "Global warming - blame the Sun" presented by Nigel Calder December, 4, 1997 with his fair moral related to global warming (as well as for ozone problem and for global change at all as well): *Beware of models. They do what they're designed to do!* Our analysis of current climate and OL models shows their contradiction with the most experimental facts and findings. Therefore Occam's Razor (the main principle of the Science) is not working! It is stating: the simplest hypothesis which is accounting for the most facts is most likely to be correct. So new theory (models) must be done as soon as possible – new equations system is written by author. Three questions were without answers in 1997: . 1) Global surface temperature correlated with the length of solar cycle, but not with the cosmic ray (CR) intensity. 2) Maximum ionisation from CR is at 12...13 km; overcooled and oversaturated water vapor is present at these altitudes. Why clouds are formed lower? 3) It is said, that at tropics the cloud modulation is ~4% at all the latitudes -3%; however, CR modulation in tropics is minimum. We propose that the climate system of the planet is R(3)AS(3)OR(3) (**R**esonance (usual, parametric and stochastic) **A**mplification **S**timulated (stochastically and synergetically) by **O**utside **R**adiation (i.e. by electromagnetic, corpuscular and gravitational) [2]. Main generator of oscillations of climate and ozone layer is equatorial/tropical atmosphere and it consists of layers and 4D structures. It is working as a multimodal laser system interacting with the extratropical atmosphere and with other geospheres (the mantle, the nucleus, the magnetosphere) and with outer space the heliosphere). Each layer consists of a coherent-resonance structures. f.e standing waves, of which amplitudes have been ruled by solar activity and are forcing global circulation of the atmosphere. It means that the higher SA the higher surface temperature and contra versa.

### 4. Acknowledgements

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