Earth's atmosphere is a mixture of various gases and consists of nitrogen (N_2, 78.084% by volume), oxygen (O_2, 20.9476% by volume), water (H_2O, up to 4% in humid air), argon (Ar, 0.934%), carbon dioxide (CO_2, 0.0314%) and very small quantities of other gases: neon, helium, methane, krypton, hydrogen etc. From time to time air can also contain dangerous chemicals due to the continuous progress of human civilization like various oxides of carbon, nitrogen and sulfur. We should obviously monitor the quality of air by all possible means and especially with the use of modern spectroscopic methods. Nuclear magnetic resonance (NMR) is a very useful and efficient tool of chemical analysis. It is also applied for investigations of gases in chemical laboratories but it was never used for the study of atmospheric gases. NMR spectroscopy does not like paramagnetic materials but molecular oxygen is obviously paramagnetic and it partially explains the problem. However the most modern spectrometers are ready for the studies of any chemicals at very low concentration, also paramagnetic chemical compounds. With this research project we propose the accurate NMR investigations of atmospheric gases. We would like to learn the basic parameters of gaseous water, nitrogen and oxygen which will be available from NMR spectra. Later we will verify how intermolecular interactions can change different molecules in the mixture of nitrogen and oxygen which is similar to air. It can be the first step for the application of NMR spectroscopy to valuable studies of our atmosphere in future. Our proposed studies are mostly experimental but quantum-chemical calculations will be added whenever the new research results are interesting and important for further applications.