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Coupled Human-Atmosphere-System Thinking

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With the discovery of fire, humankind started changing the composition of the atmosphere. Beginning with the industrial revolution, this has led to significant environmental problems, mainly air pollution and climate change. While climate change has been recognized as one key challenge of the Anthropocene, air pollution contributes to the top causes of global premature mortality. Air pollution also plays a key role in contamination of ecosystems and bio-magnification of toxins along food chains.

Even though emissions leading to air pollution and climate change often originate from the same sources, they are generally perceived and regulated separately. Climate change impacts are global and hence are tackled at an international level. Conversely, air pollution has local to regional impacts and is thus a matter of national or regional legislation. This legislative and policy divide is generally useful, since full integration could lead, for example, to detrimental delays in action against air pollution through protracted international climate negotiations.

However, the separation obscures the fact that almost any kind of human activity leads to the simultaneous emission of air pollutants, toxins and long-lived greenhouse gases. The atmosphere functions as a “dump” for human generated gaseous waste, which is then dispersed and transformed, partly chemically and partly micro-physically, perturbing natural processes in the atmosphere and leading to manifold impacts. In addition, air pollutants affect the Earth’s radiative balance directly and indirectly, hence affecting climate change, while a changing climate in turn affects air pollution. Current policies often neglect these linkages and favor mitigation in one arena, which sometimes has detrimental effects on the other. One example is domestic wood burning, which though nearly carbon neutral, deteriorates air quality. Moreover, the design of appliances, machinery, or infrastructure generally does not attempt to minimize atmospheric release, but rather only complies with either climate or air quality requirements. Nor do current narratives promote behavioral change for the overall reduction of emissions (e.g., you can drive your diesel SUV as long as it has a low fuel consumption).

This divide and thinking has not only been manifested in policy and regulations and hence media coverage, but has also shaped the public’s general perception of this issue. There is no public conceptual understanding regarding humanity’s modification of the atmosphere through the continuously and simultaneously released substances by almost any kind of activity and resulting impacts.

Here, we propose a conceptual framework that provides a new perspective on the coupled human-atmosphere-system. It makes tangible the inherent linkages between the socio-economic system, the atmospheric physico-chemical changes and impacts, and legal frameworks for sustainable transformations at all levels. To implement HAS-thinking in decision and policy making, both salient disciplinary and interdisciplinary research and comprehensive science-society interactions in the form of transdisciplinary research are necessary. Societal transformations for the sake of a healthy human-atmosphere relationship are highly context dependent and require discussions of normative and value-related issues, which can only be solved through co-designed solutions. We demonstrate the importance of HAS-thinking by examples of sustainable development in the Arctic and Himalayan countries.