Urban activity and the environment

At the same time, a number of researchers have coined the neologism of anthropocene (Crutzen, 2002) to describe the contemporary era and to stress that material and energy flows at planetary scale are now heavily influenced by anthropogenic factors alongside the natural factors that hitherto affected the planet.

And what is true at a global level also applies at other levels, especially cities and metropolises. Such interaction between physical phenomena and societal practices requires a multi-disciplinary approach.

The concentration of populations in large urban centres represents a major challenge. The intensity of pollutant emissions is crucial to the quality of air, water and public healthcare within cities and raises issues regarding all aspects of how cities are run (services, resources, transport, waste management, etc.).

Recent studies (Baldasano et al., 2003, Gurjar et Lelieveld, 2005, An et al., 2007, Favez et al, 2007, Molina et al., 2007) have demonstrated that air pollution from gaseous particles and pollutants (SO_2, NO_2, O_3) is very severe in many cities and particularly those in developing countries. On an even larger scale, the transport and chemical transformation of this pollution has a major impact on the chemical composition of the troposphere and on the climate (Lawrence et al., 2007).

Similarly, interaction between the water cycle, the city, its settlements and activities contribute to producing and transporting potentially toxic contaminants via urban wastewater whose short-, medium-, and long-term health and ecological impacts are poorly documented at present (Eriksson et al. 2005, Zgheib et al. 2010).

How can we limit pollutant emissions in these megacities as much as possible to enhance air and water quality and minimise their more far-reaching impacts on climate and ecosystems? Answering this question involves addressing the fit between atmospheric circulation models and air quality; between hydrometeorological models and models that estimate the impact of human activity (transport, use of pharmaceutical or plant health care products, etc.).

A number of North American universities have “environment institutes” (UCLA, UNC, etc.) and although there is still not much inter-disciplinary interaction between researchers, these have already made it possible to analyse problems related to new developments in the transport or energy spheres and to put forward innovative, economically optimal solutions. Take the following work as an example: Jacobson’s research at Stanford into the impacts of biofuel on air quality (Jacobson, 2007, 2009); Michalek and Samaras’ work at Carnegie-Mellon on the impacts of electric vehicles (Michalek and Samaras, 2008, Shiau et al., 2009); research carried out by CEREA around the impact of diesel particulate filters (Roustan et al., 2010); and research by Marshall et al. (2005, 2009) into the interaction between urban density and the exposure of the population to atmospheric pollution. Similar-type approaches have been tried in the domain of urban wastewater (Center for water sensitive cities, Monash University, Australia) or in collaboration with specific research areas (the Paris agglomeration in Piren-Seine, the Baltimore agglomeration in long term ecological research –LTER- Baltimore). However, this type of research depends on the development of new calculation tools that require a multi-disciplinary approach (Seigneur et Dennis, 2010 ; Fischbeck et al., 2007).

This also raises **the issue of eco-centric public policies and the conditions for their success**. Thence the need for economic tools that model the interactions between urban forms, economic approaches and energy consumption as it is the relationship between space and how space is being consumed in our societies that is being completely made over.

So, at local level, we need to study existing systemic links between the location choices of officials, property markets and (transport and residential) service requirements within cities when constraints linked to land use or infrastructure availability are factored in. For example, we could represent the different land use typologies that emerge at urban agglomeration scale as a consequence of economic dynamics (Black et Henderson, 1999), and in particular represent the emergence of polycentric structures.

The challenge at global level is to come up with an integrated approach that combines empirical and quantitative analysis of urban scenarios and how these interact with demographics (population migration), with different approaches to economic development (transport activity, infrastructure investment, energy consumption trajectories) and environmental problems (local pollution, climate change). This analytical framework has been used in the OECD's "Competitive cities and climate change" Report of 2009 to evaluate the potential macroeconomic cost reductions generated by an ambitious climate policy made possible by policies to reorganise space at local level (OCDE, 2009).

The promising results obtained demonstrate the interest of continuing with these integration-based approaches and moving towards both more refined and broader knowledge of local/global interaction at work.

Moreover, these interactions between the future of the environment and human activities should be analysed both for the impacts of human life on the environment and vice versa. Urban systems remain highly vulnerable to extreme meteorological conditions, particularly storms and the related exceptional rainfall – and these may be exacerbated by vectors such as climate change and urban sprawl (Houghton, Meira Filho et al. 1995).

Climate change may be used in particular to analyse planning issues from a different angle.

Everything that touches upon "**urban resilience**", i.e., the ability of the urban fabric to withstand storms, floods or rising sea levels, is an especially hot topic in major urban complexes (Mc Manus et al., 2008), and this also harks back to both the demands of scientific progress and technical innovations (Schertzer et al. 2010) as well as to the invention of appropriate governance methods for such risks (Folke, 2006). And while this whole issue of policies for adapting to climate change is relatively well documented in terms of chronic adaptation, there is significant room for improvement on a small spatial and temporal scale in the case of exceptional occurrences (Berne et al. 2004).

If we change focus and consider the city from the perspective of the actors that build it and give it life, two broad topics for reflection emerge.