Since the emergence of satellite Earth Observation data in the domains of Oceanography, Meteorology and more generally Geophysics, increasing amounts of datasets are accumulating in the archives, increasing the need of tools to analyze them. Without pretending to solve the problem of automatic analysis of these signals, the immensity of these databases requires that the fundamental low-level processes of analysis are adapted to the nature of the data. Moreover, the usefulness of these data is no more to prove: in the domain of Oceanography, for instance, it is well acknowledged that satelilte datasets have revolutionned the field, by providing intantaneous portrayals of the ocean at various spatial and temporal scales. In other domains, such as astronomical observation, the same remark also applies. To better exploit the existing instruments and the future devices in preparation, one has to extract pertinent information and go back to the physical parameters associated to the acquired objects.

These datasets, although not easily analyzed, often display common characteristics: they are of multiscale nature. The importance of this remark is at the centre of developments, both in Computer Science, and in renormalization techniques in Physics. A wide variety of signals can be contemplated from this kind of approach, a remark at the basis of the GEOSTAT proposal, which allows us to propose such a widenend framework of application domains, instead of focusing on a particular class of geophysical signals. Researchers involved in the GEOSTAT proposal are currently collaborating with researchers coming from different horizons, such as Astronomy, Signal Processing, Oceanography, Speech, Statistical Modeling. with the goal of obtaining results in a wide class of information systems.

The MMF is being applied by researchers in GEOSTAT to certain geophysical data, either of meteorological or oceanographic nature.

In Oceanogaphy, the first results obtained are related to the evaluation of certain characteristics of ocean dynamics such as the geostrophic stream function in combined altimetry and Sea Surface Temperature (SST) datasets. The precise determination of the stream function is of utter importance in the study of ocean dynamics, for instance in the study of large scale phenomena associated to oceanographic currents such as the gulf stream and global circulation. The MMF provides a coherent and well appropriated framework, because the geometric super-structures associated to singularity exponents receive a physical interpretation: they are associated to the multiplicative cascade (work in progress) and, in the fully developped turbulence regime, they are advected by the oceanic flow. From this one can deduce the fact that some of these geometric super-structures, the most singular manifolds are composed of instantaneous streamlines so that, in the geostrophic approximation, the stream function is proportional to a reduced signal obtained by anistropic diffusion along these manifolds. These works, some of them portrayed on cover of Physical Review Letters form an intense area of research in GEOSTAT.

In the meteorological domain, the MMF is used to characterize convection areas in Météosat thermal infrared datasets, and consequently to locate precipitation areas in convective clouds. Thermal infrared data are particularly well suited to undergo analysis through the MMF because temperature is an intensive physical variable transported and advected by the turbulent flow (atmosphere is mostly adiabatic at the scale of an analysis). The notion of source field , an object naturally associated, in the framework of reconstructible systems, to geometric super-structures and singularity exponents is able to provide a separation between the advective and convective parts in the turbulent signal, and to determine precipitation areas in convective towers.