ÉCOLE DOCTORALE
SCIENCES DE LA TERRE ET DE L'ENVIRONNEMENT
ET PHYSIQUE DE L'UNIVERS, PARIS

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**Titre du sujet : Dynamique morpho-sédimentaire des paysages éoliens à l'échelle continentale**

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**Co-directeur (trice) / Co-encadrant(e) :** En fonction de l'orientation choisie en cours de projet doctoral

**Equipe d'accueil :** IPGP- Équipe de Tectonique et Mécanique de la Lithosphère – UMR7154

**Financement :** Contrat doctoral avec ou sans mission d'enseignement

**Développement du sujet :** (Maximum 2 pages)

## Morpho-sedimentary dynamics of aeolian landscapes at continental scale

Landscapes shaped by the wind cover nearly a quarter of the Earth's continental surface. These aeolian landscapes are regions of massive wind-blown sand and dust emission, which have a major influence on continental-atmospheric-oceanic mass exchanges, climate, life and human activities. More than the others, these desert landscapes are vulnerable to changes in surface hydrology and extreme events. In the context of the ongoing global change, it is therefore crucial to improve our current understanding on aeolian landforms dynamics and to better manage their societal impact (erosion or burial of the arable lands and infrastructures, health issues due to atmospheric dust, *etc.*). In this regard, taking advantage of the recent advances in wind data, remote sensing opportunities, geochronology, and aeolian geomorphology, we propose to analyze the present-day and recent (Quaternary) evolution of aeolian landscapes on the large scale of continents.

The aim of this PhD will be to study the morpho-sedimentary dynamics of deserts related to aeolian processes over meteorological (hours to months), climatic (years to centuries), and geological (millennia to millions of years) time scales. The selected candidate will adopt a multi-disciplinary, integrated, and quantitative approach by coupling geomorphology, sedimentology, sediment transport physics, remote sensing, and geochronology. She/He will implement this approach through an original strategy involving observation and quantitative analysis from field and remote-sensing data, as well as a characterization of the present-day and past wind conditions mainly based on numerical climate modelling (Chanteloube *et al.*, 2022). Through this strategy, this PhD will deliver an original and quantitative description of the wind contribution to continental surface dynamics and its links with atmospheric circulations along the aeolian sediment routes connecting erosion (source) to accumulation (sink) areas.

This PhD will be implemented in two stages. The first step will be dedicated to the development of the source-to-sink analysis workflow recently design at desert scale (Chanteloube *et al.*, 2022), in order to quantify erosion and deposition processes over various time scales (from decades to hundreds of thousands of years) at continental scale. This step will target the global dust belt, which corresponds to the continental-wide, semi-arid to hyper-arid region extending from the western coast of North Africa, through the Middle East, to Central Asia (Prospero *et al.*, 2002). In a second step, depending on her/his progression and interests, the candidate will then have the opportunity to apply the developed workflow to different aspects of aeolian processes such as the quantification of wind-blown sediment fluxes, the physics of aeolian erosion, the formation of sand seas, or the dynamics of Martian aeolian landscapes. According to the chosen topic, several collaborations may be set up in the fields of physical geomorphology, paleoclimatology and/or planetology.

References:
Chanteloube C., Barrier L., Derakshani R., Gadal C., Braucher R., Payet V., Léanni L. & Narteau C., 2022. Source-to-sink aeolian fluxes from arid landscape dynamics in the Lut Desert. *Geophysical Research Letters*, 49: e2021GL097342.

Prospero J.M., Ginoux P., Torres O., Nicholson S.E. & Gill T.E., 2002. Environmental Characterization of Global Sources of Atmospheric Soil Dust Identified with the Nimbus 7 Total Ozone Mapping Spectrometer (toms) Absorbing Aerosol Product. *Reviews of Geophysics,* 40(1): 2-1 to 2-31.

**Candidate profile:**

The candidate must hold a Master's degree in 'Earth and Planetary Sciences, Environment' or an engineering degree in 'Earth Sciences' and have knowledge in geosciences (*e.g.*, in geophysics, geology, geomorphology, climatology, and/or remote sensing), as well as notions in scientific programming (Matlab, Python or others), data analysis (statistics), and Geographic Information Systems. She/He should also have a proven track record in the implementation of the scientific approach and in the written (reports or articles) or oral (presentations) valorization of scientific results.