Laboratoire : LEGOS (OMP), Toulouse, FRANCE
Titre du stage : **Thermal Air-Sea Coupling Control of the Oceanic Variability and Precipitation over the Agulhas Current**
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Sujet du stage :

The Agulhas Current is a major component of the global ocean and climate, and the marine environment that provides food resources, particularly proteins, to a substantial fraction of the African population (>100,000,000 people). As the western boundary current of the subtropical Indian Ocean, the volume transport of the Agulhas Current is expected to scale with the intensity of wind stress curl over the South Indian Ocean, according to linear Sverdrup theory. Notwithstanding, observations and high-resolution simulations suggest that the horizontal and vertical distributions of velocities and thermohaline fronts are highly non-linear, and that variability is substantial over a very large range of scales (from 1 day to 10 kyr, and from 1 km to 300 km). Actually, little is known about the ocean dynamics in that region, referred to as the Greater Agulhas Current System, despite numerous international programs of observation and modeling (*ACT / ASCA, ACE, INATEX, ARC, LOCO, GATEWAYS, SCOR/WCRP/IAPSO Working Group 136*).

The ocean can couple with the atmosphere through both the oceanic thermal feedback (TFB, e.g., Chelton et al. 2004; Small et al. 2008) and the current feedback (CFB, *e.g; Renault et al. 2016, 2017a*). Both coupling processes strongly involve mesoscale eddies. At the mesoscale, the TFB can wind anomalies that can be felt up to the troposphere (*Minobe et al., 2008*). It can also modulate the clouds and the precipitations (*e.g., Desbiolles et al., 2018*). *Renault et al. (2017b)* show the importance of the CFB to the atmosphere in determining the ocean dynamic of the Greater Agulhas.

This internship aims at improving our understanding of the dynamics at play, in particular the role of the TFB in determining the Greater Agulhas dynamic as well as the precipitation over that region. We will use outputs from 3 realistic ocean-atmosphere coupled simulations available for the Agulhas and the Benguela Systems: a control run that considers both the TFB and the CFB (*Renault et al., 2017b*), and two additional simulations where the Sea Surface Temperature send to the atmospheric model has been smoothed to remove the mesoscale signal (at 250km and 1000km). Comparison with satellite will be first performed in order to assess the realism of these simulations. An inter-comparison between the 3 simulations will then allow to quantify the impact of the mesoscale TFB on the Agulhas Current retroflection and dynamic, the mesoscale activity, water masses, vertical velocities, heat fluxes, wind, and precipitation.


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- Renault, Lionel, et al. "Modulation of wind work by oceanic current interaction with the atmosphere." *Journal of Physical Oceanography* 46.6 (2016): 1685-1704.
- Renault, Lionel, James C. McWilliams, and Sebastien Masson. "Satellite observations of imprint of oceanic current on wind stress by air-sea coupling." *Scientific reports* 7.1 (2017): 17747.
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