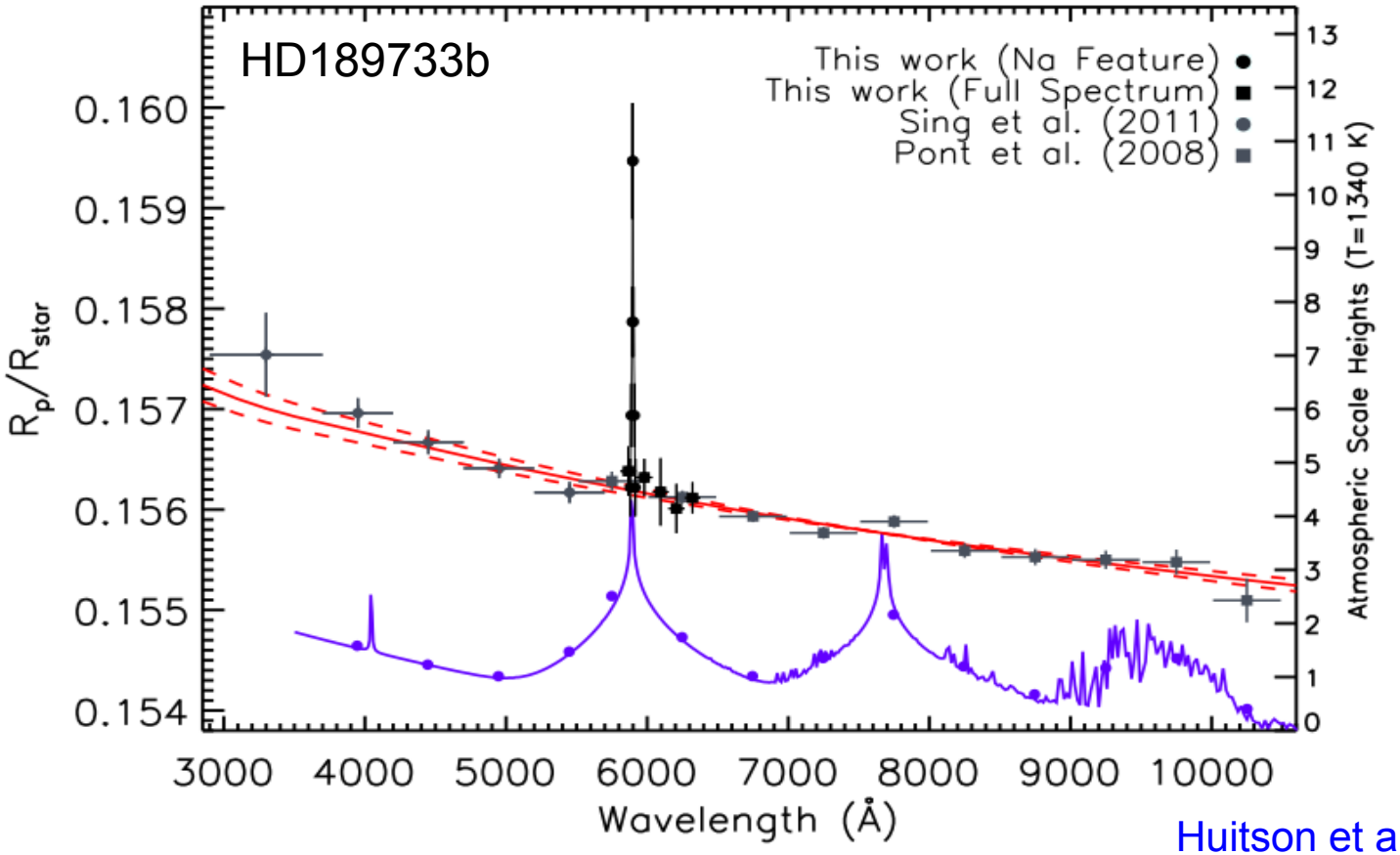
Dynamical exoplanet atmospheres: mixing, clouds and interaction with the interior

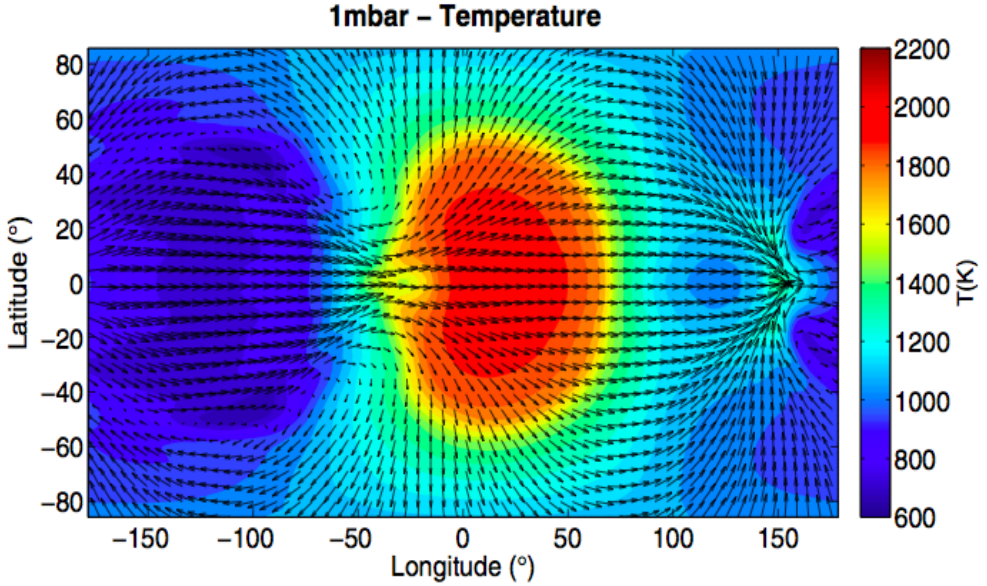
Vivien Parmentier, Sagan Fellow 2014



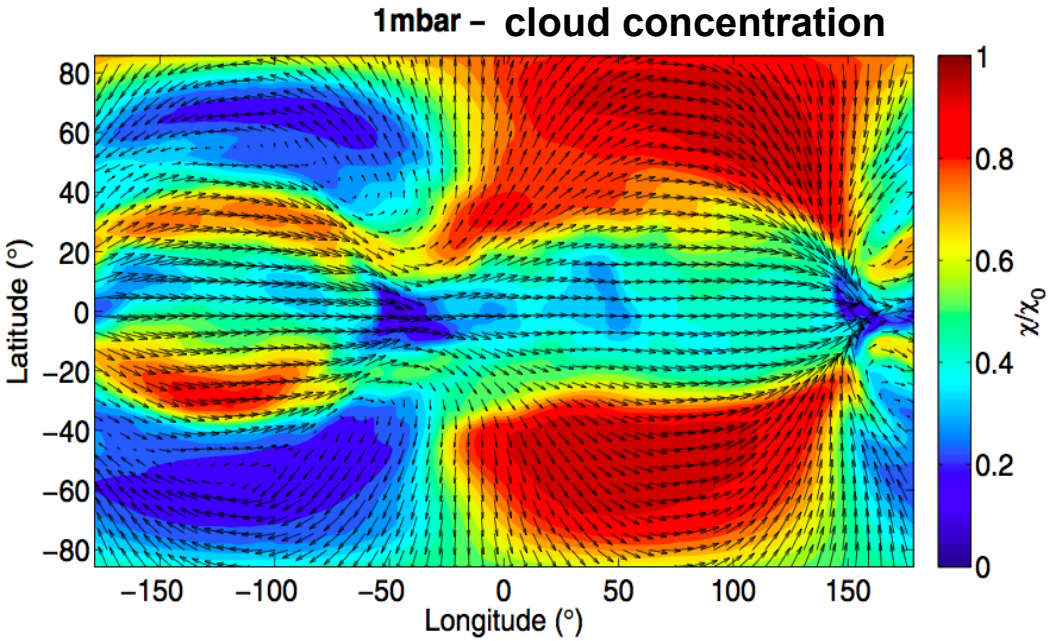
Huitson et al. 2012

Clouds seem ubiquitous in hot Jupiters atmospheres. In this transit spectrum, Rayleigh scattering due to sub-micron cloud particles obscure all the molecular features except the core of the sodium line.

Tidally locked planets are complex 3D objects



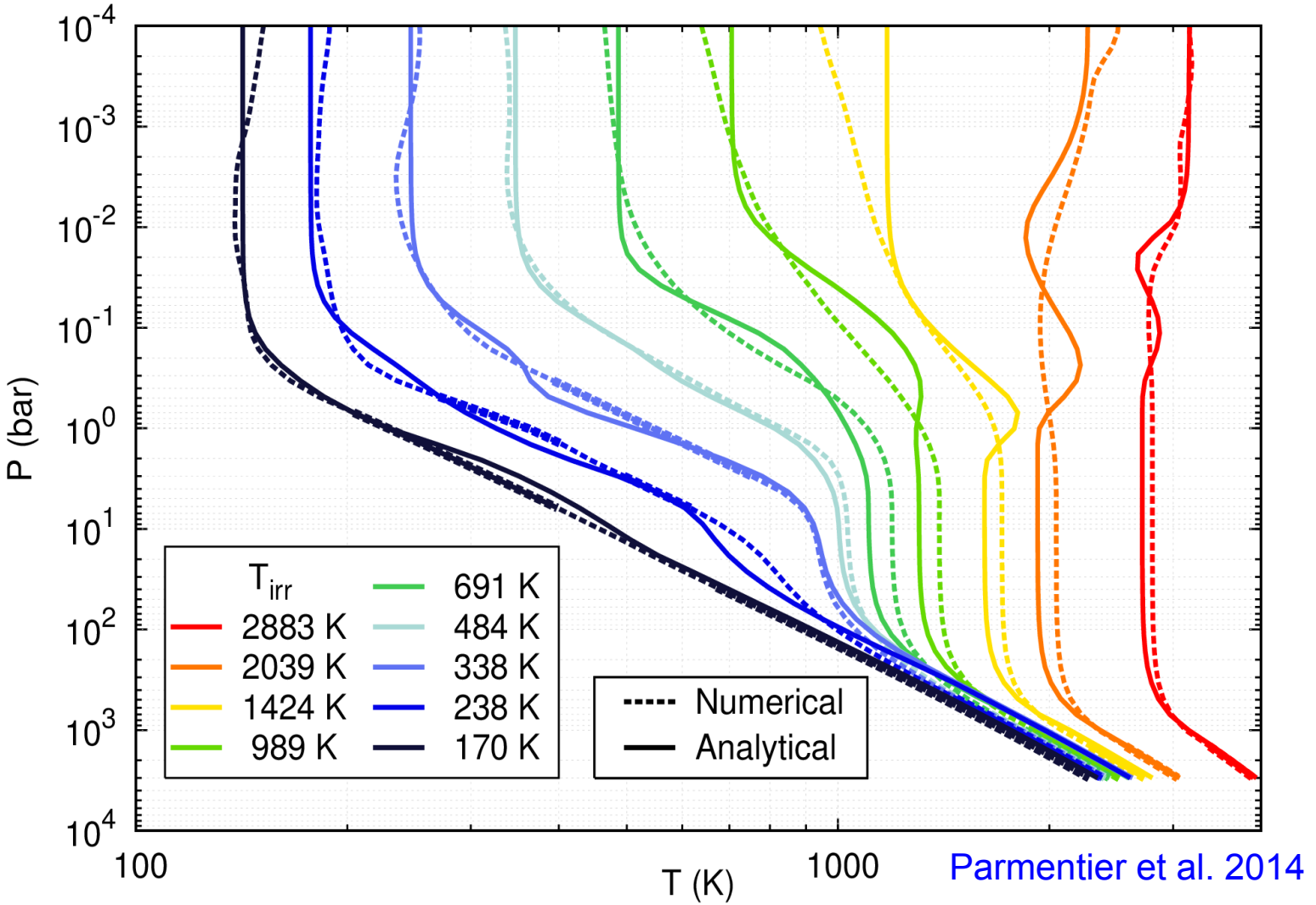
Tidally locked hot Jupiters are characterized by a strong day/night temperature contrast.
It powers large scale winds that necessary to advect material along the planet and trigger cloud formation.



Very simplified cloud models predict inhomogeneous cloud patterns.
They also predict that particles smaller than 1micron can be kept aloft in the atmosphere.

Parmentier et al. 2013

Thermal evolution of gas giant exoplanets



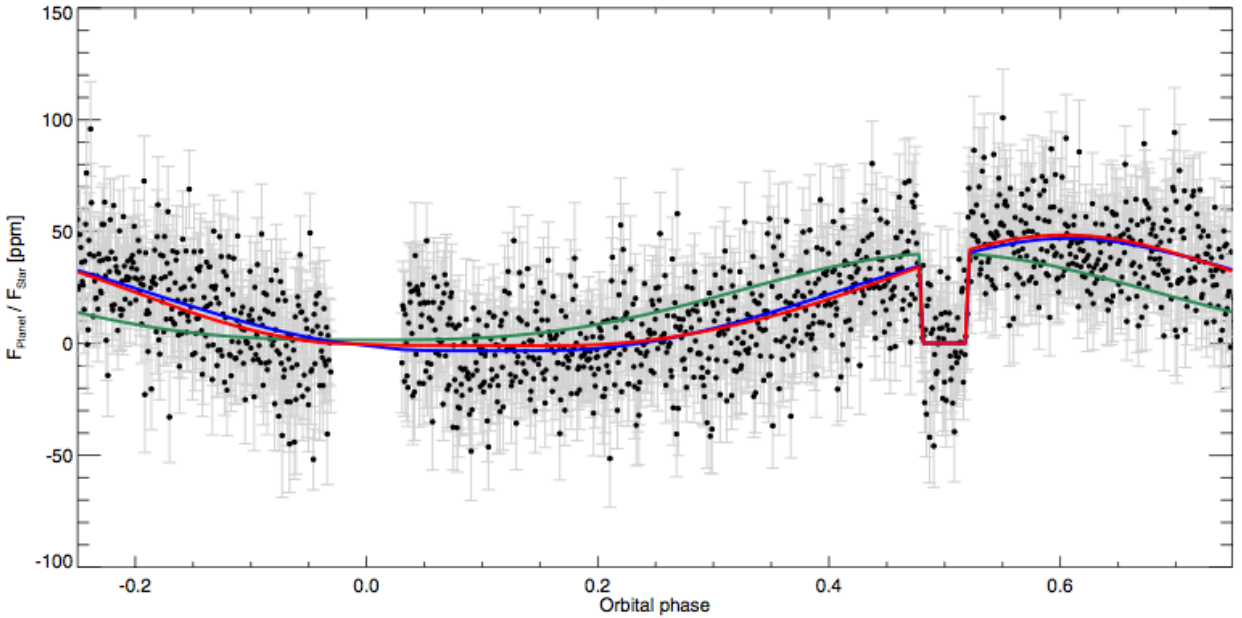
Thermal evolution of gas giant exoplanets use 1D mean atmospheric profiles as a boundary condition, however, the atmosphere of tidally locked planets are intrinsically 3D objects !

Understanding dynamical mixing and its consequences in the atmosphere of tidally locked planets

→ I will study how the large scale circulation patterns efficiently mix the radiative atmosphere of tidally locked planets.

→ I will incorporate a more sophisticated cloud model in the MITgcm and use the outputs to interpret incoming observations.

→ I will determine how the resulting 3D structure of the atmosphere can affect the long term evolution of the planet.



The phase curve of Kepler-7b shows evidences of inhomogeneous clouds.

Demory et al. 2014