Summary of Titan’s circulation

• Atmosphere superrotates (westerlies only) above 40km

• Below 40km the zonal mean wind direction varies depending on height, latitude and season
• This figure shows only one season

• Wind maps would be fairly simple...

...if not for the gravitational tides:
Tidal forcing

Eccentric orbit around Saturn => time-varying gravity field (‘tides’)

Tidal accelerations repeat every orbit, which is 1 Titan day (~16 Earth days) as Titan tidally locked

Tides primarily affect tropospheric winds
Things to remember about atmospheric data

• Nothing is static - an atmosphere is time varying

• Titan has strong seasonal changes affecting in particular:
  • The positioning of Hadley cells (meridional transport)
  • The range of heights and latitudes over which near-surface easterlies can occur (facilitating changes in wind direction)

• Tidal effects can also hugely affect the outcome of a tracer experiment (will it ‘surf’ its way out of a region, or stay put?)

• LCS method is powerful way to investigate this complex system