

Strateole Phase II:

Motivations for an equatorial superpressure-balloon campaign

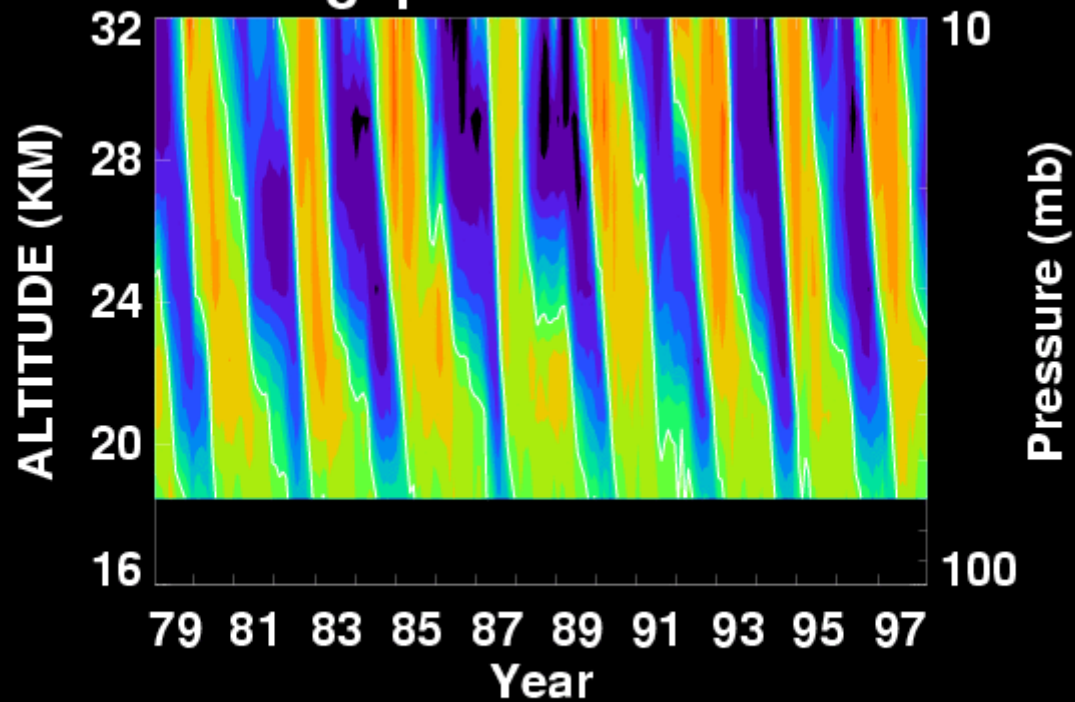
History

- Stratéole, initiated at LMD, is submitted to Cnes at the end of the 80's
- In 1998, the Stratéole campaign is split in two parts:
 - Vorcore (McMurdo)
 - Voredge (Marambio, Ushuaia)
- Vorcore took place in 2005
- We have now to think of Strateole phase II in the lights of our current knowledge of stratospheric dynamics and transport

Why an equatorial campaign ?

- Dynamics of the equatorial stratosphere is still poorly understood
 - Lack of observations
 - Sparse radiosonde network
 - Space-borne temperatures are less useful
 - Models have difficulties in simulating the equatorial dynamics (QBO)
 - High-vertical resolution needed
 - Special tuning is used

Singapore zonal wind



NASA

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Why an equatorial campaign ?

- One important reason is the dynamical balance that holds:
 - $\rho \frac{d\langle \underline{u} \rangle}{dt} = F_{\text{wave}}$
 - Whereas in the extratropics:
 $\rho \underline{f} \times \langle \underline{u} \rangle + \underline{\text{grad}} P = 0$ (geostrophic)

Why an equatorial campaign ?

- The wind is forced by a continuum of atmospheric waves:
 - Kelvin, Rossby-gravity and Rossby waves
 - Gravity waves
- The respective role of these waves is not precisely known (HL68, LH72, D97)
 - QBO period
- Most of those waves are generated by processes associated with convection in the deep tropics...
which are themselves parameterized in GCMs

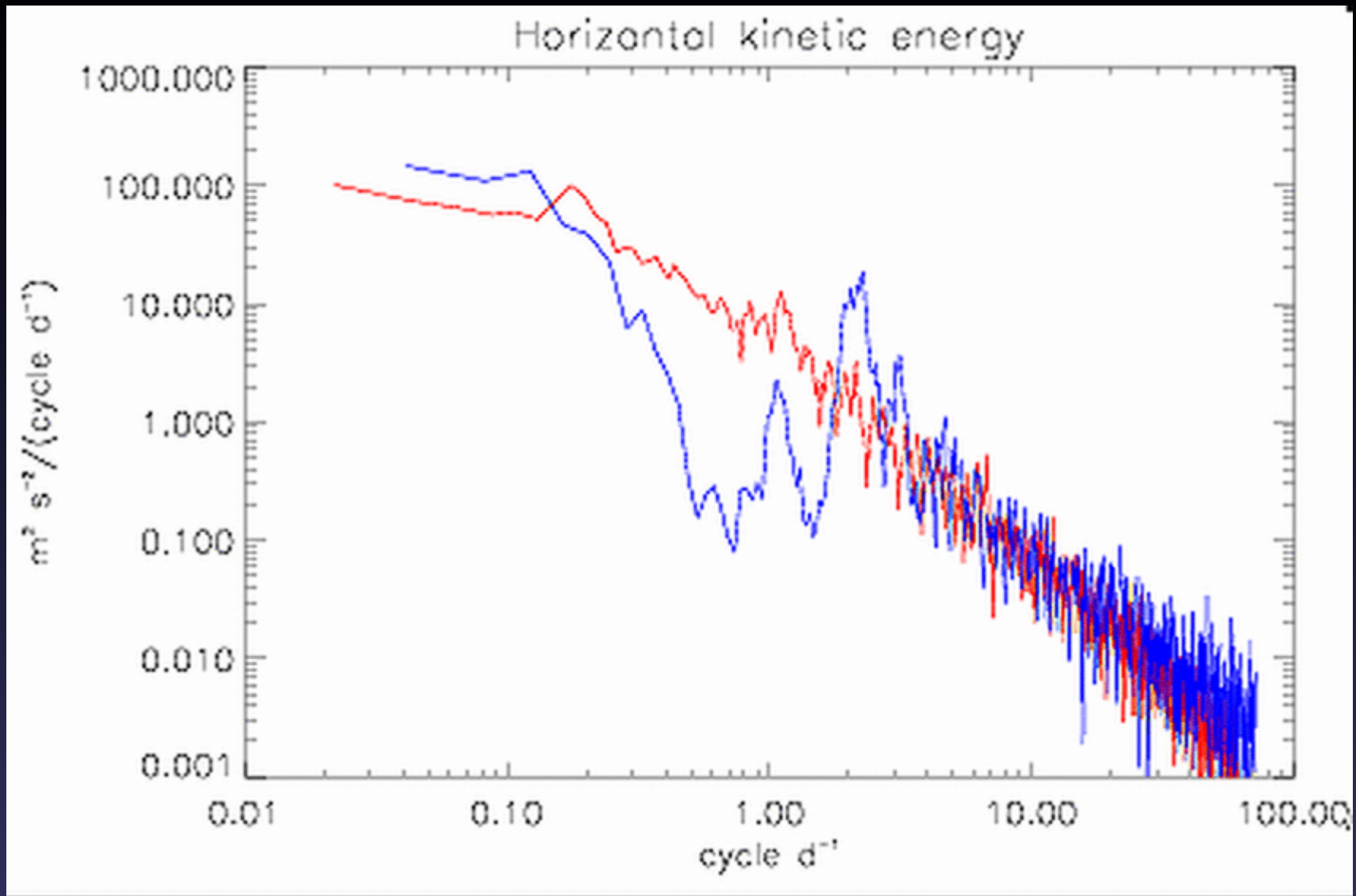
Why an equatorial campaign ?

- However, the equatorial stratospheric dynamics (QBO) play a very significant role on the middle-atmosphere dynamics
 - Holton-Tan mechanism
 - Ozone loss intensity in the Arctic and in the mid-latitudes
- QBO downward propagation depends on the Brewer-Dobson circulation

Why a superpressure balloon equatorial campaign ?

- Superpressure balloons are unique devices to study the dynamics
 - Long-duration balloons
 - Whole spectrum of waves
 - continents/oceans
 - convection/clear skies
 - Physical behaviour is simple
 - Atmospheric motions can be easily inferred from the balloon motions -> subtle quantities
 - Quasi-Lagrangian tracers

Why a superpressure balloon equatorial campaign ?



Why a superpressure balloon equatorial campaign ?

- A Vorcore-like campaign (or even better) may produce an unprecedented dataset that can be assimilated by operational models
- Preliminary results from the Equator 1998 campaign by Pawson et al. Show a significant impact on the zonal velocity at the balloon flight level, but also up 5 km above... with only 3 balloons

Why an equatorial campaign ?

- Other relevant issues
 - Transport processes in the equatorial UTLS
 - Dehydration in the TTL
 - Cirrus clouds in the equatorial upper-troposphere
- Here again, superpressure balloons can be very useful
 - Quasi-lagrangian
 - Able to fly above deep convective systems

Why a superpressure balloon equatorial campaign ?

- Opportunity
 - Validation of the ADM-Aeolus wind-lidar satellite
 - Launched by ESA around 2008
- Campaign a priori supported by SPARC WMO project
 - International famous scientists have already expressed their interest (B. Vincent, K. Hamilton, T. Tsuda, etc)

Preliminary plans

- 2-phase campaign to sample both phases of the QBO
- 2009-2010
- Developments
 - Higher-rate telemetry
 - New instruments
 - Hygrometer
 - Carbon-dioxide sensor
 - Rayleigh lidar

Current needs

- Quickly write a proposal (first draft) that can be circulated among a potentially interested international community (modelers, observation people)
- Identify funding agencies and submit proposal