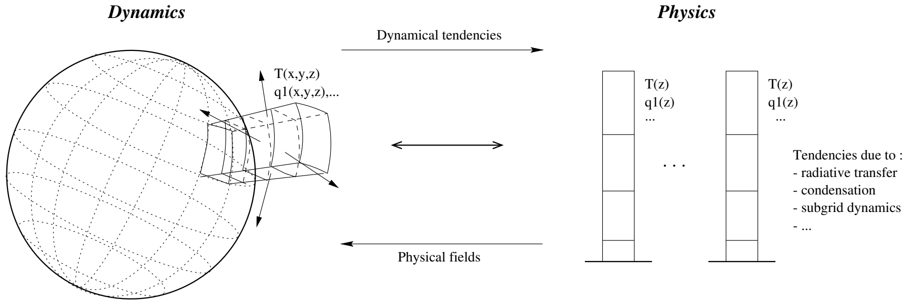

Fig. 2 : Separation dynamics / physics

2.3 Processes and variables of a typical Martian GCM

2.3.1 Variables

Here are the main physical (i.e. local) variables of the model :

- local temperature.
- kinetic turbulent energy (*i.e.* wind variance)
- concentration of various aerosols[6] (dust, clouds, etc...) or minor gaseous constituents (water vapor especially).
- surface pressure.
- ground and subsurface temperature.
- various ground properties (ice coverage, moisture, etc...)
- winds

Note that :

- Some of the previous variables are also dynamical variables (i.e. they are used in the dynamical part of the code to compute dynamical tendencies for all physical variables, including themselves). These are temperature, winds, tracer mixing ratio, and surface pressure.
- Surprisingly, the local pressure is *not* a local variable. That is because it is the *actual* vertical coordinate : the cells are vertically defined by pressure levels, or more exactly by their σ *coordinate* : $\sigma = p/p_S$ where p_S is the ground pressure : you have to see the vertical grid as an elastic one, dilating or contracting with winds and temperatures changes. This choice makes very easy to include the effects of topography on the circulation (by changing the value of p_s). The altitude coordinates used in the diagrams are actually *pseudo-altitudes*, given by $z = h \ln(p/p_S)$ where h is the typical height of the Martian atmosphere (often considered equal to 10 km, but given more formally by $h = \frac{RT}{g}$). That would match with the true height if the atmosphere was isothermal and h matching it...

[6] also called *tracers*