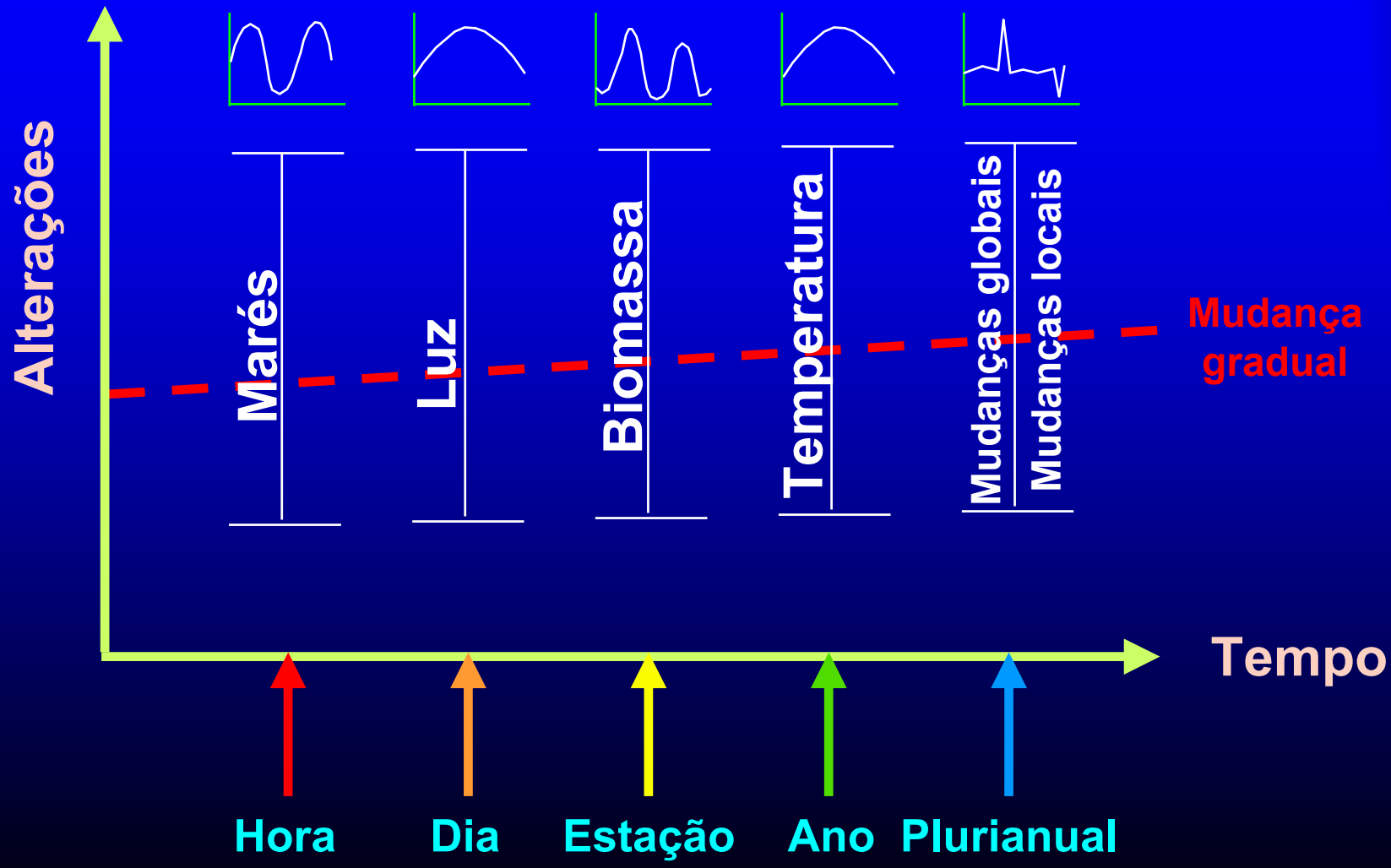
Ecological modelling

Alterações em sistemas costeiros



Ecological Modelling - Objectives

Description and support

- Test and validate mental models
- Support sampling design
- Describe and hindcast
- Support data interpretation (e.g. laboratory models)

Forecasting

- Predict *general* behaviour of ecosystem
- Test and diagnose potential modifications
- Distinguish long-term signals from short-term variation

Models - Characteristics

- Generality
- Realism
- Accuracy
- Simplicity

Models should be portable!

Loss of realism is expected

Loss of accuracy due to smoothing, difficulty in accommodating stochastic events, etc

If possible, reduce complexity

Models - Components

Dimensions

- Statistical
- Zero-dimensional (time only)
- One-D (rivers, narrow estuaries)
- Two-D (non-stratified estuaries, coastal areas)
- Three-D (systems with pronounced horizontal and vertical gradients)

Time and space scales

- Hydrodynamics - Small cells, short timestep and time scale (tidal cycles, spring-neap cycles, localised case studies)
- Ecology - Larger boxes, longer timestep and time scale (seasonal cycles, annual patterns, multiannual variation)

Models - Components

Model elements

- State variables (nitrate, phytoplankton)
- Forcing functions (light, temperature)
- Processes (production, mineralization)
- Parameters (light extinction cofficient, half-saturation constants, grazing rate)

Model requirements

- Physical framework (box volumes, areas, etc)
- Boundary conditions (concentration values at model limits)
- Initial conditions (starting values for model)

Operational models (a.k.a. data assimilation)

- Re-initialised at appropriate time steps

Models - Stages in development

Model Conception

- Objectives of the model
- Components of the model (variables, forcing functions)
- Scope of the model (time and space)
- Limitations and closure

Model Implementation

- Problem decomposition, definition of appropriate sub-models
- Data handling and generation
- Model building (visual, structured programming, OOP)
- Running and testing

Model Calibration

- Tuning parameters and functions using field data

Model Validation

- Testing against an independent dataset

General scheme of a simple ecological model