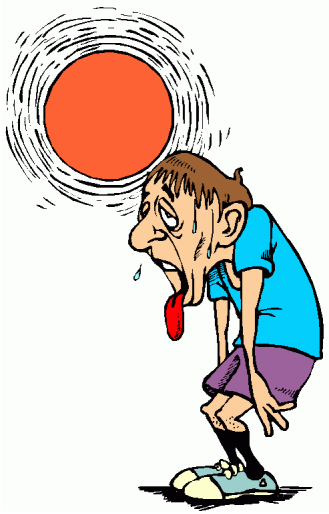
User-Oriented Variables (UOVs) to facilitate communication & development

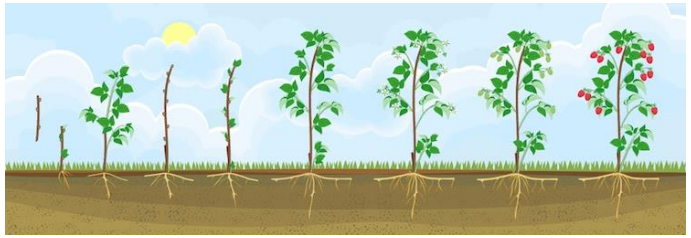
Discomfort Index



Measure of how hot it feels when factoring in the effect that relative humidity has on ability to loose heat through sweating.

$$DI = T - 0.0055(100 - RH)(T - 14.5)$$

Health



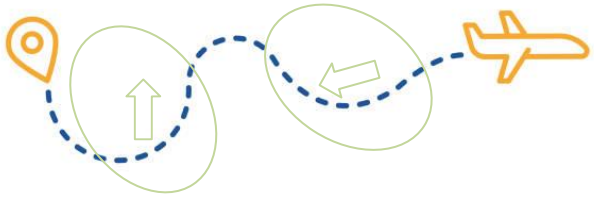
Growing Degree Units

Increases linearly with the with temperature above a threshold T_b (≈7°C for wheat).

$$GDU = \sum_{Day=1}^{n} \text{Max}\left(\frac{T_{max} + T_{min}}{2} - T_b, 0\right)$$

Agriculture

Transport



$$\breve{F}' = \int_{Dep}^{Arr} \boldsymbol{v}_a \cdot \boldsymbol{dl}$$

Uncertainty in the fuel requirement associated with the integral of the predicted along-track winds.

Fuel usage

Energy

$$\breve{P} = v^3$$

Turbines get bigger an more efficient. This is the meteorological component of power.

Wind power

Summary of discussions on User-Oriented Variables (UOVs)

- A set of UOVs could facilitate two-way dialogue
  - Give users a heads-up on relevant performance changes
  - Allow forecasters to learn about key interests and calibration approaches
  - Note: Generic indicators rather than tailored products
- Identify important user sectors and develop/adopt UOVs
  - Health: Discomfort Index, Tmax, Tmin, Air quality
  - Agriculture: Growing Degree Days, Accumulated precipitation, Soil moisture, Frost (late spring)
  - Energy: Wind/Solar power, Heating/Cooling degree days
  - Insurance: Wind force
  - Transport: Fuel usage along a flight path(?)
  - Large-scale user: NAO, PNA, Monsoon, … indices
- Considerations
  - Actionable thresholds (largely extreme)
  - Availability of observations and model data (S2S phase 3 aim for highest spatio-temporal resolution?)
  - Averaging/accumulation period increasing with lead-time
  - Scores (proper), reliability, refinement, sharpness, and user-oriented scores *etc*.
  - Scored against analysis (“potential skill”) and observations (“actual skill”)
  - Flexible software framework (which could expand)
- Speak with key sectors and/or learn from previous/current projects
  - Copernicus Sectoral Information Systems (SIS) and Emergency Management System (EMS)
  - TIGGE learning from S2S (e.g. S2S4E) to develop more seamless verification

User-oriented variables (UOVs): Motivation (with reference to Energy sector)

UOVs might facilitate better two-way communication between forecasters and users. What can the user expect from a system upgrade? What can forecasters learn from calibration approaches?

$$\breve{P} = v^3$$

$$P = \frac{1}{2}\rho A C_p v^3 N_g N_b$$

$\breve{P} =$ User-oriented wind power
$v =$ Wind velocity

$P =$ Wind power
$\rho =$ Air density
$A =$ Rotor swept area
$C_p =$ Coefficient of performance
$v =$ Wind velocity
$N_g =$ Generator efficiency
$N_b =$ Gear box bearing efficiency

Turbines get bigger, performance improves, efficiencies get better, but the key UOV might be v^3