Development of a low-cost meteorological station to measure Essential Climate Variables

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Introduction
- Many regions in the Earth are lacking basic infrastructure to measure interesting atmospheric parameters
- Preliminary research on a low-cost meteorological station to measure essential climate variables (ECV)
- Market niche: especially designed...
  - for (but not limited to) developing countries
  - to meet requirements & standards of international scientific community & organizations for research on the Earth system & climate change monitoring
- Important benefits from acquiring a simple set of ECV:
  - 1°: optimization of irrigation systems & water input into crops
  - 2°: improvement of climate change monitoring:
    - bridging gaps in ECV acquisition: surface air pressure & land surface wind speed & direction
    - allowing for calibration & validation of satellite data & derived products
  - 3°: ease of diffusion of wind energy

Methodology
- Objective: to establish best shelter design using computational fluid dynamics (CFD) software
- Performance simulated in most demanding scenario (from perspective of surface air temp.) - extreme temp. & solar radiation
- Criterion to establish goodness of shelter design:
  "..."accuracy with which surface air temp. is reproduced in a reference point inside the shelter, representing hypothetical position of temp. sensor"

Results & Discussion
- Situation of the market:
  - wide variety of small meteorological stations
  - high-tech, high-performance products for domestic & agricultural markets in developed countries
  - expensive (500 to 8000€ or more)
  - meteorology not a priority in developing countries, usually with more limited budgets
- Potential clients: governments, public administrations & institutions, public & private companies, NGOs, farmers, & transnational or intergovernmental organizations, like Global Climate Observing System (GCOS), Food & Agriculture Organization (FAO), World Climate Research Program (WCRP), World Meteorological Organization (WMO), etc.
- Guidelines & milestones to obtain profitability:
  - supplied by a social enterprise (inclusive business):
    1. ... involves local community
    2. ... price incremental respect to client income
    3. ... enables access to new business opportunities/ways to improve well-being
  - access to fiscal advantages, etc.
- UNFCCC &/or GEOSS may support development & implementation

Conclusions
1) Important benefits from acquiring a simple set of ECV:
   i. breakthrough in agriculture in countries lacking meteorological infrastructure
   ii. help in climate change monitoring
   iii. diffusion of wind energy
2) Low-cost station features competitive advantage respect to equivalent commercial stations in:
   - large markets (developing countries), or
   - particular applications (networks to monitor climate change)
3) Explore this idea... station supplied by a social enterprise
4) Smaller shelters perform better than shelter based on recommendations from the WMO
5) Effects of shelter material, dimensions & design on performance less critical than white paint
6) Shelters made of PVC or rubber, &/or in alternative designs, are probably more interesting if other criteria are taken into account, e.g. whether they make more sustainable, easier &/or cheaper logistics, manufacturing, etc.

Future work
- ... Realization of a feasibility study
- ... Research for support to improve any step in the full development chain including design, product development, prototyping, testing, manufacturing processes, etc.
- ... Fund raising
- ... Further study the facilitation of acquired data to the international community
- ... Design & construction of a prototype to more precisely establish the costs of manufacturing the proposed station
- ... Elaboration of a business plan