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Guest editorial

From basic agrometeorological science to agrometeorological services and information for agricultural decision makers: A simple conceptual and diagnostic framework

Agricultural meteorology beyond the basic understanding of all its aspects has only one aim: providing agrometeorological services and information to farmers and other decision makers in agricultural production. The needs for such services are obviously different for different production systems with different inputs in different climates. Services are particularly sorely missing for low external input sustainable agriculture in warmer climates, but they can use a boost everywhere where environmental conditions are an important factor in yield determination.

Considering the literature one cannot escape the impression that these connections between agrometeorological sciences and services have often got snowed under in the limited scope of many elaborate endeavors. It may, therefore, not be a luxury to consider a conceptual and diagnostic framework in which the connections between our different endeavors are simply pictured but in which a way out is shown towards ultimate emphasis on agrometeorological services and information for decision makers.

1. Recent history

Wieringa (1996), for the COST Action 711, tried to answer the question ‘‘is agrometeorology used well in European farm operations’’? He concluded from widely distributed questionnaires that at that time the statement for Europe that ‘‘most nations provide operational weather services for agricultural users’’ was wishful thinking. The enquiry review learned that the main issue in Europe were problems with the ‘‘free availability of data’’, while the last link in the information chain, ‘‘acceptance and use’’, was also weak. More recently Gommes (2003) confirmed that this situation in very many cases still exists and that in most countries there has never been any serious market research to identify potential customers of agrometeorological services, including commercial customers who would be in a position to pay for services and, indirectly, fund activities aimed at less wealthy ‘‘customers’’. Nevertheless, agrometeorological services are slowly going commercial in Europe and the USA (Stigter, 2006a; WMO, 2007).

I started to explicitly distinguish agrometeorological services and the support systems to such services in 1999, when it was my task to review and summarize the contributions to the WMO/CAgM Workshop ‘‘Agrometeorology in the 21st century: needs and perspectives’’ in Accra, Ghana (Stigter, 1999, 2006b; Stigter et al., 2000). I used that same division among other places in a Workshop for provincial agrometeorologists in Hanoi, Vietnam (Stigter, 2001). To show the need for equipping extension intermediaries with much more substantial information that could serve the local farming systems. Subsequently I further developed and used a conceptual and diagnostic framework (Fig. 1) in my teaching in Africa and Asia, to make clear to my students how far most mainstream agrometeorological science has drifted apart from actually serving agricultural production in more direct ways (e.g. Stigter, 2006b).

I did so in a climate training course for government environmental officers of different background at the Asian Disaster Preparedness Center (ADPC) in Bangkok (Thailand) (Stigter, 2002a) as well as in various University seminars organized for me in Indonesia (e.g. Stigter, 2002b, 2003a) and Sudan.

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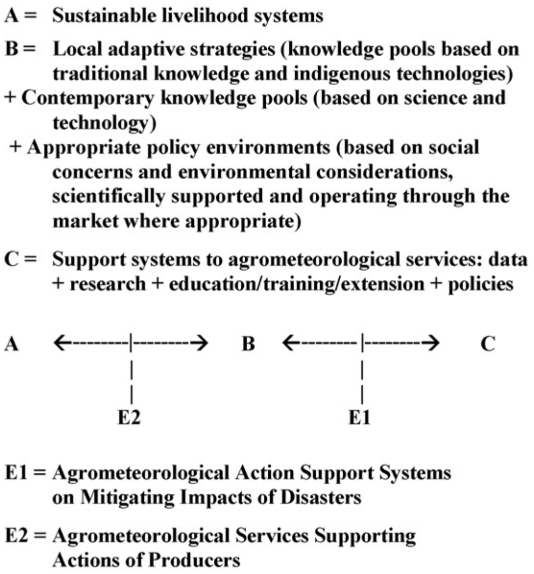

Fig. 1. Conceptual and diagnostic framework picturing generation and transfer of agrometeorological information in an ‘‘end to end’’ system from basic support systems to the livelihood of farmers.

During another WMO/CAgM Workshop, in 2002 in Ljubljana, Slovenia, we used the scheme to demonstrate the position and role of traditional knowledge and indigenous technology to cope with climate variability (Stigter et al., 2005a). I also used it to emphasize the importance of other agrometeorological and agroclimatological information in providing services to farmers in developing countries, in addition to interannual and seasonal climate forecasting, in a WMO/CLIPS expert team meeting in Banjul (the Gambia) (Stigter, 2004). It served in a policy paper presented in Washington in my function in the Management Group (MG) of the Commission for Agricultural Meteorology (CAgM) of WMO as coordinator for support systems in policy making for agrometeorological services (Stigter, 2003b). It was also presented in India and the Philippines (Murthy and Stigter, 2003, 2004) and used as a starting point to elaborately illustrate the need for extension intermediaries in another policy paper for CAgM presented in Brazil at another MG meeting (Stigter et al., 2005b).

2. Definition and examples

We consider belonging to agrometeorological services all agrometeorological and agroclimatological information that can be directly applied to try to improve and/or protect the livelihood of farmers in agricultural production, so yield quantity and quality and income, while safeguarding the agricultural resource base from degradation.

Good examples of such services, including the set up of pilot projects for on-farm validations, which may be abstracted from the WMO/CAgM Accra and Ljubljana Workshops (Sivakumar et al., 2002; Salinger et al., 2005) are (e.g. Murthy and Stigter, 2004):

- the products of agroclimatological characterization, obtained with whatever methodologies;
- advises such as in design rules on above and below ground microclimate management or manipulation, with respect to any appreciable microclimatic improvement: shading, wind protection, mulching, other surface modification, drying, storage, frost protection, etc.;
- advisories based on the outcome of response farming exercises, from sowing window to harvesting time, using climatic variability data & statistics of a recent past or simple on-line agrometeorological information;
- establishing measures reducing the impacts and mitigating the consequences of weather and climate related natural disasters for agricultural production;
- monitoring and early warning exercises directly connected to such already established measures in agricultural production, to reduce the impacts and to mitigate the consequences of weather and climate related natural disasters for agricultural production;
- climate predictions and forecasts and meteorological forecasts for agriculture and related activities, on a variety of time scales, from years to seasons and weeks, and from a variety of sources;
- development and validation of adaptation strategies to increasing climate variability and climate change and other changing conditions in the physical, social and economic environments of the livelihood of farmers;
- specific weather forecasts for agriculture, including warnings for suitable conditions for pests and diseases and/or advises on countervailing measures;
- advises on measures reducing the contributions of agricultural production to global warming and keeping an optimum level of non-degraded land dedicated to agricultural production;
- proposing means of direct agrometeorological assistance to management of natural resources for development of sustainable farming systems in technological advances with strong agrometeorological components.

One of the conclusions in Ljubljana was that the main issues at present are how to make better use of the existing information and to disperse knowledge to the farm level (Salinger et al., 2005). It was also again concluded that agrometeorologists must play an important role in assisting farmers as well as policy makers with the development of feasible coping strategies (also Salinger et al., 2000). This is true for nearly all countries but developing countries are particularly vulnerable.

3. Support systems and a framework in which they operate

The simple distribution between agrometeorological services and support systems to such services was a logical consequence of the presentations in Accra of needs and perspectives in the future of agrometeorology. For that purpose it was sufficient. However, it is insufficient when dealing with direct actions to be supported in agricultural production and farming systems. In discussions within WMO/CAgM (with R. Motha and M.V.K. Sivakumar, private communication, 2001) we realized that with respect to these actions, support in data, research, education/training/extension (e, t and d) and policies are operating at several levels.

I have, therefore, distinguished in the framework (Fig. 1) three action domains. The first one (A) is that of the livelihood of farmers in which the actual services supporting actions of producers (E2 guidance) have to be operated. The second domain is that of the selection/collection and combination of knowledge (B) actually to be used to derive and establish the E2 agrometeorological services. Here are determined the initial and boundary conditions for problem solving in agricultural meteorology.

There are three components in that B domain (e.g. Stigter, 2005): (1) suitable local adaptive strategies based on traditional knowledge and indigenous technologies; (2) selected contemporary knowledge in science and technology; (3) appropriate policy environments based on social concerns and environmental considerations (Norse and Tschirley, 2000). Only a right mix of these three components will deliver the right kind of knowledge and conditions that can be used in developing E2 services.

The third domain (C) distinguished is that of the basic support systems earlier mentioned. To use the right parts from the often full shelves in the support systems offered by the C domain, to compose/construct/select the right mixture in the B domain, guidance is needed from agrometeorological action support systems on mitigating impacts of disasters (E1). Here disasters are defined as all events that considerably diminish yields (quality and quantity) and/or income in the farming systems concerned.

Going from right to left in the domain sequence, the support systems become more and more operational. In the C domain there are a lot of autonomous scientific and technological developments, with respect to theories and methodologies, often little related to E1 or B, certainly with respect to what may be used operationally in developing countries. The E1 systems are representing our good intentions in agrometeorology to diminish the impact and mitigate the consequences of disasters, using selected and coordinated parts of the support systems, that are, therefore, lifted to a higher operational level of immediate usefulness.

However, there remains in many cases a huge gap between E1 and E2 because the use of the support systems has least been lifted, through the again selective and coordinating B domain, to the highest necessary operational level, that of developing and applying E2 services operating in the A domain.

As indicated, data, research, e, t and e and policy support systems to agrometeorological services have in the picture of this framework three levels of operational use. The lowest in the C domain, the highest in the A domain and an essential one in between after the selection and coordination made in the B domain. The first lifting to a higher operational level goes in practice often through the development of E1 Action Support Systems that select knowledge useful in disaster mitigation (or other yield protection/improvement, for that matter). This is insufficient for use of suitable agrometeorological information at the level of the farmers. We have to go through the B domain for a second lift in applicability to get to the operational level relevant in the livelihood of farmers that have to be guided by E2 agrometeorological services.

4. Concluding remarks

Recently, we have been involved in reports on some failures (Lemos et al., 2002; Onyewotu et al., 2003; Stigter, 2004) as well as some successes (Gadgil et al., 2000; Abdalla et al., 2002; Baier, 2004; Al-Amin et al., 2005; Rahimi et al., 2006; Stigter et al., 2005c) in the provision of agrometeorological services in Africa, Asia and Latin America to poor farmers in developing regions. In other cases we dealt with proposals for services that could not yet or only very locally materialize (Olufayo et al., 1998; Oteng'i et al., 2000; Salinger et al., 2000; Ati et al., 2002; Al-Amin et al., 2006; Zhao et al., 2006). Although in the form of case studies, these mostly well-documented examples strongly confirm that particularly in developing countries larger operational qualities of agrometeorological information, made into services, should be obtained. The most important factors in such improvements appear to be:

(i) a much better determination of the actual needs for such information and services in the A domain of decision makers in agricultural production;
(ii) much more explicit attention for agrometeorological information that can be operationally used in E2 services in the A domain;
(iii) training of agrometeorological extension intermediaries, that can be equipped with results obtained in the B domain for use in the A domain; while
(iv) consequences of policy environments and presence/absence of the right mix in the B domain should be understood for the conditions under which operational information must be applied and
(v) an explicit recognition should emerge that very much work done in agrometeorology under E1 in the fields of monitoring, early warning, forecasting, mapping, methodology developments, modeling and quantification, needs to be further lifted into higher operational levels to create actually needed services.

It should finally be realized that ballooning of basic support systems in the C domain is of limited effect on the useful application of agrometeorological information and services in the A domain in the farming systems that need such applications most.

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