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Datasheet for the decision of 27 March 2012

Case Number: T 0438/09 - 3.5.02

Application Number: 05754054.4

Publication Number: 1761906

IPC: G08B 21/10, G08B 31/00

Language of the proceedings: EN

Title of invention:
Method and system for automated location-dependent recognition of flood risks

Applicant:
Swiss Reinsurance Company Ltd.

Headword:
-

Relevant legal provisions:
EPC Art. 84

Keyword:
"Clarity - yes (after amendment)"

Decisions cited:
-

Catchword:
-

Case Number: T 0438/09 - 3.5.02

D E C I S I O N
of the Technical Board of Appeal 3.5.02
of 27 March 2012

Appellant: (Applicant)	Swiss Reinsurance Company Ltd. Mythenquai 50/60 CH-8022 Zürich (CH)
Representative:	Braun, André jr. Braunpat Braun Eder AG Reussstrasse 22 Postfach CH-4015 Basel (CH)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted 17 October 2008 refusing European patent application No. 05754054.4 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: M. Ruggiu
Members: M. Rognoni
R. Moufang

Summary of Facts and Submissions

I. The appellant (applicant) appealed against the decision of the examining division refusing European patent application no. 05 754 054.4.

II. In the contested decision, the examining division held that the subject-matter of claims 1 and 24 was not clear within the meaning of Article 84 EPC and that, therefore, the request to grant a patent on the basis of such claims had to be refused under Article 97(2) EPC.

III. Oral proceedings were held before the Board on 27 March 2012.

IV. The appellant requested that the decision under appeal be set aside and that the case be remitted to the department of first instance for further prosecution on the basis of independent claims 1 and 24 filed at the oral proceedings.

V. Claim 1 according to the appellant's request reads as follows:

"Signalling system for automated location-dependent recognition of flood risks, comprising:

a central unit (20) that comprises a multi-dimensional lookup table (203) corresponding to a spatial high resolution grid of a specific geographic territory, flood risk factors (P) being associated with the grid and indicating a flood frequency within a grid cell, the flood risk factors (P) being calculated through interpolation based on flood zone tables associated with the specific geographic territory depending on a respective grid cell's horizontal distance and/or elevation difference to a river and/or drainage area,

the central unit (20) further comprising a correlation-module (21) for generating, on the basis of a relationship linking flood risk factors and river discharge parameters with water depths, an event-specific probabilistic water depth value (4) in a grid cell,

the system further comprising distributed gauging stations (5/30/31/32) arranged in a low spatial resolution in relation to the grid, and configured to determine river discharge parameters (T) and to transmit the river discharge parameters (T) over a network (50) to the central unit (20), the river discharge parameters comprising at least values for a return period as a measure of intensity of flood events, and

the system further comprising a module configured to signal a flood risk in a grid cell according to the probabilistic water depth value (H) generated by the correlation module from the transmitted river discharge parameters."

Independent claim 24 reads as follows:

"Method for automated location dependent recognition of flood risks, comprising the steps of generating a spatial high resolution grid for a specific geographic territory and associating flood risk factors (P) with the grid, the flood risk factors indicating a flood frequency within a grid cell and being calculated through interpolation based on flood zone tables associated with a specific geographic territory depending on a respective grid cell's horizontal distance and/or elevation difference to a river and/or drainage area,

determining a relationship linking flood risk factors and river discharge parameters with water depths for generating by a correlation module an event-specific probabilistic water depth value (H) for a flood event in a grid cell,

determining river discharge parameters (T) by distributed gauging stations (5/30/31/32) arranged in a low spatial resolution in relation to the grid of the flood risk factors (P), the river discharge parameters comprising at least values for a return period as a measure of intensity of flood events,

signalling a flood risk in a grid cell according to the probabilistic water depth value (H) generated by the correlation module from the transmitted river discharge parameters."

VI. The arguments of the appellant relevant to the decision can be summarized as follows:

An important aspect of the present invention was the generation of a flood frequency map (p-map) which associated flood risk values to the cells of a high resolution grid overlying the map of a specific territory. The flood risk factors were calculated through interpolation on the basis of flood zone tables and depending on the grid cell's distance and/or elevation with respect to a river and/or drainage areas. The possible interpolation routines were not shown in the application because they were well-known to the skilled person.

Another essential aspect of the invention was the determination of a relationship linking flood events of different intensities (*i.e.* different return periods T) and flood risk factors to the water depths to be expected in corresponding grid cells. This relationship of the kind shown in Figures 8 and 9 was obtained by analysing historical records as provided by flood maps. The data processing required to arrive at the relationship was also well-known to a skilled person. Once determined, this relationship could be used to assess the damage risk in a given grid cell of the region of interest as function of the cell's risk factor and of the intensity of a flood event. In conjunction with distributed gauging stations for determining river discharge parameters the above relationship would provide a real-time assessment of the probable water depth in case of a monitored flood event.

For the skilled reader, the independent system claim 1 and the independent method claim 24 comprised all the features required to define in a clear and concise manner the present invention in its essential aspects. Hence, they complied with the requirements of Article 84 EPC.

Reasons for the decision

1. The appeal is admissible.

2.1 The present application deals essentially with the problem of assessing how a certain area of a specific region is likely to be affected by a flood event of a given intensity. As customary in the field, the impact of a flood event in a certain area is expressed in terms of "water depth", whereas a measure of flood intensity is the flood event's return period (T), *i.e.* the probability that a flood event occurs in a given year. Thus, a flood with a 1% probability of occurring in a given year is defined as a 100-year flood event.

2.2 The gist of the invention consists essentially in overlaying the map of a region with a high resolution grid and in associating each cell of a grid with a flood risk factor. A relationship linking flood risk factors and return periods with water depths is then used to determine the water depth in a given cell as a function of the cell's flood risk factor and of the flood event's intensity (*i.e.* return period).

3.1 The essential question to be considered in the present appeal is whether the independent claims 1 and 24 of the appellant's request satisfy the requirements of Article 84 EPC.

3.2 Claim 1 relates to a *"Signalling system for automated location-dependent recognition of flood risks"* comprising the following features:

(a) a central unit that comprises a multi dimensional lookup table corresponding to a spatial high resolution grid of a specific geographic territory,

(a_1) flood risk factors being associated with the grid and indicating a flood frequency within a grid cell,

(a_2) the flood risk factors being calculated through interpolation based on flood zone tables associated with the specific geographic territory depending on a respective grid cell's horizontal distance and/or elevation difference to a river and/or drainage area,

(b) the central unit further comprising a correlation-module for generating,

(b_1) on the basis of a relationship linking flood risk factors and river discharge parameters with water depths,

(b_2) an event-specific probabilistic water depth value in a grid cell

(c) the system further comprising distributed gauging stations

(c_1) arranged in a low spatial resolution in relation to the grid, and

(c_2) configured to determine river discharge parameters and to transmit the river discharge parameters over a network to the central unit,

(c_3) the river discharge parameters comprising at least values for a return period as a measure of intensity of flood events,

(d) the system further comprising a module configured to signal a flood risk in a grid cell according to the probabilistic water depth value generated by the correlation module from the transmitted river discharge parameters.

4.1 Features (a), (a_1) and (a_2) relate to a first aspect of the present invention which consists in creating a *"high resolution grid of a specific territory"*, assessing *"flood risk factors"* for said specific territory and assigning a risk factor to each element of the grid (*i.e.* to each *"grid cell"*).

As explained in the description of the published application (see page 10, line 32 to page 11, line 3) the lookup table of the central unit corresponds to a high resolution grid based on decentralized measurements of flood risk factors of a specific territory, whereby the flood risk factors reflect the averaged flood frequency and/or susceptibility to flooding within a grid cell.

4.2 For the sake of example, the flood frequency map of North Carolina (NC) is shown and explained as follows:

"Figure 11 shows an elevation model of NC with the mentioned zones. Between Cape Hatteras and Cape Fear some regions are often affected by hurricanes. For the flood frequency map (or P-map) the grid can e.g. consist of values between 0 (never flooded) and 1 (always flooded) indicating the susceptibility to flooding. In this example the values can e.g. be derived from the First American 100-year flood zones, the digital elevation model and the river network. As mentioned, the flood frequency map, i.e. the flood risk values associated with the grid, can e.g. consist of values between 0 (never flooded) and 1 (always flooded) indicating the susceptibility to flooding of each location (latitude, longitude). The values of the flood risk factors (P) between 0 and 1 can be related directly to flood frequency, for example P=0.58 stands for the 100-year flood zone. Of course, other flood zones could be chosen as e.g. flood zones with a certain other return period (50-, 100-, 250-, 500-years). The flood zones can be determined based on geomorphologic parameters such as the horizontal distance and elevation difference to the next river and/or the drainage area. The data in this example were e.g. validated with FEMA data from the USA and proofed good results in several countries (CZE, UK, SVK, BEL)" (page 11 of the published application, lines 13 to 30 - emphasis added).

4.3 In other words, the flood risk factor is a parameter, in the example ranging from 0 to 1, which indicates the susceptibility to flooding of a certain area of territory covered by a grid cell, whereby the flood risk is defined with respect to a typical flood event which has a certain probability of occurring within a given year, so that a flood with a probability of 1% is customarily described as a 100-year flood event. Thus, on the basis of geomorphological parameters and historical data a parameter indicative of the flood risk in a given grid cell is defined.

As implied by feature (a_2), the risk factors which cannot be derived directly from flood tables are calculated through interpolation depending on the grid cell location with respect to a river and/or a drainage area.

4.4 The application does not show any particular interpolation method for calculating flood risk factors or explain why a flood risk factor P=0.58 stands for the 100-year flood zone in the given example. The processing steps involved in this calculation are merely generally outlined on page 12 of the description.

However, the appellant has convincingly shown that the data and model required to perform the interpolation according to feature (a_2) are well-known to a skilled person who is familiar, for instance, with the meteorological archival and retrieval system of ECMWF (European Centre for Medium-Range Weather Forecasts). Thus, in the light of the expert knowledge to be expected in the field of the invention, the Board finds that features (a), (a_1) and (a_2) are clear within the meaning of Article 84 EPC.

5.1 A further important aspect of the present invention is the relationship which links flood exposure (expressed by the flood risk factors P) and flood events characterized by certain return periods T (*e.g.* a 50-, 100-, or 250-year flood event) to the water depths in the grid cells of a certain region affected by flooding. This relationship, typically illustrated by the diagrams of Figure 8 and 9, can then be used to determine the water depth which is likely to occur in a specific grid cell with a flood risk factor P in case of a flood event of a certain intensity.

As pointed out in the description (application as published, page 14, line 31 to page 16, line 16), a relationship between probable flood events and their impact in terms of water depths on a territory characterized by a certain susceptibility to flooding is determined by analysing a probabilistic flood event set of a known territory. In the example, the set consisted of a large number (973) of flood maps indicating the water depth at each flooded cell with a resolution of 50 m.

5.2 In the light of the description, there can be no doubt that feature (b_1) implies the evaluation and processing of flood records, such as flood maps, in order to obtain a relationship of the kind shown in Figures 8 and 9. An analytical expression of this relationship is given on page 15 of the description.

6.1 Feature (b_2) relates to the evaluation of the probable water depth in a grid cell with a certain risk factor in the case of a certain flood event. The water depth is obtained as a function of the grid cell's flood risk factor and of the flood event's return period T by means of the relationship referred to in feature (b_1).

6.2 The Board accepts that it is not necessary to define the relationship more precisely because it is to be assumed that the skilled person would know how to analyze the historical data in order to arrive at an analytical expression or a lookup table expressing said relationship. Furthermore, the description gives on page 15 and in claim 15 of the published application an analytical expression for this relationship and some values for its parameters.

Thus, the Board finds that features (b), (b_1) and (b_2) define the constitution and function of the correlation module in a manner sufficiently clear for the skilled person.

7.1 As specified by features (c), (c_1), (c_2), (c_3) and explained on page 13 (last paragraph) of the description, the system of the invention further comprises distributed gauging stations for determining river discharge parameters which are transmitted to the central unit.

7.2 Although the description specifies that gauging stations are distributed within a grid cell, it is evident that that there must be fewer gauging stations than grid cells, because the gauging stations are necessarily located in the vicinity of rivers and not all cells can be close to a river. Furthermore, it is specified in the application as filed (see claim 7) that the gauging stations are located in a low spatial resolution with respect to the grid.

7.3 The description also explains in detail how return periods are determined (see first half of page 15 of the published application) and, in particular why the return period is a useful measure of intensity of flood events (see page 14, second paragraph).

8.1 The last module specified by feature (d), which constitutes the link between the central unit (b) and the data provided by the distributed gauging stations, is meant to signal a flood risk in terms of the water depth value determined by the correlation module as a function of the discharge parameters (return period) transmitted by the gauging stations.

8.2 In the light of the preceding features, it is implicit that the water depth value referred to in feature (d) is generated on the basis of the relationship used by the correlation module and of a flood intensity expressed in terms of the corresponding return period.

9.1 Claim 24 relates to a method for automated location dependent recognition of flood risks comprising the following steps and features:

(a') generating a spatial high resolution grid for a specific geographic territory and associating flood risk factors with the grid,

(a'_1) the flood risk factors indicating a flood frequency within a grid cell and

(a'_2) the flood risk factors being calculated through interpolation based on flood zone tables associated with a specific geographic territory depending on a respective grid cell's horizontal distance and/or elevation difference to a river and/or the drainage area,

(b_1') determining a relationship linking flood risk factors and river discharge parameters with water depths

(b') for generating by a correlation module

(b'$_2$) an event-specific probabilistic water depth value for a flood event in a grid cell,

(c'$_1$) determining river discharge parameters

(c') by distributed gauging stations arranged in a low spatial resolution in relation to the grid of the flood risk factors,

(c'$_2$) the river discharge parameters comprising at least values for a return period as a measure of intensity of flood events,

(d') signalling a flood risk in a grid cell according to the probabilistic water depth value generated by the correlation module from the transmitted river discharge parameters.

9.2 It is self-evident that there is a direct correspondence between (a) to (d) of claim 1 and (a') to (d') of claim 24, so that it can be concluded that also claim 24 satisfies Article 84 EPC.

10.1 In summary, the Board finds that, although some of the wording used in the independent claims may appear rather general and abstract, claims 1 and 24 as a whole give a definition of the invention which is sufficiently clear and complete for a person skilled in the relevant technical fields.

10.2 Hence, independent claims 1 and 24 comply with the requirements of Article 84 EPC. Furthermore, the Board is satisfied that the subject-matter now covered by the independent claims does not extend beyond the content of the original application, as understood by the skilled reader (Article 123(2) EPC).

11.1 In view of the fact that, in the contested decision, the examining division examined only the clarity of independent claims 1 and 24 and in particular did not consider the novelty and/or inventive step of the claimed subject-matter, the Board finds that it would not be expedient, at this stage in the proceedings, to examine whether the dependent claims currently on file satisfy the requirements of Article 84, since, depending on the result of the further prosecution of this case by the first instance, the claims may be further amended.

11.2 Under these circumstances, the Board considers it appropriate to make use of its power under Article 111(1) EPC and to remit the case to the department of first instance for further prosecution on the basis of independent claims 1 and 24 according to the appellant's request.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance for further prosecution on the basis of independent claims 1 and 24 filed at the oral proceedings of 27 March 2012.

The Registrar: The Chairman:

U. Bultmann M. Ruggiu