Available online at www.sciencedirect.com
SciVerse ScienceDirect
Procedia Engineering 26 (2011) 1157 – 1167
Procedia Engineering
www.elsevier.com/locate/procedia

First International Symposium on Mine Safety Science and Engineering

Coal Mine Gas Emission Gray Dynamic Prediction

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Abstract

This paper introduces three kinds of mathematical prediction models: grey prediction, new information, and metabolism. The three prediction models were verified and analyzed by the example of the mine in Hegang,as a result, it is showed that the new information model predictions' result was more accurate, the information model combines with the monitoring system can realize the dynamics of coal mine gas emission projections.

Keywords: Grey prediction,gas emission,dynamic

1. Introduction

The amount of the mine gas emission is one of the important parameters which directly affects the size of mine ventilation plan, the design of mine, and the safety technical measure's implementation. And the fast and accurately forecast to the gas emission has the important meanings to both of the design of mine and safety production. We must be prior to forecast the situation of the mine gas emission in the process of exploitations to the coal seam which has high content of gas.

2. Emission affecting factor analysis

Usually, there are many factors in the affections of the amount of mine gas emission, such as regional geological conditions, the coal metamorphism degrees, mining methods, atmospheric pressure changes

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doi:10.1016/j.proeng.2011.11.2286

and other factors, so in the mine gas emission prediction, it is difficult to think about these factors comprehensively and accurately, and the data acquisition is very difficult too. The research object of the grey system theory is part of information known, part of the information unknown small samples , poor information, uncertainty system. It can be predicted by little data, and the forecasting accuracy can also meets the need. So that it can choose grey system to forecast the gas emission amount.

3. Model building

The start point of grey system theory is the research to the output sequence of system but not too much relates to the system's structure and input, the demand of the original data length is not high, therefore, grey forecasting model can overcome the defect of the general model of hard analysis to gas emission factors and dealing with the mutation data .Through the establishment of simple mathematical model, to treat all kinds of complicated factors of the influence of the amount of gas emission with "grey processing" greatly reduce the difficulty of the data model's building and calculation and the dependent on it, and the forecasting accuracy can also satisfy the needs.

3.1. Gas forecast basic model

Grey prediction model is based on grey generation functions, a kind of method using the differential fitting as the core . Grey forecast theory finds that all random variables are grey ash and process change within a certain range, a certain moment , to the amount of grey its handling isn't seeking its statistical law and distribution laws, but dealing with the original data through certain desultorily approach, making it to become more regular time series data, and to the processing of the original data: one is to provide middle information to build models ; two is to weak the volatility of the original data[1] [2] [3] .

To the grey prediction model, parameters should accord to the sequence of the three conditions , to test three conditions of grey modeling is very difficult, therefore, in practice, normally according to the size of the grade of the original sequence $(\sigma^{(0)}(k))$ to judge the feasibility of the model. Sets the already test gas emission amount as $X^{(0)}$, then:

$$(X^{(0)}(1), X^{(0)}(2), X^{(0)}(3), \Lambda, X^{(0)}(n)) \tag{1}$$

$$\sigma^{(0)}(k) = \frac{x^{(0)}(k-1)}{x^{(0)}(k)}, k \in n \tag{2}$$

Only when $\sigma^{(0)}(k) \in (0.1353, 7.389)$, can set a model, usually the model practice condition is $\sigma^{(0)}(k) \in (e^{\frac{-2}{n+1}}, e^{\frac{2}{n+1}})$ .In type "n" according to actual needs of precision can take more than 3 number. The data has been detected a accumulate, weaken its randomness, after accumulated, the data showed exponentially increase trend, access to new data series:

$$x^{(1)}(k) = \sum_{i=1}^{k} x^{(0)}(i) \quad (k = 1,2,3......n) \tag{3}$$

The data set accumulate for $X^{(1)}$

$$X^{(1)} = (x^{(1)}(1), x^{(1)}(2), x^{(1)}(3), \Lambda, x^{(1)}(n)) \tag{4}$$

The grey prediction modeling building idea is directly turning the time series into differential equation, and establishing the abstract developed and changed dynamic model .The general model, as GM(*h*,*m*) model, is the differential equation in the time continuous function type, in parentheses *h* present the order number of differential equation, *m* present the number of variables, namely:

$$\frac{d^h(x_1^{(1)})}{dt^h}+a_1\frac{d^{h-1}(x_1^{(1)})}{dt^{h-1}}+a_2\frac{d^{h-2}(x_1^{(1)})}{dt^{h-2}},\ldots,+a_h x_1^{(1)}=\sum_{i=1}^{m-1}b_i x_{i+1}^{(1)}\quad i\in(i=1,2\ldots m-1) \tag{5}$$

In type the development grade a_h and the grey coefficient role b_i can be calculated by the least square method .

Commonly use GM(h,m) model as single sequence order linear dynamic model GM (1, l), that has only one variable amount GM model, because the greater h is, more complex calculation is, and the precision is not high, therefore, h is commonly 3 rank bellow, the most common h =1,then it is GM(1,1), the differential equation model for (6):

$$\frac{dx^{(1)}}{dt}+ax^{(1)}=b \tag{6}$$

Coefficient vector $\hat{a}=[a,b]$， Accumulate matrix B for

$$B=\begin{bmatrix} -\frac{1}{2}(x^{(1)}(1)+x^{(1)}(2)) & 1 \\ -\frac{1}{2}(x^{(1)}(2)+x^{(1)}(3)) & 1 \\ \vdots & \vdots \\ -\frac{1}{2}(x^{(1)}(n-1)+x^{(1)}(n)) & 1 \end{bmatrix} \tag{7}$$

$$Y_n=\left[x^{(0)}(2),x^{(0)}(3),x^{(0)}(4),\ldots,x^{(0)}(n)\right]^T \tag{8}$$

Method of least square

$$\hat{a}=(B^tB)^{-1}BY_n \tag{9}$$

Into the differential equation, obtained to be a function of time, And let $x^{(1)}(0)=x^{(1)}(0)$,Then

$$\hat{x}(t+1)=(x^{(1)}(1)-\frac{b}{a})e^{-at}+\frac{b}{a} \tag{10}$$

Reduction

$$x^{(0)}(t+1)=\hat{x}^{(1)}(t+1)-\hat{x}^{(1)}(t) \tag{11}$$

$$x^{(0)}(t+1)=\hat{x}^{(1)}(t+1)-\hat{x}^{(1)}(t)=(x^{(1)}(1)-\frac{b}{a})e^{-at}-(x^{(1)}(1)-\frac{b}{a})e^{-a(t-1)} \tag{12}$$

So that get *a* is not effective to the model of all, must meet $a\in(-2,2)$ to ensure the effectiveness of the model. Their value *a* can be different situations of prediction: when $-a\leqslant0.3$, GM (1, 1) can be used to forecast to middle or long-term forecast; When $0.3<-a\leqslant0.5$, GM (1, 1) can be used to the short-term forecast, middle or long-term forecast should carefully use; When $0.5<-a\leqslant0.8$, with GM (1, 1) should be very cautious about short-term predictions; When $0.8 < -a \leqslant 1$, should use residual fixed GM (1, 1) model, When-a>1, unfavorably use GM (1, 1) model.

3.2. Dynamic model building

Coal mine underground gas emission forecasting should realize dynamic prediction and timely reflect the change trend of gas concentration,. Dynamic prediction has new information model and metabolism model two kinds, needs to choose the dynamic grey prediction model as the actual situation according to the concrete situation conform. $x^{(0)}(n+1)$ as the latest information , $x^{(0)}(n+1)$ will be put into $X^{(0)}$, says, the model build with $X^{(0)} = (x^{(0)}(1), x^{(0)}(2), x^{(0)}(3), \Lambda, x^{(0)}(n), x^{(0)}(n+1))$ as the new information model; Put into the latest information $x^{(0)}(n+1)$, remove the old information $x^{(0)}(1)$, says the model build with $X^{(0)} = (x^{(0)}(2), \Lambda, x^{(0)}(n), x^{(0)}(n+1))$ as metabolism model[4] [5] [6].

Special working environment of coal mine safety requirements must be put in the first place, prediction to the model reliability, efficiency is very important. Static prediction model is suitable for the development trend in rules of the short-term forecast; New information forecasting model shall apply to the prediction process which has not determined signal interference, and can alleviate the interference in sudden; The metabolism model is sensitive to the sudden interfering signal through the prediction process, and more suitable for the situation of that the prediction change trend which was not in rules, and can quickly reflect the trend of the amount of the gas emitted from the coal mine .

3.3. Aaccuracy testing

Through the model calculate the error between the gas emission amount $\hat{x}^{(0)}(k)$ and the measured data of the gas emission $x^{(0)}(k)$, namely, $e^{(0)}(k) = \dfrac{x^{(0)}(k) - \hat{x}^{(0)}(k)}{x^{(0)}(k)}$, judge the model whether meet the requirements, the general $|e^{(0)}(k)| < 20\%$, the best $|e^{(0)}(k)| < 10\%$, then the accuracy is:

$$p^0 = (1 - e^0(avg)) \times 100\%, \quad e^0(avg) = \frac{1}{n-1}\sum_{k=2}^{n} |e^0(k)| \times 100\% \tag{13}$$

Usually, the change of the amount of gas emission from coal mine is slow, which can satisfy the need of a grey prediction model, but also needs strict inspection to the forecast results , when the error is over a certain range, must adjust or fixed the model.

4. Example

One coal mine in Hegang of Heilongjiang province, equipped a safety monitoring system, monitoring center is set in mine office. One host, type as KJ80, one computer and 2 underground stations , type as AK201C. The system is composed of methane sensor, fan stopped switch sensor, carbon monoxide sensor, temperature sensor.

Inspection data of gas emission from August 4 to August 18 was shown on the table 1 and used the data from August 4 to August 13 as initial data to predict by the model of grey predicting, new information predicting and metabolism predicting.

Because the gas emission's changing is smaller and for fully studying on the rules of original data, it is using AGO sequence $X^{(2)}$ after the secondary accumulating to establish mathematical model.

Table 1. Gas emission on working place in ×× coal mine from August 4 to August 13 on 2009

Date	8.4	8.5	8.6	8.7	8.8	8.9	8.10	8.11	8.12	8.13	8.14	8.15	8.16	8.17	8.18
Gas emission （m^3/min）	0.69	0.67	0.63	0.75	0.67	0.69	0.73	0.73	0.67	0.71	0.69	0.65	0.59	0.61	0.63

4.1. Grey Predicting

$X^{(0)}(k)$ =(0.69,0.67,0.63,0.75,0.67,0.69,0.73,0.73,0.67,0.71)

（1）Testing Class Ratio

- Calculating class ratioσ(k) ,according to σ(k)=x(k-1)/x(k),to get：

  σ(k)= (1.0299,1.0635,0.84,1.1194,0.971,0.9452,1,1.0896,0.9437)

- Judging Class Ratio

Because the number of series data is 10,according to the judgeing formula of $\sigma^{(0)}(k), \sigma^{(0)}(k) \in \left(e^{\frac{-2}{n+1}}, e^{\frac{2}{n+1}}\right)$,to get $\sigma^{(0)}(k) \in$(0.8338.1.1994). Based on $\sigma^{(0)}(k)$： all data points are among the acceptable range,so we can establish model of GM(1.1).

（2）Establishing Model of GM(1,1)

- Modeling Sequence

Sequence $X^{(0)}(k)$ of initial data、Sequence $X^{(1)}(k)$ of once accumulating AGO data、Sequence $Z^{(2)}(k)$ is average value of the secondary accumulating AGO data $X^{(2)}(k)$ and $X^{(2)}(k)$,as Table 2 shown.

Table 2. Modeling sequence of grey predicting

Sequence \ Number	K=1	K=2	K=3	K=4	K=5	K=6	K=7	K=8	K=9	K=10
$X^{(0)}(k)$ grey prediction	0.69	0.67	0.63	0.75	0.67	0.69	0.73	0.73	0.67	0.71
$X^{(1)}(k)$ grey prediction	0.69	1.36	1.99	2.74	3.41	4.1	4.83	5.56	6.23	6.94
$X^{(2)}(k)$ grey prediction	0.69	2.05	4.04	6.78	10.19	14.29	19.12	24.68	30.91	37.85
$Z^{(2)}(k)$ grey prediction	——	1.37	3.045	5.41	8.485	12.24	16.705	21.9	27.795	34.38

- Calculating Intermediate Parameters

$$C=\sum_{k=2}^{n} Z^{(2)}(k)=131.33 \qquad D=X^{(2)}(10)-X^{(2)}(1)=37.85-0.69=37.16$$

$$E=\sum_{k=2}^{n} Z^{(2)}(k)X^{(1)}(k)=716.12 \qquad F=\sum_{k=2}^{n} Z^{(2)}(k)\Lambda 2=2975.48$$

- Calculating GM(1.1) Parameters a,b

  a= Δa /Δ b= Δb /Δ

  Δa is calculated the following formula Δa =CD-(n-1)E=-1564.85

  Δ is calculated as the following formula Δ =(n-1)F-C^2=9531.75

  Δ*b* is calculated as the following formula Δ*b* =DF-CE=16520.8

  so a=-0.1642, b=1.7332.

- Choose Model

  Defined (GM(1.1)

  $X^{(1)}$(k)+a $z^{(2)}$(k)= b ⇒ $X^{(1)}$(k)-0.17 $z^{(2)}$(k)= 1.74

  GM(1.1) the whitening response formula

  $\hat{x}^{(2)}$ =（$X^{(1)}$(1)-b/a）e^{-ak} +b/a

  so $\hat{x}^{(2)}$（k+1）=11.2457 $e^{0.1642k}$ -10.5557

  $\hat{x}^{(1)}$（K+1）= $\hat{x}^{(2)}$（k+1）- $\hat{x}^{(2)}$（k）

（3）Testing Residuals

To list the table of calculated values to test residuals, according to the table we can know the following. ε(avg)=10.8690% ,p0 =(1-ε(avg))100%=89.131%,grey prediction error of metabolism prediction is within the allowable range.

（4）Predicting

Based on the whitening response formula $\hat{x}^{(2)}$（k+1）=11.2457 $e^{0.1642k}$ -10.5557,Substituting k=10,11,12,13,14,15 into the whitening response formula, the results of sliding scale are：$X^{(0)}(11)_{\text{grey prediction}}$=1.332, $X^{(0)}(12)_{\text{grey prediction}}$=1.5697 , $X^{(0)}(13)_{\text{grey prediction}}$=1.8498, $X^{(0)}(14)_{\text{grey prediction}}$=2.1799, $X^{(0)}(15)_{\text{grey prediction}}$=2.569.

4.2. Grey new information prediction

$x^{(0)}(n+1)$ is the newest information(injection：$x^{(0)}(n+1)$ is the actual gas emission),Substituting $x^{(0)}(n+1)$ into $X^{(0)}(k)$,so using $X^{(0)}=(x^{(0)}(1),x^{(0)}(2),\Lambda,x^{(0)}(n),x^{(0)}(n+1))$ to establish prediction is new information prediction model $x^{(0)}(n+1)$.

The actual gas emission from August 4 to August 14 on the working place is the initial data , so：

$X^{(0)}(k)$ =(0.69,0.67,0.63,0.75,0.67,0.69,0.73,0.73,0.67,0.71,0.69)

（1）Testing Class Ratio

- Calculating class ratio σ(k)

  according to σ(k)=x(k-1)/x(k)

so : $\sigma^{(0)}(k)$=(1.0299,1.0635,0.84,1.1194,0.971,0.9452,1,1.0896,0.9437,1.029)

- Judging Class Ratio

Because the number of series data is 11,according to the judgeing formula of

$\sigma^{(0)}(k), \sigma^{(0)}(k) \in \left(e^{\frac{-2}{n+1}}, e^{\frac{2}{n+1}} \right)$,so we get

$\sigma^{(0)}(k) \in$(0.8465.1.1814),Based on $\sigma^{(0)}(k)$, all data points are among the acceptable range,so we can establish model GM(1, 1).

（2）Establishing Model of GM(1. 1)

- Modeling Sequence

New information prediction model initial sequence is $X^{(0)}(k)$, sequence AGO is $X^{(1)}(k)$,sequence AGO is $X^{(2)}(k)$,sequence $Z^{(2)}(k)$ is average value of sequence $X^{(2)}(k)$,as Table 3 shown.

Table 3 Modeling sequence of new information prediction

sequence \ Number	K=1	K=2	K=3	K=4	K=5	K=6	K=7	K=8	K=9	K=10	K=11
$X^{(0)}(k)_{\text{new information prediction}}$	0.69	0.67	0.63	0.75	0.67	0.69	0.73	0.73	0.67	0.71	0.69
$X^{(1)}(k)_{\text{new information prediction}}$	0.69	136	1.99	2.74	3.41	4.1	4.83	5.56	6.23	6.94	7.63
$X^{(2)}(k)_{\text{new information prediction}}$	0.69	2.05	4.04	6.78	10.19	14.29	19.12	24.68	30.91	37.85	45.48
$Z^{(2)}(k)_{\text{new information prediction}}$	——	1.37	3.045	5.41	8.485	12.24	16.705	21.9	27.795	34.38	41.67

- Calculating Intermediate Parameters

C= $\sum_{k=2}^{n} Z^{(2)}(k)$ =173 D= $X^{(2)}(11) - X^{(2)}(1)$ =45.48-0.69=44.79

E= $\sum_{k=2}^{n} Z^{(2)}(k) X^{(1)}(k)$=1034.07 F= $\sum_{k=2}^{n} Z^{(2)}(k) \Lambda 2$ =4711.87

- Calculating GM(1, 1) Parameters a,b

a= $\Delta a/\Delta$ b= $\Delta b/\Delta$

Δa is calculated as the following formula Δa=CD-(n-1)E=-2592.03

Δ is calculated as the following formula Δ =(n-1)F-C^2=17189.7

Δb is calculated as the following formula Δb =DF-CE=32150.55

so a=-0.15,b=1.87.

- Choosing Model

Defined GM(1, 1)

$X^{(1)}$(k)+a $z^{(2)}$(k)= b ⇒ $X^{(1)}$(k)-0.15 $z^{(2)}$(k)= 1.87

GM(1.1) the whitening response formula

$\hat{x}^{(2)}$（k+1）=（$X^{(1)}$(1)-b/a）e^{-ak} +b/a

$X^{(1)}$(1)=0.69, b/a=-12.4667

$\hat{x}^{(2)}$（k+1）=13.1567 $e^{0.15k}$ -12.4667

$\hat{x}^{(1)}$（K+1）= $\hat{x}^{(2)}$（k+1）- $\hat{x}^{(2)}$（k）

（3）Testing Residuals

To list the table of calculated values to test residuals, according to the table we can know the following.：

ε(avg)=11.7538%,p^0=(1-ε(avg))100%=88.2462% ,new information prediction error of metabolism prediction is within the allowable range.

（4）Predicting

Based on the whitening response formula

$\hat{x}^{(2)}$（k+1）=13.1567 $e^{0.15k}$ -12.4667

$\hat{x}^{(1)}$（K+1）= $\hat{x}^{(2)}$（k+1）- $\hat{x}^{(2)}$（k）

Substituting k=11,12,13,14,15 into the whitening response formula,the results of sliding scale are $X^{(0)}(11)_{\text{new information prediction}}$=1.144, $X^{(0)}(12)_{\text{new information prediction}}$=1.3292, $X^{(0)}(13)_{\text{new information prediction}}$=1.5443, $X^{(0)}(14)_{\text{new information prediction}}$=1.7942, $X^{(0)}(15)_{\text{new information prediction}}$=2.0846.

4.3. Grey metabolism model prediction

Changing the oldest information $X^{(0)}(1)$ with the newest information $X^{(0)}(n+1)$ and using $X^{(0)} = (x^{(0)}(2), \Lambda, x^{(0)}(n), x^{(0)}(n+1))$ to establish model is metabolism prediction model. So $X^{(0)}(k)$ = (0.67,0.63,0.75,0.67,0.69,0.73,0.73,0.67,0.71,0.69).

（1）Testing Class Ratio

- Calculating class ratio σ(k)

according to σ(k)=x(k-1)/x(k)

so $\sigma^{(0)}(k)$= (1.0635,0.84,1.1194,0.971,0.9452,1,1.0896,0.9437,1.029)

- Judging Class Ratio

Because the number of series data is 10,according to the judgement formula of $\sigma^{(0)}(k), \sigma^{(0)}(k) \in \left(e^{-\frac{2}{n+1}}, e^{\frac{2}{n+1}} \right)$,so we can get $\sigma^{(0)}(k) \in$(0.8338.1.1994) Based on $\sigma^{(0)}(k)$ all data points are among the acceptable range ,so we can establish model of GM(1.1).

（2）Establishing Model of GM(1, 1)

- Modeling Sequence

Metabolism prediction model initial sequence is $X^{(0)}(k)$, sequence AGO is $X^{(1)}(k)$,sequence AGO is $X^{(2)}(k)$,sequence $z^{(2)}(k)$ is average value of sequence $X^{(2)}(k)$,as Table 4 shown.

Table .4.Modeling sequence of metabolism prediction model

Sequence \ Number	K=1	K=2	K=3	K=4	K=5	K=6	K=7	K=8	K=9	K=10
$X^{(0)}$ metabolism prediction	0.69	0.67	0.63	0.75	0.67	0.69	0.73	0.73	0.67	0.71
$X^{(1)}$ metabolism prediction	0.67	1.3	2.05	2.72	3.41	4.14	4.87	5.54	6.25	6.94
$X^{(2)}$ metabolism prediction	0.67	1.97	4.02	6.74	10.15	14.29	19.16	24.70	30.95	37.89
$z^{(2)}$ metabolism prediction	——	1.32	2.995	5.38	8.445	12.22	16.73	21.93	27.825	34.425

- Calculating Intermediate Parameters

C= $\sum_{k=2}^{n} Z^{(2)}(k)$ =131.27 D= $X^{(2)}(10) - X^{(2)}(1)$ =37.89-0.67=37.22

E= $\sum_{k=2}^{n} Z^{(2)}(k) X^{(1)}(k)$ =717.661 F= $\sum_{k=2}^{n} Z^{(2)}(k)\Lambda 2$ =2980.433

- Calculating GM(1, 1) Parameters a,b

a= Δa /Δ b= Δb /Δ

Δa is calculated as the following formula Δa =CD-(n-1)E=-1573.080

Δis calculated as the following formula Δ =(n-1)F-C^2=9592.084

Δb is calculated as the following formula Δb=DF-CE=16724.357

so a=-0.164，b=1.774。

- Choosing Model

Defined GM(1, 1)

$X^{(1)}(k)$+a $Z^{(2)}(k)$ = b ⇒ $X^{(1)}(k)$-0.164 $Z^{(2)}(k)$ = 1.774

GM(1, 1) the whitening response formula

$\hat{x}^{(2)}$（k+1）=（$X^{(1)}(1)$-b/a）e^{-ak}+b/a

$X^{(0)}$ (1)= 0.67, b/a= -10.817

$\hat{x}^{(2)}$（k+1） =11.487 $e^{0.164k}$ -10.817

$\hat{x}^{(1)}$（K+1）= $\hat{x}^{(2)}$（k+1）- $\hat{x}^{(2)}$（k）

（3）Testing Residuals

To list the table of calculated values to test residuals, according to the table we can know the following. ε(avg)=11.0464%,p^0=(1-ε(avg))100%=88.9536%,Error of metabolism prediction is within the allowable range.

（4）Predicting

Based on the whitening response formula

$$\hat{x}^{(2)}(k+1)=11.487e^{0.164k}-10.817$$

$$\hat{x}^{(1)}(K+1)=\hat{x}^{(2)}(k+1)-\hat{x}^{(2)}(k)$$

Substituting k=10,11,12,13,14,15into the whitening response formula ,the results of sliding scale are $X^{(0)}(11)_{\text{metabolism prediction}}$=1.3548, $X^{(0)}(12)_{\text{metabolism prediction}}$=1.5963, $X^{(0)}(13)_{\text{metabolism prediction}}$=1.8808, $X^{(0)}(14)_{\text{metabolism prediction}}$=2.2159, $X^{(0)}(15)_{\text{metabolism prediction}}$=2.6109.

5. Results analysis

Using the mine inspection data of gas emission from August 4 to August 13 as initial data , predicted by the model of grey prediction , new information predicting and metabolism prediction ,the result of the predictions to the gas emission from August 14 to August 18 is compared with the truth, shown at Table 5.

Table .5.Modeling sequence of metabolism prediction model

Prediction Value / Prediction Model	$X^{(0)}(11)$	$X^{(0)}(12)$	$X^{(0)}(13)$	$X^{(0)}(14)$	$X^{(0)}(15)$
original data	0.69	0.65	0.59	0.61	0.63
model of grey prediction	1.332	1.5697	1.8498	2.1799	2.569
model of new information prediction	1.144	1.3292	1.5443	1.7942	2.0846
model of metabolism prediction	1.3548	1.5963	1.8808	2.2159	2.6109

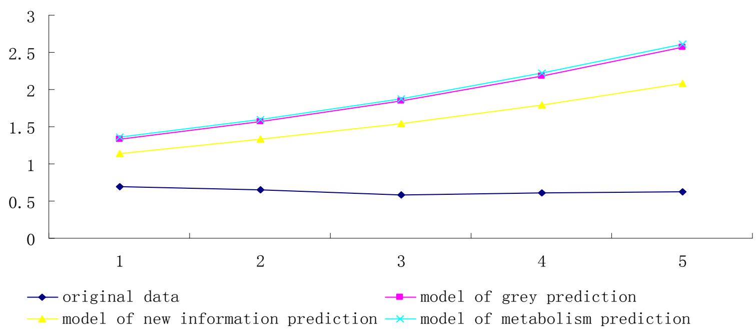

Fig. 1. compared with the results of grey prediction、new information prediction、metabolism prediction

According to Table 5 and figure1,inter compared with three prediction models, the results of new information prediction are most close to the truth ,the next is grey prediction ,the last is metabolism prediction. New information prediction model is suitable for the situation which has uncertain signal interference during predicting .So that it can relieve influence of the sudden interference. When combining with the coal mine safety monitoring system ,we can timely renew initial data for increasing the accuracy of the prediction.

6. Conclusions

To the special influence factors of the coal mine underground gas emission and the feature of the grey prediction model, it puts forward to the grey prediction model to predict underground gas emission trend. Through comparing and analyzing an example of the coal, it finally chooses the new information model as a coal mine underground gas emission forecasting model, which can not only overcome the general model's difficulty in underground gas emission data acquisition and the model's establishment, but also can realize the dynamic prediction of the gas emission, timely reflect the trend of the gas concentration's changing, provide a line to achieve production safety in underground coal mines.

Acknowledgement

It is a project supported by the High-Tech Research and Development Program of China (863 Program) (2008AA12A214).

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